

Table 1: Comparison of Brazilian and Indian R&D initiatives in Telecommunications Technology

	Brazil	India
	CPqD	C-DOT
1. Year of establishment	1976	1984
2. Mode of organization	<ul style="list-style-type: none"> • Two phases • Phase 1: 19776 to June 30 1998: Stand alone public laboratory. Technology developed by the lab is transferred to Brazilian private sector companies at nil rates of royalty • Phase 2: July 1 1998 on wards: Private Foundation. It consists of the central laboratory, two manufacturing companies and two service oriented companies 	<ul style="list-style-type: none"> • Stand-alone public laboratory. Technology developed is licensed to Indian public sector enterprises and private sector laboratories at a price (royalty plus technical know-how fees)
3. Annual budget (Average amount in US \$ during 1992-2002)	<ul style="list-style-type: none"> • US \$ 81 million (<i>Ratio of CPqD 's R&D budget to the R&D expenditure of Ericsson in 2002- 0.0179</i>) 	<ul style="list-style-type: none"> • US \$ 21 million (<i>Ratio of C-DOT's R&D budget to the R&D expenditure of Ericsson in 2002- 0.0047</i>)
4. Mode of financing	<ul style="list-style-type: none"> • Phase 1: 100 per cent research grants from its parent telecom service provider, Telebras • Phase 2: 70 per cent self generation through sale of technology and services; 30 per cent research grants from the government. Has now beginning to learn to stand on its own feet. 	<ul style="list-style-type: none"> • 100 per cent research grants from its parent and the main telecom service provider, the Department of Telecommunications. But cumulative royalties received (1984- 2002) account for 25 per cent of the total cumulative grants received. Royalties received in 2002 accounted for 75 per cent of the total budget of the lab. Can stand on its own feet
5. Number of R&D scientists and engineers (as of 2002)	<ul style="list-style-type: none"> • 469 (41 per cent of total employees) 	<ul style="list-style-type: none"> • 780 (62 per cent of total)

6. Main areas of technological strength	<ul style="list-style-type: none"> • Family of digital switching systems of varying capacities best suited to Brazilian conditions. The switches have a market share of 32 per cent of the total stock of direct exchange lines in the country (during the 1990s) • Has a clear strategy for migrating to New Generation Network Switches • Optical Networking Products • Telecom software development 	<ul style="list-style-type: none"> • Family of digital switching systems of varying capacities best suited to Indian conditions, especially in the smaller Rural Automatic Exchanges. The switches have a market share of 50 per cent of the total stock of direct exchange lines in the country (during the 1990s) • Sizeable amount of this have been exported to other developing countries • Could be credited with the development of the telecom equipment manufacturing industry in India • No telecom software manufacturing on its own, but has jump started the development of the telecom software industry in India in an indirect manner
7. Capability in mobile telecommunications technology	<ul style="list-style-type: none"> • Weak. Traditional strength only in Fixed Telephony. No clear strategy. Appears to have lost out to MNCs 	<ul style="list-style-type: none"> • Weak. Traditional strength only in Fixed Telephony. No clear strategy. Appears to have lost out to MNCs
8. Patenting record and exports (cumulative since inception)	<ul style="list-style-type: none"> • 109 patents were granted within Brazil and 50 were granted abroad. No major exports. 	<ul style="list-style-type: none"> • Patenting record is not known. But considerable exports of the smaller capacity exchanges to nearly 22 developing countries
9. Instruments of state support	<ul style="list-style-type: none"> • Fiscal instruments for supporting R&D • Legal instruments for continuing to assure a potential markets for its technology within the domestic economy 	<ul style="list-style-type: none"> • Fiscal instruments for supporting R&D; Ambiguous and ambivalent stand of the Ministry of Finance with respect to continuation of this strategy. Laboratory risk being closed down. • Public procurement under strain owing to privatisation of telecom services
10: Future scenario	<ul style="list-style-type: none"> • Learning to adjust to the external environment characterised by 	<ul style="list-style-type: none"> • Struggling to exist. No clear government policies despite being very competent in coping

	increased from MNCs and freer imports	with MNC competition and freer imports.
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Mani, Sunil : (2004, forthcoming), **Coping with Globalisation, An analysis of Innovation capability in the telecommunications industry in developing countries.**