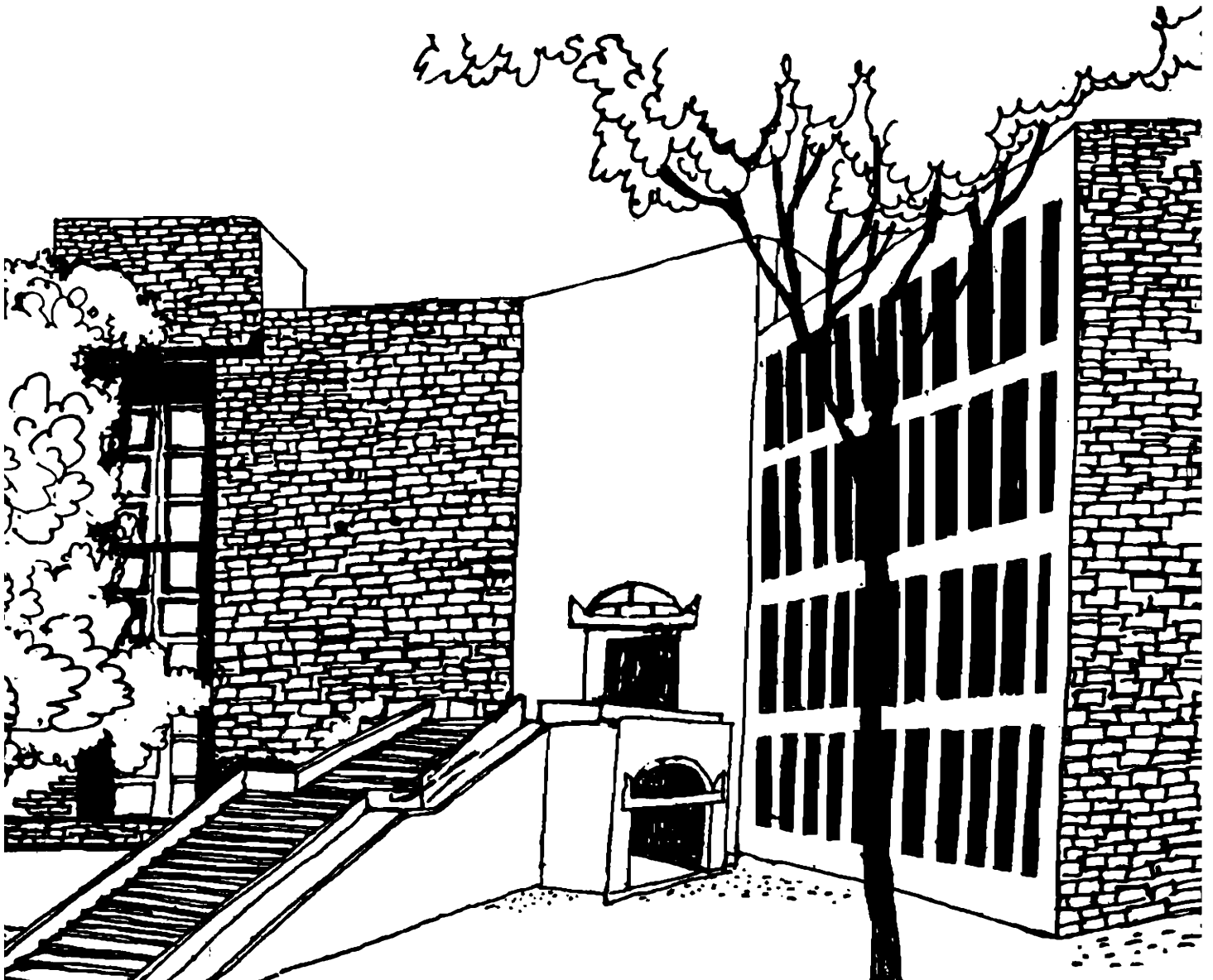विद्याविनियोगाद्विकास:

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Working Paper

Strategic Partnering in Telecom Software:
Northern Telecom's Technology Network
in India

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Introduction

Recent literature on technological change and economic development has focused a great deal on the determinants of developing technological capabilities in less developed economies. Earlier research focus on macro changes has been gradually replaced by studies which try to relate macro changes to micro (firm level) developments. A few noteworthy strands in this literature include role of multinationals (MNC) in developing technological capabilities, host country policies to attract foreign firms, nature and role of inter-firm linkages, and the impact of information technology on developing global inter-firm network.

Studies have shown that MNC activities can have a significant and positive impact on technological capabilities of firms in developing countries provided these firms make technological investments and countries adopt pro-competition policies (Kokko, 1992; Evenson and Westphal, 1994). Another set of studies begin with the premise that MNC activity can enhance capabilities and explore how policies can help developing countries win "locational tournaments" to attract foreign investments (Mytelka, 1998).

With the decline of Fordism, many researchers have started looking at interfirm linkages with renewed interest in recent years. The growth in product sophistication and variety has induced inter-firm linkages as no single firm can develop capabilities in all aspects of product and process technology. Basant and Chandra (1997) have discussed this issue in the context of telecom technologies. Within inter-firm linkages, issues relating to "hierarchies and markets" and "strategic networks" have received considerable attention (Williamson, 1995, Hamilton and Feenstra, 1995). The information revolution has further added new dimensions to strategic alliances and flexible networks. As a result, global networks are increasingly becoming relevant for developing country firms (Kobrin, 1998).

Given the above developments, an understanding of how inter-firm networks evolve and function and how developing country firms can benefit from these alliances, becomes crucial. The present paper attempts a preliminary exploration of some of the issues referred to above through a case study of an

international technology development network in telecom software. This research is based on survey questionnaire and in-depth interviews of firms participating in the network.

Context

India is emerging as a major software development centre in the world with the current estimated exports of US $ 1.1bn worth of software and related services. Bangalore, Mumbai, New Delhi, Chennai and now Hyderabad have emerged as important centres of software related activity in the country. About 30 per cent of Indian software firms are located in Bangalore. They contribute about 25 per cent to the country's export revenues. The Bangalore cluster has slowly evolved from one that provided on-site turnkey services at client's location to one that is starting to develop branded products. Within this broad spectrum, global software outsourcing (GSO) has emerged as an important and rapidly growing activity. GSO arrangements have significant strategic implications as they not only have a potential of increasing the volume of business significantly but also require capabilities of higher order, improving thereby the opportunities of learning for the participating firms. Not much work has been done on GSO activities in India. A study by Barrett et al (1997) is an exception which focuses on one such relationship in India to highlight changes in managerial practices in domestic firms.

One such experiment is Northern Telecom's (Nortel) partnership with four Indian software companies, three of which are located in Bangalore. The alliance is unique in various ways. It was envisaged as a long term stable relationship among "peers" and not between "master and slaves". The Indian partners were asked to contribute to the mainstream of Nortel's work and the implicit division of labour that keeps "architects" in the North and "coders" in India was sought to be broken. Nortel, therefore, does not view its Indian partners merely as a cheap source of software production; financial gain by squeezing the partners is not the long term goal. Instead, they are willing to help them evolve into genuine two way partners. Finally, the network in India is being developed in the image of the mother lab of Nortel in Ottawa, which does research in all areas covering a broad spectrum of telecom products. Some evidence to support this characterisation of the network is discussed below. The

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relevance of such networks is obvious. Such alliances, unlike many other 'one-way' alliances, have significantly higher learning potential for participating firms in developing countries. The conditions under which such knowledge generation is facilitated needs to be explored.

Participating Firms

Nortel is a leading telecommunication firm from Canada which specializes in developing technology for digital networks. Its revenue in 1997 was US$ 15.5bn, 37 per cent of which emanated from outside North America. Nortel has 38 R&D collaboration sites in different parts of the world including India. Recently, it has developed strong relationships with some leading software firms in India to develop products that will utilize the telecom knowledge of Nortel and the software expertise of Indian firms. Over the past nine years, Nortel and its Indian partners have been developing software and software testing tools for Nortel products like DMS, Meridian, Norstar, S/DMS Transport Node and products for the personal communications services market

In 1989, the International R&D Group of Nortel entered into GSO arrangements with two Indian software development companies - Silicon Automation Systems (SAS) located in Bangalore, and Tata Consultancy Services (TCS) which has headquarters in Mumbai. Two more companies were added to this arrangement in 1992. These were, Infosys Technologies (Infosys) and Wipro Systems (Wipro), both of which are located in Bangalore. These firms compete with each other in the domestic and international markets. Infosys was founded in 1981. It is a premier software development company with an annual turnover of about US $ 37.8 mn in 1996-97. It spent around 5 per cent of its turnover on R&D. Infosys focuses on software services in the areas of distribution, finance, retail, telecom, insurance, internet and engineering services. In addition, they have products in the area of bank automation. Established in 1989, SAS develops tools & services that enable the design of semiconductors, telecommunications, computing & networking equipment. The company's stated core competence is signal processing which has resulted in solutions for digital communications, with specific emphasis in multi-media technologies. Currently it employs 300 people of which 250 are engineers. Its annual turnover in 1996-97 was US $ 4.6 mn. Setup over 30 years ago, TCS is Asia's

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largest consulting group with activities that range from management consulting to IT solutions, offshore development & branded software products. About 9,800 people work for TCS whose sales turnover in 1996-97 was US $ 201 mn. TCS invested about 8 per cent of its revenue on R&D. Wipro Systems is a division of Wipro Infotech that was started in 1984 (while Wipro Infotech was formed in 1981). Wipro Systems has over 2500 employees with an annual turnover of US $ 14.3 mn. 1993-94. Within Wipro Infotech, Wipro Systems has been setup as a unit focusing on global software outsourcing. Each of these companies have offices in different parts of the world.

Genesis and Formation of the Network

The International R&D group at Nortel started to think about forming linkages with firms in India in the late 1980s. Two senior employees of this group, both of Indian origin, spearheaded this effort. These two were involved in conceptualizing and implementing various aspects of these relationships. While the major impetus for forming this alliance came from Nortel, some of the Indian partners were also actively looking for such linkages. As a part of their preparation Nortel checked with Texas Instruments and Hewlett Packard about their experiences of working in India. With the help of individuals in these and in other companies known to Nortel initiators, a long list of potential partners was developed. With further queries, a short list of 30 companies was prepared. Each of these 30 potential partners were visited by the Nortel employees. Selection of the four Indian firms was done by · Nortel on the basis of very specific skills and capabilities that these firms had developed over the years. There appear to be three broad reasons for this partnership to emerge - active interest of the two Indians at Nortel to develop long term links with India, emergence of India as a strong, low cost software development centre and the desire of Nortel to externalize its R&D work to reduce its costs. The Indian firms were looking to earn foreign exchange, keep their best people within the country, enter into domains like telecom and for opportunities to learn the latest technology & management practices and climb up the product complexity ladder.

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Organisation of the Network

The partnership is not an equity based joint venture. It is an ongoing contractual relationship between Nortel and its partners, each relationship is individually defined. Bulk of the physical investments were made by Nortel. In each partners location, Nortel has created an infrastructure which is comparable to what exists in Canada. Apart from the state-of-the art telecom hardware (switches etc.), Nortel has installed large capacity (2 gigabits) dedicated lines for communication between Nortel and its partners. Nortel also invested a great deal in training activity.

Linkages between Indian firms and Nortel are not organized in a manner which requires interaction among the Indian partners; collaboration is extremely limited and informal. This interaction, typically focuses on sharing of some standards and practices but mainly on communication infrastructure related issues. Besides, training of partner firms employees is common. They, however, do not collaborate with each other on any project. Each Indian partner has an independent project relationship with Nortel. Allocation of projects to each partner by Nortel is governed by its overall strategy to map disciplines across partners and avoid overlap. Each partner in India has specialisations and "collectively" the four Indian partners are growing in the image of Nortel's mother lab in Ottawa which works on a broad spectrum of telecom products. As the firms do not work together, Nortel remains the "Director" of the network.

The alliance does not preclude entry of new partners in the future. However, from Nortel's point of view, addition of new partners would imply investment by Nortel in developing infrastructure (including hardware) at partner's premises. This can be quite expensive. Moreover, catching up for the new entrant may be difficult. Nortel, however, is not averse to additional partners if they can bring in specialised knowhow to expand the technology domain of the network.

Clearly, the parameters of these linkages are driven by Nortel's International R&D group. The relationship is somewhat hierarchical with Indian firms feeding into Nortel's research and product

development activities. However, an attempt is made to minimise hierarchy, particularly at each centre, where young professionals are encouraged to interact with seniors and "participate" in a variety of ways in the operation of the group.

The Nortel projects, which started with low skill assignments such as program testing have gradually evolved into full fledged off-shore development centres for Nortel to develop, modify and support software products or software components of Nortel products. The initial projects were arms-length technical contracts with very limited interaction between development teams of Nortel and the Indian firms. This relationship evolved with the successful completion of many of these projects. Gradually, Nortel commissioned larger and more complex development projects requiring more sophisticated hardware & communication infrastructure along with enhanced interaction between Nortel and Indian teams. Current projects include DMS-100 feature development for Asia/Pacific markets, such as Japan; interface approval for a cellular switch in India; DMS-10 and Meridian feature development for global markets. At the off-shore development centres, Nortel has installed advanced telecom hardware for testing these software. It is hoped that with the synergistic interaction between increased access to telecom hardware & software, communication infrastructure and the improving project skills, these alliances will graduate to product design & development centres. Most of the current work focuses on the further development of existing Nortel products; only a small proportion can be categorised as research.

It must be re-emphasized, however, that at this point in time, each Indian partner works on independent projects; integration of these projects, if at all, is done by Nortel. There are reasonably well defined rules for protecting the intellectual property of Nortel. Trust plays a key role in avoiding leakages of proprietary knowledge. While the relationship does not prohibit collaboration of Indian companies with Nortel's competitors, movement of persons working on Nortel projects to substantially similar projects of competitors is not permitted. An agreement on non-disclosure at the corporate level is signed and each person working on Nortel projects individually signs such an agreement. Anything the partners develop with Nortel belongs to Nortel unless they agree to negotiate and to share.

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Interestingly, within the Indian firms' premises, Nortel projects are located in physically separate areas with restricted access. Each of the Indian partners have different types of relationships with many international firms. For instance, one of these Indian firms also has a Nortel like offshore software development centre for NCR. Besides, the Indian firms have a large number of Fortune 500 firms as customers around the world like Microsoft, IBM, Oracle, Fujistu, Philips, Hitachi, Sharp, Toshiba, National Semiconductors, Texas Instruments etc. The Indian companies compete fairly aggressively in the international market for projects.

Strategic Intent of Nortel

Software is increasingly substituting for a variety of tasks which were earlier performed by telecom hardware. Software development in North America has become extremely expensive due to the shortage of skilled manpower. It seems that the strategic intent of Nortel was to outsource software development for telecom devices from relatively inexpensive off-shore locations. Indian firms provided a rich pool of software development capabilities as well as ability to gear up fast to develop new application software. However, their telecom related knowledge base was limited. This provided excellent opportunities of collaboration between firms with complementary capabilities. Nortel made specific efforts to develop/update the telecom hardware/software related knowledge of its Indian partners. While the expectation of cost savings was important and it fructified with Nortel saving of about $ 50 million per year due to the network, the long term perspective was probably more important. Only that can justify the kind of investments Nortel has made.

Nortel has been seeking opportunities to adapt its telecom technology for Asia-Pacific market. Besides, it has so far been unsuccessful in entering the Indian telecom market; its international competitors like Siemens, Alcatel , AT&T and Ericsson are already present in India. This alliance, therefore, not only provides Nortel an access to the inexpensive software development resource in India, but also allows them to enter the Indian market with products specially designed for India. Moreover, an R&D arrangement of this kind brings product development activity closer to the markets in the Asia-Pacific region. The concept of a more open "two-way" partnership was partly necessary to attract good Indian

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firms and provide stability to the relationship. There was always a possibility of another international competitor to build such a network if Nortel had not taken the initiative. At the moment, however, the Indian market is not growing as rapidly as expected and on that count, Nortel's investment only makes long term strategic sense.

Benefits to Indian Firms

Benefits of this alliance to Indian companies have been numerous. The firms together make about $ 50 million per year for the country. The major gain has been in developing telecommunications related knowledge and acquiring expertise to produce to world standards and satisfy global markets in this sector. Since there was reciprocity and Nortel was not averse to connecting Indian firms to the world market, the partners learned the whole package, got exposed to how Nortel functions, how it deals with the customers and so on.

Strategically, the entry of Indian firms into telecommunications software market has been a significant outcome of this alliance. This market is likely to grow rapidly in the near future. The alliance not only facilitated entry into this market segment but is also creating learning opportunities which may eventually help Indian partners to become important players in this emerging segment.

The Indian partners also received training on telecom technology and Nortel's products. Such learning opportunities arose during visits of Nortel experts to Indian sites as well as visits of Indian engineers to Nortel's facilities overseas. Specific learning occurred through the use of new telecom related software (especially in switching), entry into new markets segments relating to various telecom product lines, development of new products (mainly in the form of new features on existing products), acquisition of knowledge relating to international programming standards as well as protocols/standards in telecom process (process & quality standards for developing highly complex products) etc.

The Indian firms feel that association with Nortel has accelerated the development of their technological capabilities in this business. However, since they have other linkages with large number of international firms, such capability building could have occurred, *albeit at a much slower pace*, in the absence of this alliance. All these firms also view this relationship in a long term perspective. They would like to graduate to become equal partners of Nortel in their product development process and marketing. As indicated earlier, Nortel too views this relationship in a similar perspective given its huge investment of time and resources in building these relationships.

There have been two other spillover benefits. The alliance has enhanced the credibility of and has provided better visibility to Indian partners. This, in turn, has helped them attract other customers. The Nortel development centres have had strong demonstration effects within each company. Similar spillover effects of the partnership on the telecom software sector is, however, difficult to ascertain.

The Indian software industry is very competitive with very high employee turnover. There are several other firms in the industry which are as good as the Indian firms in the Nortel partnership. A large and fairly well distributed pool of software related knowledge exists in the country. This creates a potential for competing firms to learn from the Nortel partnership. The organisational form chosen for the alliance tries to minimise knowledge spillovers from one participating firm to the other and within the participating firms through certain norms and protocols. But knowledge spillovers through employee turnover continue to take place.

In Search of a Larger Perspective

This interesting experiment between Nortel and four Indian companies throws up several questions on the potential of developing, nurturing and sustaining such hi-technology networks in developing countries. Given India's reasonable capabilities in telecom technology (for example, switches developed by Centre for Development of Telematics, C-Dot) and high knowledge base in software, and given the tremendous potential of synergies between these two knowledge systems, one would

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have expected "Nortel like" arrangements to emerge within the country among Indian software and telecom hardware firms (see Basant and Chandra, 1997 for an assessment of some of these capabilities). Why did this not happen? One possible answer can be that the telecom activity was largely in the domain of the public sector and the State did not recognise the value of innovation related interactions between manufacturers of telecom equipment (e.g., Indian Telephone Industries, ITI) and the technology developers (e.g., C-Dot and software firms). The same was true vis-a-vis the links between service providers and technology developers (Basant and Chandra, 1997). The other explanation can be sought in the fact that Indian telecom firms were not competing on the basis of innovations in domestic or export markets. They mostly focused on adaptation activity for the local market and on cost reductions. Consequently, the need for such partnership was not felt.

Nortel, on the other hand, was both a manufacturer and developer of technology, competing with other international firms on the basis of state of the art technology. Unlike many other multi-nationals, Nortel was unable to enter the liberalising Indian telecom sector with its existing products. It foresaw, on the one hand, the large and significant emerging role of software in telecom technology and recognised on the other, the potential of Indian software firms in contributing to the development of these technologies. It also needs to be noted that the technology gap between the Indian software firms and their counterparts abroad was relatively narrow. It can be argued that in technologies where the gap in capabilities among the participating firms/countries is high, such linkages may not come about or may not result in significant learning for a developing country partner.

This network adds to the growing evidence that technology alliances of developing country firms with MNCs having excellent manufacturing and technology development capabilities in areas where the technology gap is relatively narrow can potentially play a crucial role in upgrading capabilities of developing country firms. While the participating Indian companies have gained a lot through this arrangement, it needs to be ascertained whether such linkages can result in significant spillover benefits for the rest of the sector/economy. If yes, under what conditions? Does the spillover potential depend

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on the nature of the organisation of such arrangements or the technology gap between the participating firms and their competitors within the domestic economy ? More on this later.

For an MNC like Nortel, in addition to cost advantages, such alliances can provide an opportunity to enter emerging markets like India through the "technology development" route and this collaboration may prove to be extremely useful for Nortel's entry into India in the near future. How can one encourage such "entry" by MNCs? Technology gap may prove to be crucial in this regard. For example, Bangalore was the right choice for Nortel - with three of the four partners located there, the cost of installing additional infrastructure (in addition to what the city already provides) was relatively low, and the ease of installation was high. Moreover, the pool of competent people, with software as well as telecom related skills, was very high. It is noteworthy that, both ITI and C-Dot, which had the potential of forging such networks on their own are located in Bangalore. Interestingly, most of the alliance partners in India depended to a significant extent on telecom engineers from these two public sector firms to set up their respective Nortel facilities. Incidentally such spillovers from public sector firms in India have become significant in post reform India.

Looking Ahead

The long term sustainability of this alliance would depend on the nature of learning by the Indian partners and the extent of locked-in investment by the participating firms. Though Nortel has invested significantly in this partnership, it is not clear what role this alliance plays in its global network of alliances. Nonetheless, Nortel views this network as one of their most advanced ones. Likewise, Indian firms have developed similar linkages with other MNCs, probably not as intensive. There is no doubt that Nortel has shared with the partners a lot of its proprietary technology. As the technological capabilities of the Indian partners improve, Nortel will have to share more of such technologies to sustain the alliance. A significant part of the knowledge embodied in this technology is tacit and its mis-appropriation difficult to monitor and detect. However, the credibility of the Indian partners and, therefore, their ability to attract partners in future is highly dependent on their protecting Nortel's intellectual property. Its is this "shared vulnerability" which is most likely to keep the alliance alive and

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help it grow. Some of the Indian partners may be asked to do the sunset phase of some telecom products, including dealing with Nortel's customers. Working with Nortel on its new products can also not be ruled out, although this might prove to be riskier for Nortel. In any event, it is important to note that if this relationship continues to grow as vigorously as it has in the past, at some stage the issue of the ownership of intellectual property will also have to be addressed.

The organisational arrangement was probably optimal for Nortel. It is clear that intensive interaction among the Indian partners would have helped them learn more from the alliance. However, Indian partners may not have preferred such an arrangement given the fact that they compete with each other vigorously. Interestingly, Nortel appreciates many of these concerns including those relating to IPRs and is open to sharing proprietary benefits. Their expectation, however, is that such sharing of IPRs would require Indian partners to bring more to the table; be more entrepreneurial and take risks to develop new products and markets. Two of the Indian partners prefer the "command-execute" mode and are reluctant to take risks, while the other two are more entrepreneurial. As a result, the relationship between Nortel and the two entrepreneurial partners has matured more than its linkages with the other two firms. Nortel claims that collaboration among Indian firms was part of its vision and they did make some rudimentary efforts at inducing more collaboration among the Indian partners. However, the Indian partners did not seem very enthusiastic. Being competitors and collaborators at the same time is probably not very easy.

Under what conditions would the Indian partners collaborate on product and technology development, since that seems to be an optimal strategy to maximise learning? Can the much maligned Indian public sector still take the lead in this direction and facilitate co-operative R&D among competitors? Will the lack of significant public or private investments in telecom training not act as a barrier to the growth of such alliances in future? Answers to these questions may partly define the future of collaborative product development and research in this sector.

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