"Interaction between Universities and Technology Clusters in Emerging Economies –

Case Study of Cyberjaya, Malaysia - A Greenfield development and Cyberabad, India – A

Brownfield Development"

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Introduction

Universities are known for their contribution to the process of stimulating economic growth of a region. The essential role of universities is to generate and disseminate knowledge and train human resources in various branches of knowledge to be deployed in various sectors including industry. The synergy and interactions between policy, university and industry has been a key in driving a region's growth. However, at a global level, there are variations in the contributions of universities to industry as well as the industry's reciprocity to knowledge creation. This calls for a contextualized understanding of the actual role that universities play in regional economic development in particular and national development in general.

This paper tries to explore the nature and content of interaction among the university, industry and government in the Greenfield development of the Multimedia Super-corridor (MSC) created by the Malaysian Government, and the Brownfield development of the software industry cluster in Hyderabad. The paper attempts to understand generative and developmental roles of regional knowledge cities – Cyberjaya and Cyberabad, in terms of the interaction among R&D institutions, industrial clusters, social, cultural and policy environment, and the consequent outcomes. Analysis of

the interplay of these factors would shed light on the variations in the levels of interactions and the place of knowledge cities in the global context.

Background Literature

Universities are essentially engaged in teaching – education for the development of human resources and knowledge production dissemination. The third task is to interact with society and industry. The Triple Helix forum proposes an enhanced role of the universities as 'entrepreneurial universities' (Etzkowitz and Leydesdorff, 2000) and thus strengthen industry-university-state interaction. Universities are poised to create not just knowledge; they also play a major role in promoting innovation in industry and create new high-technology firms, offer consulting for local industry, advice to politicians and policymakers and informing general public debates and shaping the national spatial distribution of social opportunities and services.

Literature on University and Industry linkages suggests that a wide variety of University Industry Linkages (UILs) can exist (see Basant and Chandra 2006) and can vary from labor market related, to the creation of spin-offs, to joint R & D projects and so on and these links are informal and formal. Universities play generative role and developmental role in their interaction with the industry and their contribution to the overall regional development. The developmental role of universities is focused more on the ways in which the university-industry interaction in a regional innovation system is organized. It results in a shift in the role of universities from passive knowledge and human resources production centres to a more dynamic and applied research centres useful to the industry (Chaminade C., et. al., 2007).

In most developing countries the academic institutions are still confined to the traditional roles of research and generating skilled human resources. The idea of "entrepreneurial science" (Etzkowitz, 1989), is taking off in some areas of science such as Bio-technology and pharmaceuticals. But in IT sector and Computer Science, the phenomenon of spinoffs from academic institutions is still nascent in emerging economies such as India. Studies indicate that the faculty and students in institutions are not able to set up enterprises due to lack of seed funding, inappropriateness of research for commercialization, and absence of institutional regulations and a conducive policy to set up firms. There are also issues of coping with the intellectual property and other related issues (for example, owning equity in spinoffs) that are very important in setting up new enterprises. In this context, the triple helix model emphasizes the process of formation of hybrid, recursive and cross-institutional relations among the trinity – university, industry and government.

Cyberjaya can be identified as a Greenfield cluster development, a fresh government initiative with no pre-existing R&D institutions in that region. Cyberabad in Hyderabad can be identified as a Brownfield development, where the Universities and other institutions existed before the initiative and the Government of Andhra Pradesh offered policy support to software firms to establish their units which

led to the cluster formation in this region. Each of these regions exhibit specific social, cultural, economic and policy attributes. The formation of the University-industry-government linkages in these regions is the research focus of the present paper.

Methodology

The study relies on secondary data on both the cities and also on in-depth interviews with professionals in the universities and industry and bureaucracy in the government in Hyderabad and in Cyberjaya - MSC region. Interviews would facilitate an understanding of the processes underlying formation of UILs in the context of dynamic regional development and a nuanced understanding of the secondary data sources. In the case of Cyberabad, an ongoing research project on Science, Ethics, and Technological Responsibilities of Developing and Emerging countries, supported by the European Commission being carried out by the first two authors provided insights into the academia – industry linkages in Hyderabad.

 In the following sections the cases of Cyberjaya and Cyberabad are presented with findings and conclusions drawn on the basis of the findings.

Case 1 - Multimedia University (MMU) in Cyberjaya – the nucleus town of the Multimedia Super Corridor (MSC) Project

In this section a discussion of the role of the main university in Cyberjaya viz Multi Media University (MMU) is presented. Before discussing the role of MMU – the university in Cyberjaya it is felt that a brief overview of the Cyberjaya cluster is warranted.

Cyberjaya is the brain child of 'Tun' Dr Mahathir Mohamad, the former Prime Minister of Malaysia and Cyberjaya was conceived as the country's first intelligent city of the future. The 30sq km township is a specially designed township meant to serve as the catalyst for the development of a technology park forming the core part of the Malaysia Multimedia Super Corridor (MSC) region. The high-tech cyber township, billed as the Silicon Valley of Malaysia, is located in the district of Sepang in the state of Selangor, about 30km south of Kuala Lumpur. While the announcement of the city was done in 1996, Cyberjaya was officially opened by Dr Mahathir in May 1997.

To facilitate the development of the cluster, a regional development agency called the Multimedia Development Corporation (MDeC) was set up to co-ordinate with various agencies of the government. MDeC also helps by guaranteeing to firms a 30-day turnaround for applications (this is, the application process for what is known as the MSC Status – making the company eligible for all incentives in the MSC region). All firms that come into the MSC cluster are eligible for several incentives and gaining eligibility in the MSC the firms are required to apply for an "MSC Status" where they are evaluated against certain criteria. The government was interested in promoting research and development

through these firms and not just trading companies and give the MSC status only to such companies. So the MDeC also plays the role of brokering linkages among the government, industry and the MMU in Cyberjaya.

For most business requirements, companies setting up their units in the MSC region need not seek approval from other government agencies but need apply only to the MDeC. (M.V. Avvari and Ismail I. 2005). In addition to the administrative role in developing the cluster – the MDeC has a role for catalyzing linkages between the different players in the cluster.

The MSC Project and Cyberjaya Cluster are considered a (federal/central) government policy driven cluster for which all the planning and development came from the Prime Minister's office. Though it is not termed as a formal Public Private Partnership model, the government took the help of Industry – for e.g. Telekom Malaysia was involved in providing the communications infrastructure and Tenega Nasional (The national energy corporation) provided 'redundant' power lines to support the 99.99% guarantee for power supply. In addition Dr. Mahatir, the then Prime Minister, played an important role in convincing MNCs like NTT (Nippon Telegraph and Telephone) Communications and Nokia etc to establish their offices in the cluster. There was also the MSC Flaghsip Project - which included several other national projects The key regional development agency for Cyberjaya - MDeC - is called as a quasi-govt institution - funded by the government but run autonomously. At this juncture it is important to note that Cyberjaya and the MSC project as a whole is termed as a Greenfield cluster that has been literally built from the scratch where once there were palm oil trees. A large palm oil plantation was acquired for the development of MSC project and a university specially to support the cluster was planned and the responsibility for developing the university was given to Telekom Malaysia – the Malaysian telecommunications firm. In addition the government of Malaysia put in place special policies and institutional framework. This gave a quantum jump for Cyberjaya to become a leading edge multimedia hub attracting world-class multimedia and Information and Communication Technology (ICT) companies. This includes incentives to attract companies into the city, the development of modern state-of-the-art integrated infrastructure and ICT system, and the provision of an effective and efficient public transport system.

Since its beginnings in 1996 – the MSC project and Cyberjaya has seen many changes and can be considered as an emerging cluster. In the following section the main university of Cyberjaya viz Multimedia University will be introduced followed by a discussion of the role it plays in the Greenfield cluster.

Overview of the University – MMU Cyberjaya

Multimedia University (MMU) is a private tertiary education institution - set up through Universiti Telekom Sdn Bhd (UTSB), as a wholly owned subsidary of Telekom Malaysia. MMU is a twin campus University located in Cyberjaya (which is part of MSC) and a branch campus in the town of Melaka. The Cyberjaya campus comprises four faculties: Creative Multimedia, Engineering, Management and Information Technology. As the university "at the heart of the MSC" - MMU is supposed to serve as a catalyst for the development of the high tech ICT industry of the nation, parallel to the Silicon Valley-Stanford model in the United States. In the following sections an attempt is made to present the role played by this university in cluster that is built from scratch – a Greenfield cluster.

Role in the MSC – Cyberjaya

MMU was initially known as Univeristi Telekom, Cyberjaya campus opened in 1999. As mentioned above, this campus was the brainchild of the country's fourth Prime Minister, Tun Dr Mahathir Mohamad, as a center of learning and research for the Multimedia Super Corridor (MSC), the country's high-tech research and industrial area. The relationship between the campus and the MSC was intended to be similar to the relationship Stanford University shares with the Silicon Valley. Its role included providing skilled workforce for the development of MSC and for the companies operating in the MSC, the university was thought to be natural collaborative/strategic alliance counterpart for the companies in MSC project. In addition it was to be -

1) "Antenna" for adopting external knowledge and mediator for local knowledge circulation
2) Knowledge provider in university-industry linkages, and
3) Incubator for academic spin-off companies

When the University started in 1999 in Cyberjaya the following aspects were observed.

Initial roles

One of the main roles played by MMU was to help in the 'kick starting' of Cyberjaya the nucleus town of the MSC Cluster. As soon as the MSC project was conceived, there was the Asian Financial Crisis and there was very slow movement of firms into Cyberjaya. It was at this time that the University was asked to expedite the development and moving into the Cyberjaya campus. The campus started off with the move of part of the staff from the Melaka campus with almost 3000 students and staff. This move into Cyberjaya helped to provide some threshold population for the starting of the development of the city – from something as simple as creating demand to attract providers of basic needs like restaurants and other businesses supplying daily needs and also to providing support to development of start-ups and for the firms in Cyberjaya to collaborate.

US Model of Entrepreneurial Research University

This was attempted with Business / Technology Incubator being located within the campus of the university. The MSC Incubator (now known as the MSC Technology Commercialization Centre) was set up within the campus of MMU. It was hoped that the research outputs of the university would be fed into the start ups in the incubator. One of the divisions of MMU called the Multimedia Product Development Centre was in the incubator to facilitate development of linkages between the MMU and start up firms in the incubator. While there were some firms in the incubator that had developed links with the university – the links was more through student internships than from the research laboratories. These student internships were funded or sponsored by the regional development agency for the MSC project.

Financing Entrepreneurship in the Cluster

A new and interesting role played by the university involved funding of start-ups that came from the students of the university. There were business plan competitions and proposals were solicited, evaluated and after selection were funded to be in the incubator. Some firms emerged with this programme within the incubator in Cyberjaya and also in the Melaka campus.

University Industry R&D

In the initial days the MMU had established collaborative linkages with about 37 companies and several universities from all over the world. The linkages were in forms such as scholarships given by firms to students in the university to pursue research relevant to them. Research grant and, setting of laboratory facilities within specific faculties in the university (NTT (Nippon Telegraph and Telephone) Communications, Alcatel, Lucent were some of the firms that sponsored equipment and visiting staff from their R&D units etc), in addition to joint R&D activities with some other firms. Its joint ventures in research and development with firms in the MSC is an example of the type of co-operation that the Government hoped that will enable Malaysia to benefit its transformation into a high-tech society.

Overall the university's role in the Greenfield cluster was threefold:

a) A supplier of human resources to the firms in the cluster
b) a collaborative partner for the surrounding firms and
c) as a catalyst for the kick-starting the cluster township itself. The diagram below summarises the role of a university like MMU that was specially set up in Cyberjaya to support the development of a Greenfield cluster like the MSC project.

Fig. 1: Role of University in a Greenfield Cluster
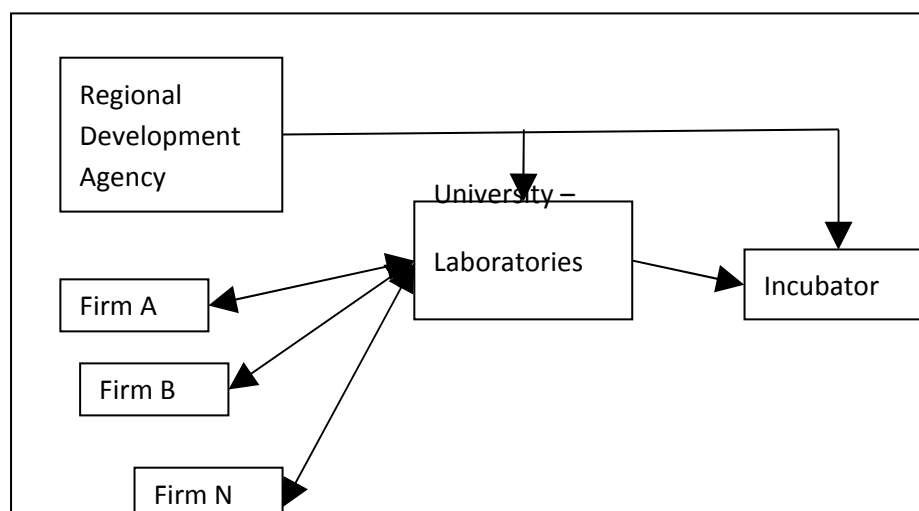
 As for the knowledge flow – interestingly the flows were from the large MNCs into the university laboratories through their sponsored programs – be it the laboratories of the sponsoring of researchers from their research centres to the university or the faculty from the university to their research centres. The two way arrow from the university to firms also indicates that the university takes on the role of a supplier of human resources to firms and indirectly transferring knowledge also.

But as the Cyberjaya cluster has evolved over the ten years there has been a major change in terms of the firms that emerged within the cluster and also change in role of the university as explained below.

Emerging Role of the University

This section shows how the role of the MMU has changed over the years and the modes of collaboration of the MMU.

Formal R&D Collaborations Unit

In recent years MMU has set up a formal collaborations unit for R&D. Table no. 1 shows the role that the unit plays not only in the development of R&D – but in terms of facilitating linkages with the industry within and outside the clusters in several ways – like joint R&D with firms to access several grants or funds, developing joint ventures, student internships etc.

Table _no 1: MODES OF COLLABORATION BY MULTIMEDIA UNVERSITY - CYBERJAYA

Joint R&D - Facilitates companies who wish to team up with the MMU to apply for external funding to do research such as Technofund, Innofund, MSC Malaysia R&D Grant Scheme (MGS), Demonstrator Application Grant Scheme (DAGS) and Industry R&D Grant Scheme (IGS).

Contract R&D - Facilitates and assists companies who wish to engage the MMU to work on specific research projects.

Consultancy - Facilitates the provision of advice and guidance to research projects/products with collaborating partner companies.

Joint venture - Assist companies who wish to explore and undertake research ventures with MMU.

Training and short courses - Facilitate training and short courses in the areas of interest to companies.

Sponsorship - Assist companies who wish to set up laboratories at MMU, or provide equipment and/or software donation to MMU.

Endowment Chair - Assist companies who are interested to sponsor Chair Professor(s) to carry out teaching and research at MMU; Assist the professors in providing consultancy in the projects related to the collaborative companies.

Industrial training - Platform for the MMU students to undergo their industrial training in Collaborating Partner companies. Platform for undergraduate students to undertake their final year projects or postgraduate student projects in the areas of interest in the collaborative partners companies.

Scholarships - Assist companies who wish to provide scholarships to the MMU staff and students.

Source: http://www.mmu.edu.my/index.php?req=d45&id=689

Entrepreneurial University

The university now has a formalised annual business plan competition for students as a training programme to feed into the Cluster business plan competition.

Participating in the Partnership Programmes of the Regional Development Agency – MdeC

The MSC project in general, recognizes MNCs playing a major support role in the development of the ICT sector of Malaysia. The Technoprenuer Development Division of MDeC has a programme called the Technology LABS programme - that focuses on developing partnerships with MNCs - more specifically in terms of enhancing the Technoprenuer Eco-System to support the development of new ventures and existing SMEs in the ICT sector. The MMU plays a role in this programme partnering with MDeC and some MNCs – one programme in which the MMU is involved is the Microsoft Innovation Centre partnering with MDeC and Microsoft & HP. In addition the MMU is also involved with Sun Microsystems and another with JTrends (Mohan 2006) The following diagram shows Multimedia University's linkages.

Fig. 2: MMU in the Technology LABS programme to Support ICT firms in the MSC Cluster
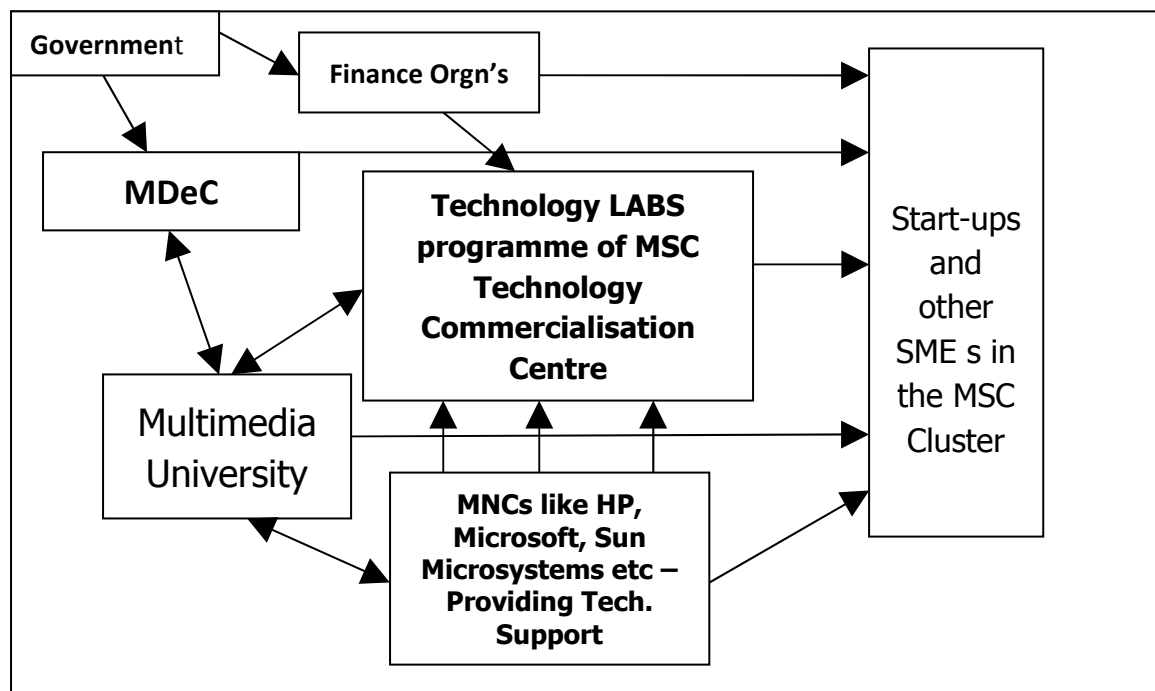
Through this Technology LABS prgogramme involving partnering of MNCs with MMU, the Technoprenuer Development Division of MDeC hopes to benefit the overall eco-system in terms of

- Leveraging on the MNCs partners expertise, experience, knowledge and networks in strengthening the eco-system
- Adopt the best practices in developing and maintaining the best eco-system
- Improve service delivery time and cost to technopreneurs and minimize failure points across the technopreneur value chain
- And develop better resource capabilities

And for the entrepreneurs and SMEs, the partnerships with MNCs is expected to provide

- greater access to markets like business outsourcing opportunities, etc.
- wider networking platform to build contacts, share knowledge and share experiences
- greater access and exposure to technical experts and technology trends

These labs are located in the incubator mentioned earlier and the incubator is now known as the MSC Malaysia Technology Commercialization Centre (TeCC) which is part of the National Incubator system.

Overall as the cluster develops and the MMU grows, it can be observed that the linkages are getting institutionalized through programmes – and unlike the science and technology development perspective – MMU's role seems to be moving towards supply of technology education, technical manpower and development of entrepreneurship.

Summary of the MMU Case

Overall from the case of MMU – it can be observed that there is a role for the university that is beyond the knowledge development and transfer and supply of human resources. In a Greenfield cluster the university plays an important role in being among the first 'occupants' creating a threshold population for development of some essential services within the cluster – thus promoting and attracting other firms to move in. In addition the presence of a technical university helps to profile the cluster in the global markets. Being a new university – although the Figure No 2 shows two way arrows – there was more support from the Industry to University. The MMU had to take support from several MNCs for the development of its research agenda and their laboratories. Several resource persons from the Industry were posted in the university for this purpose and in some cases young faculty from MMU were sent to the main R&D centres of the firms. This indicates a very significant difference in university-industry interactions as seen in literature based on mature clusters and long established universities.

As the university matured, it did not merely remain a recipient of support, but plays an equal role along with industry as seen in the technology labs programmes. From day one a very important role that the university has been playing is in entrepreneur development – through its programmes and by participating in the programmes of the regional development centre. Mohan V. Avvari, (2006) observed that there is evidence of the MMU, on the basis of its experience is playing a supporting role in the development of another cluster – a mature electronics industry cluster - in another region of the country.

The discussion so far sheds some light on the type of university-industry interactions and the role of a new university in a greenfield field cluster. It can be quite different from that of established universities in mature or brownfield clusters. The weakness of the study however, is the inability to determine the challenges in these interactions. It can be safely said that the university-government interactions between MMU and MDeC (the regional development agency) seem quite straight forward in terms of some MOUs being formed - for example, in a Memorandum of Agreement between MMU and MDeC in 2005, where MDeC will provide access to facilities through its Creative Applications and Development Centre (CADC) and MMU conducts research and training through its courses in these areas to support the industry in general. Another limitation of the paper is that it does not focus on the conflict or anxieties and tensions in the interaction between MMU and Industry. General conversation with executives in the industry led to mixed reactions – while there is a positive view in terms of human resources supply, views about the role of MMU in supporting research and development there seems to be differences in perceptions. These aspects need to be explored further.

As the MSC project developed over the last ten years in Cyberjaya – there is a growth of firms in the Shared Services and Outsourcing (SSO) sector rather than R&D centres and also a growth in the creative Multimedia sector. A longitudinal study of the process of MMU's development and its interactions with the MSC cluster and with others clusters would throw light on how the role of the university changes along with the changes in the development of the cluster and the anxieties and tensions that arose as part of the process and how these were managed.

http://www.skyscrapercity.com/showthread.php?
s=af7ea05e40fd4cebae9d4083d66fe698&t=115161&page=11

Case 2 - Cyberabad and the University of Hyderabad – Role in a multi-nuclei knowledge Centre

The IT Cluster – STPI – HITEC City Phase 1 and 2

India started witnessing an IT revolution with Bangalore, Mumbai, Chennai and Delhi as key IT hubs. The government of Andhra Pradesh realised the need for infrastructure development to attract investments of several IT companies. In Hyderabad, the establishment of the Software Technology Park of India – STPI in the year 1991-92 marks the beginning of the IT sector in Hyderabad. This was followed by the Hyderabad Information Technology and Engineering Consultancy City – HITEC City project with public-private investments.

Cyber Towers is the first phase of HITEC City and was inaugurated in November 1998. This is the first Major Public Private Partnership project between Larsen and Toubro Infocity and Andhra Pradesh Industrial Infrastructure Corporation – APIIC. (Companies include 7Hills Business Solutions, AppLabs, Keane, Microsoft, Patni Computer Systems, Oracle Corporation, GE Capital and Prithvi Information Solutions, Orbees, Four Soft). HITEC City is in a sprawling 151 acres of land, and has been developed with the best facilities for communication and amenities, and enables hassle free operations.

Many companies operated offshore development facilities and call centres in this four-quadrant, 10-story building. The Cyber Gateway is Phase II of HITEC City. The Cyber Gateway is designed for ITES and BPO services with multiple redundancies for connectivity and power. Large offshore processing operations operate out of this building. Dell, Inc., General Electric, Capitol Records, Lanco Global Systems and Microsoft were the first companies to start operations at the Cyber Gateway. They were soon followed by Oracle, Virtusa, Vertex Computer SystemsVertexcs.com and others. Soon the companies grew in size and operations and started to build their own campuses.

This was soon followed by the establishment of HITEC City-2 which is an IT / ITeS Special Economic Zone and it is being promoted as an extension of HITEC City. Several other parks accommodating companies with thousands of IT professionals were developed such as the Cyber Pearl, The 'V' An Ascendas IT Park, Mindspace IT Park apart from companies such as WIPRO, Tata Consultancy Services (TCS).

Though, Hyderabad has been a late entrant into the Information Technology industry (Ramachandran, 2005), it has witnessed growth of exports and expansion with several MNCs establishing themselves. Several factors have contributed to this growth such as the entrepreneurial vision and leadership of the then Chief Minister N Chandrababu Naidu, formulation of an IT Policy in 1999, a separate ITES Policy in 2002, a grand strategy for brand building for HITEC City, establishment of financial district, promoting IT education through International Institute of Information Technology – IIIT, and several

others in the areas of bio technology, life sciences, the Indian School of Business with a global reputation. The area around which the cluster of IT companies was being established was given the name 'Cyberabad' by Mr.Naidu and he started using this word often in his speeches to present the growth that his government has brought about.

Overview of the University of Hyderabad

For this study we selected the University of Hyderabad to examine the University – Industry interaction. As mentioned in the methodology section, the first and second authors have been working in the project SET DEV (Science, Ethics, and Technological Responsibilities of Developing and Emerging countries) supported by the European Commission. This project yielded several insights into the academia and industry linkages through a focus group discussion on the ethical Dimensions of the communication between the research community and business on March 20th, Friday 2010 at the School of Social Sciences of UoH. This was addressed to researchers, research institutions and the business world. A dynamic mix of Academicians, eminent scientists and professionals form software industry in Hyderabad participated in these sessions leading to interesting insights.

The University of Hyderabad is a premier institution located in Hyderabad. It is well known in the country for the post graduate education in several science, engineering, social science and humanities departments as well as Ph.D programme and research fellowships in the country. It was established by an Act of Parliament (Act No. 39 of 1974) on 2nd October, 1974.The Government of Andhra Pradesh provided 2.500 acres of land for the academic buildings and activities in 1974. University Grants Commission (UGC) the grant giving agency for universities in the country has declared the University of Hyderabad as a 'University with Potential for Excellence' in 2005 and has sanctioned several inputs, including additional funds, to sustain and enhance quality of education and research. The University provides several amenities to students and its faculty such as a state-of-the-art – automated library, campus wide WiFi connectivity and sports facilities. The National Assessment and Accreditation Council awarded the top grade of A ***** to the University (on a five-point scale) The University has also been rated by the NISSAT (National Information System for Science and Technology) of the Department of Scientific and Industrial Research (DSIR), Government of India, as the only University under the 'High Output – High Impact' category among the top 50 institutions in India with publications in citation - index journals. Department of Science and Technology ranked the University and has sanctioned over Rs. 10 crores as a special amount. Several departments receive FIST (Fund for Improvement of Science and Technology) and UGC Special Assistance to augment research facilities. In addition the DST supported the establishment of a Super computing Facility. The university hosts a cluster of Research and Development institutions including -

- Institute of Life Sciences – ILS
- C R Rao Advanced Institute of Mathematics, Statistics and Computer Science (AIMSCS) towards promoting research and advanced studies in mathematics, Statistics, Computer

Science and allied subjects, and also to jointly undertake collaboration in research, teaching, consultancy work and extension activities in the subjects of Mathematics, Statistics, Computer Science and allied subjects

- AMDISA a SAARC recognized body, working with initiatives of leading management Schools in the SAARC region. AMDISA promotes Management Education and Management Development in the SAARC region

The Department of Computer and Information Sciences offers post-graduate courses (Masters) - M.Tech and MCA and research programmes in all major areas of Computing, Information Science and Artificial Intelligence.

- The Department offers four different programmes of study leading to-
- M.C.A.
- M.Tech. (Computer Science)
- M.Tech. (Artificial Intelligence)
- M.Tech. (Information Technology) with specialization in Banking Technology & Information Security in collaboration with Institute for Development and Research in Banking Technology - IDRBT
- Ph.D programme

Active contacts and collaborations are maintained by the department with industry and several other academic institutions through MOUs and MEAs to strengthen research and teaching programmes. These include United Nations University/International Institute of Software Technology, Macau and University of Trento, Italy. Towards promoting further research Post-Doctoral Fellowships are available in specific areas with collaboration with IDRBT. GATE fellowships and the IDRBT fellowships are available to students for M.Tech. (IT) students for meritorious students (as per the institute's terms and conditions). There is also a limited financial assistance is available to meritorious students with financially / socially weak backgrounds. Proposed institutions include TIFR, CDFD, DBT Animal Biotechnology facility and a Knowledge and Innovation Park.

Table No 2: University of Hyderabad, Department of Computer Sciences - Academic Collaboration

Research Lab Support	Academic Collaboration	MOUs	Projects
DST	United Nations University/International Institute of Software Technology, Macau	IBM	MIT
AICTE	University of Trento, Italy.	ISTL	University Grants Commission
MIT		Sierra Atlantic	Indian Space Research Organization
Verizon Inc. USA			Defence Research & Development Organization
			Dept. of Science &Technology

The University offers a strong educational base with an internal evaluation system. It also provides campus placements through MOUs with leading companies, for the graduates of the Department of Computer Science.

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Table no 3: Number of Degress awarded by Univeristy of Hyderabad over the years

Statement showing the number of degrees awarded from 1977 to 2008

Year	MA	MSc	MCA	BTech	MPA	MFA	MBA	PG Dip.	M.Tech	M.Phil	Ph.D	Total
1977	6	-	-	-	-	-	-	-	-	34	-	40
1978	23	-	-	-	-	-	-	-	-	17	-	40
1979	21	25	-	-	-	-	-	-	-	39	-	85
1980	27	34	-	-	-	-	-	-	-	64	-	125
1981	102	54	-	-	-	-	-	-	-	29	-	185
1982	98	52	-	-	-	-	-	-	-	46	3	199
1983	82	66	-	-	-	-	-	-	-	67	21	236
1984	117	83	-	-	-	-	-	-	-	93	13	306
1985	104	61	-	-	-	-	-	13	-	47	26	251
1986	110	65	26	-	-	-	-	17	15	74	18	325
1987	125	73	25	-	-	-	-	17	27	72	18	357
1988	120	119	24	18	-	-	-	20	36	90	21	448
1989	161	97	34	41	-	-	-	13	35	106	27	514
1990	157	105	27	23	12	5	-	8	44	133	24	538
1991	176	114	28	1	15	4	-	48	28	102	24 @	540@
1992	181	126	23	1	18	6	-	21	41	122	45 @	584@
1993	188	108	34	0	15	4	-	45	43	143	26 @	606@
1994	215	120	33	0	18	7	-	37	39	138	53 @	660@
1995	214	117	29	0	13	7	-	39	36	129	57	641
1996	215	117	32	0	15	3	-	18	21	111	60	592
1997	226	140	39	0	14	5	-	24	78	111	70	707
1998	243	144	38	0	18	5	-	18	37	97	73	673
1999	242	143	43	0	13	11	-	10	32	110	82	686
2000	249	148	34	0	9	11	-	11	44	85	58	649
2001	266	151	19	0	10	13	28	9	22	105	54	677
2002	249	163	49	0	21	14	32	10	37	109	52	736
2003	247	161	39	0	15	16	29	8	74	129	79	797
2004	279	182	44	0	12	20	27	9	112	172	81	938
2005	247	175	38	0	05	17	32	25	80	114	81	814
2006	281	164	39	0	13	17	30	21	63	102	92	822
2007	289	160	39	0	12	17	36	2	102	119	90	866
2008	264	165	39	0	13	16	39	12	124	119	97	888
Total	5224	3432	775	84	260	199	253	455	1169	3028	1350	16529

* M.Sc. (Tech)

@ The figures are corrected. Though there is a slight change in the year wise Ph.D's and total number of Degrees awarded, there is no change in the total number of degrees awarded during these four years as a whole.

Source – 34ᵗʰ Annual Report – University of Hyderabad April 2008 to March 2009

The university concentrates on academic activities with various distance education programmes. The academic schedule is strictly followed with students in full time courses. There are formal meetings with industry but not on a commercial basis. However, students Internships are available for almost all the students for a semester during course work with leading software companies such as IBM.

Policy

The policy and strategy of the previous government is the catalyst which promoted a conducive 'eco-system' for business according to the ex-head of the STPI. The government promoted the IT industry with several benefits and incentives of single window system, critical infrastructure such as data cable systems, dedicated satellite linking system, created space through STPI to support the IT industry's

'business eco-system'. The policy however did not recognize the potential of universities in the transformation form generational to developmental roles. According to the data available with the NASSCOM the number of IT and ITES professionals employed in India has grown from 284,000 in 1999-2000 to over 1 million in 2004-05.

Figure 3 - Indian IT and ITES Sectors: Growth in Professionals

Source: NASSCOM - http://www.nasscom.in/Nasscom/templates/NormalPage.aspx?id=6314
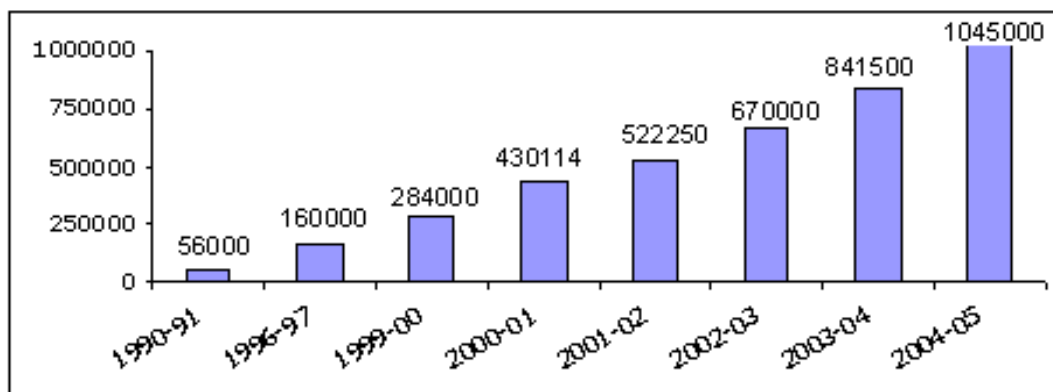
Role of Universities and Academic Institutes as only Human Resource contributors

According to the CMD of a software company, the role of universities has not changed in Cyberabad. He says that, during the earlier times, it was easy to procure a software contract, but it was difficult to get the required skilled manpower needed for the project. But now there is an abundance of skilled manpower but procuring a software development contract is very difficult. At the moment there are very few companies that are willing to collaborate with the universities. They have been confined to generating manpower. According to the MD of the Microsoft Development Center in Hyderabad, there are too many engineering educational institutes, and there too much of a turnover of the engineers in Hyderabad.

Figure 4 The Supply pool of IT professionals

Indian IT sector: Labour Supply				
(in '000s)	2003-04	2004-05	2005-06E	2006-07E
No. of Engineering Graduates	215	284	348	382
No. of IT (Computer Science, Electronics, Telecom) professionals	141	165	181	193
No. of IT professionals entering the workforce	**80**	**94**	**103**	**109**
No. of non-IT engineers entering the workforce	**40**	**40**	**40**	**40**
No. of graduates (other disciplines) entering the IT workforce	**30**	**30**	**30**	**30**
Total fresh IT labour supply	**150**	**164**	**173**	**180**

Source: http://www.nasscom.in/Nasscom/templates/NormalPage.aspx?id=6314

NASSCOM provides information on the knowledge professionals available in the country -

- New recruits in the industry are fresh graduates and there is a large pool of fresh graduates turned out each year
- Number of employees in the ITES-BPO segment has witnessed the highest levels of growth over the last few years – attributed to the tremendous growth in demand for these services.

Figure 4 The Supply pool of IT professionals

Indian IT and ITES Sectors: Professionals Employed				
	2001-02	2002-03	2003-04	2004-05
Software Exports sector	170,000	205,000	270,000	345000
Software-domestic sector	22,000	25,000	28,000	30000
Software- in house captive staff	224,250	260,000	290,000	322000
ITES-BPO	106,000	180,000	253,500	348000
Total	**522,250**	**670,000**	**841,500**	**1045,000**

Source: http://www.nasscom.in/Nasscom/templates/NormalPage.aspx?id=6314

The NASSCOM study points out to the software market in India providing direct employment to more than 2.2 million (and nearly twice the number by way of indirect employment), there is a need to "strengthen professional education (through curricula, faculty, infrastructure, pedagogy improvements) in line with the IT industry's requirements and further catalyze the interface between the academia and corporate/industry".

University – Industry Interaction in Cyberabad

As mentioned in the methodology section, there were many software industry professionals and academicians involved in the Project SET DEV focus group discussion at the UoH served as inputs for the findings and discussion in this section. There were also other professionals – the Managing Director of the Microsoft Development Centre, the head of the STPI at the time of its establishment, a CMD of a software company and academicians and placement officer in the UoH were also interviewed for the purpose of this paper. According to all the professionals who were interviewed, the Managing Director of MNC – Microsoft, MD of a software company, a University Associate Professor of Computer Sciences who co-ordinates placements of students, and the ex-head of the STPI (who worked from 1991 in the founding stages of the cluster), university –industry interaction in IT has been minimal. There were only few collaborations for research such as that between IIIT Hyderabad and Microsoft Bangalore which was quoted by the MD of MSDC (Microsoft Development Centre-Hyderabad).

According to the ex-head STPI of Hyderabad, at the time of the establishment of the STPI there were not many professionals for the industry. The educational system was not bringing as many qualified engineering graduates required for the growing number of companies and projects. The UoH report shows a gradual rise in the number of graduates of MCAs through the 1993-2004 periods. According to the Faculty interviewee the University has limited seats for the MCA and M.Tech programmes and the university is producing highly skilled workers.

Memorandum of Understandings between University and Industry and R & D

The MD of MSDC is of the view that the passion with which the sciences academicians are working in areas such as Biotechnology is not visible in the Computer Science departments of universities He attributes this to the lucrative jobs on the offer for software professionals who prefer to work in industry rather than engage in teaching or research in universities. This leads to poor quality teachers who are not so motivated for their field.

According to the faculty, the companies in Cyberabad are engaged only in software contracts such as maintenance and module development which does not require any highly skilled professionals; there is no need for the university to ask for any collaboration on this front. In case of product development the university is contributing through placements and internships. Most of the patents are filed by the Research and Development centres of the MNCs. They employ Indian IT professionals in these

centres. He observes that the companies which are engaging the M.Tech and MCA students for internships are extremely satisfied with their work and are willingly offering employment to these students after completion. In fact the university professors are expecting higher level of technical work which is not needed for the industry.

The level of research that the computer scientists in the department at the university are engaged in is of at an advanced level and is academic, which is not required for the services and maintenance oriented projects taken up by the IT companies located in Cyberabad.

The model followed in the collaboration between IIIT and MSDC, Bangalore has been that of consulting projects required by the industry According to the consultancy, the knowledge arising out of the project is shared only with the company. It is not disclosed to a third party. This creates anxieties among scientists in academic institutions as the culture of academic institutions emphasises publication of their research outputs.

> *"Academicians look for publications and companies look for protection". Hence there is a need for a clear collaborating terms and conditions for both the parties involved. This is the factor that affects their interactions for a mutual benefit.*

This there is a hesitation on the part of the academics to actively collaborate with industry.

Training and Skill Development of Manpower

According to the MD of Microsoft Development Centre in Hyderabad, any company recruits based on the aptitude of the candidate and not exactly for the knowledge and skill. This is because universities offer generic knowledge and cannot fine-tune the skill for the industry requirement. Industry offers training to suit its technical environment.

There is a clear distinction between product development companies and service offering software companies in terms of requirement of human resources as well as research orientation. According to the MD of MSDC, the available manpower in Cyberabad there is a small number of candidates with high levels of skills who are appropriate for a product developing company but there are more number of lower level skilled workers who are appropriate for software services companies.

A computer science who is also the placement co-ordinator at the University of Hyderabad said that all the students are employed through the campus placements. This is especially with the case of M.Techs and MCAs. Only a few are looking for research and Ph.Ds. The faculty member of UoH provided the list of companies which entered into MOUs with the UoH - IBM, Honeywell India Ld., GE India Innovation, Sierra Atlantic, Tata Consultancy Services, and J P Morgan (finalized but formal contract out to be signed).

The M.Tech course offered in collaboration with the Institute for Development and Research in Banking Technology has been attracting some MNCs specializing in the area of financial data security. The University of Hyderabad is producing highly skilled and human resources for various product development as well as software service oriented roles in IT industry. The UoH plays a significant role in providing human resources in a variety of areas relating to IT industry and also to industries that have an interface with IT though in small numbers.

University research and Industry research differences

The academician at the UoH is of the view that the research and evaluation system is very rigid and serious compared to that of the industry standards. This was evident in the internships which are evaluated by a professor who guides the student throughout the internship. The professors are not so satisfied with the academic content whereas the industry is very happy in taking the student after the course completion. This way the university is able to provide near 100 percent employment to all the students. This is an indicator of the high levels of skills imparted to the students which is of benefit to the industry.

There are at present 72 Ph.Ds and on an average 5 Ph.Ds are awarded every year. This is considered as about 80% of the total number of Ph.D.s produced in this stream in India. These Ph.Ds essentially remain in academics and very few opt for industry employment. The company Teradata is the only one which is interested in collaborating with the research work through university. According to the UoH faculty of computer Science department, the industry is under utilizing the manpower produced by the university.

Research lab Sponsors

There are some contributions of the companies with MoUs with University towards human resource development. This includes the IBM and Sierra Atlantic who have sponsored specialized computer laboratories for the use of students in the university. These are used for particular courses and the students are benefitting from these labs according to the faculty of Computer Sciences of the university.

The findings of the Cyberabad data can be summarised with the following chart -
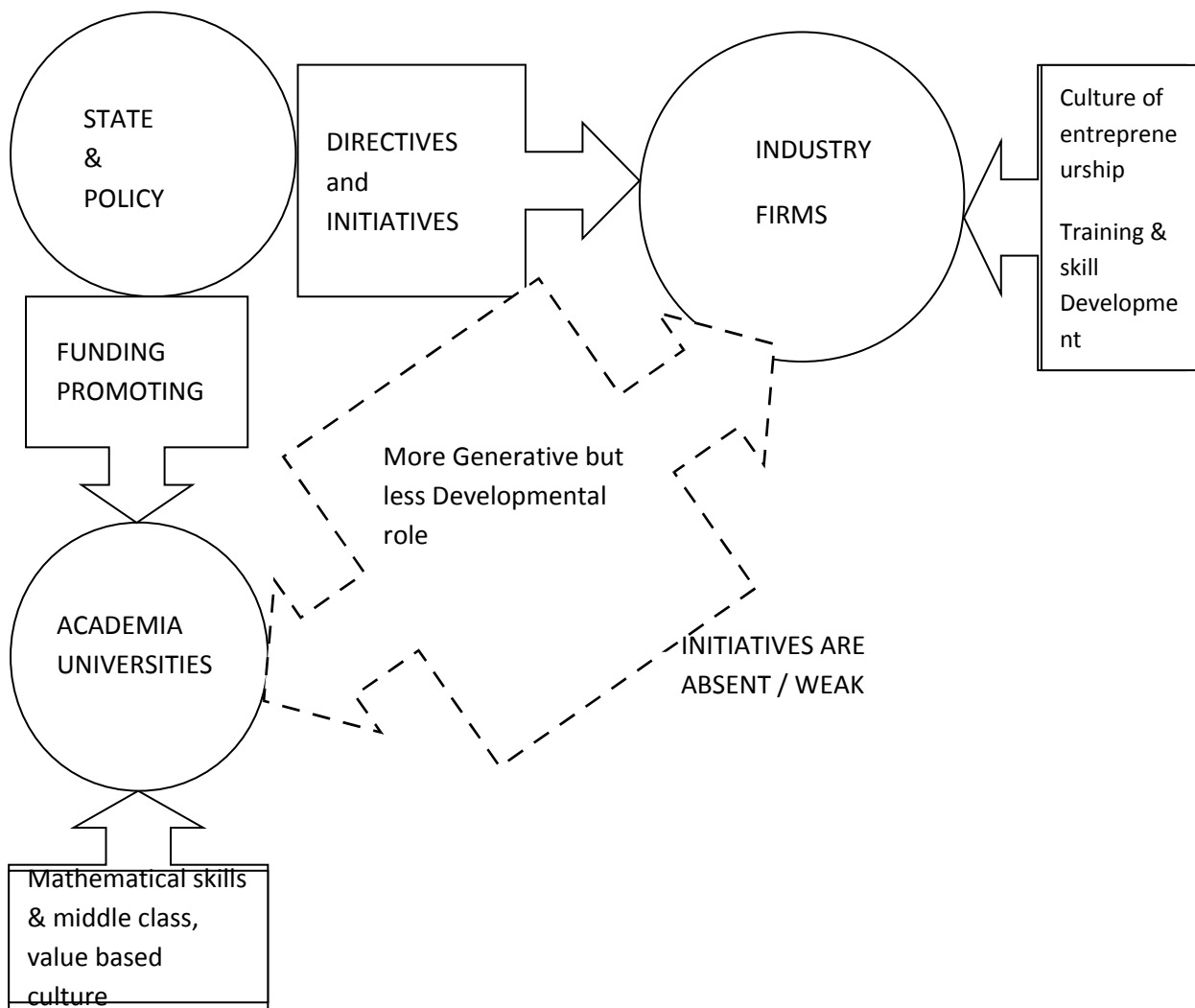
The policy and strategy that shaped the initial and later stages of the IT industry in Cyberabad has been successful in creating the cluster and its sustenance. The initiatives and directives can be very effective as they offered immense benefits to the start-ups and the MNCs. Institutes like IIIT and ISB were established also have been contributing to the regional development in a generative role with their placements and research initiatives. There is a strong emphasis on natural sciences, mathematics branch and engineering in the Indian education system. This has resulted in turnout of a large number of skilled science and engineering graduates, with English proficiency and quantitative concepts. This has been harnessed by the IT industry for its rapid growth. (NASSCOM – India Advantage – www.nasscom.com).

Cyberabad has experienced a shortage of skilled engineers at the initial stages of the development of the industry. This triggered the establishment of many engineering educational institutes, with poor quality teaching and students. There has been a rapid growth of engineering colleges over the last one and half decades.

According to the Strategy Paper on Higher Education, Government of Andhra Pradesh Higher Education Department Hyderabad, 2001 Source: http://www.aponline.gov.in/ (04/03/2003), in 1994-95, there were 32 engineering colleges with an intake of 9335, which grew to 245 colleges in 2001-2005 with an intake of 70000 students. In 2009 there were 320 engineering colleges with an intake of about over 1lakh students.

The rapid increase in these engineering colleges has its ill-effects on the educational system. Most of the engineering colleges were established by educational entrepreneurs who saw these colleges as sources of profits. As a result, most colleges employ poor quality teaching staff and have poor infrastructure. Further, most of the engineering graduates from almost all branches of engineering tended to opt for IT jobs rather than opting for higher education and research in different branches

The cluster in Cyberabad has been essentially focusing on software services and as back offices who maintain the main offices across the globe. These jobs do not require very high levels of research orientation. Therefore the need for these companies is met through the engineering graduates passing out of the privately managed engineering colleges. The value system of the social groups, communities and especially middle class among these groups and communities in Andhra Pradesh tends to emphasise education that guarantees employment and in their view engineering education offers promise of lucrative jobs. As a result the demand for engineering education grew more for social considerations rather than market demands. The social demand for engineering education led to phenomenal increase in the number of engineering colleges, the intake and the number of engineering graduates. This gives ample scope for the companies to select the best available skilled knowledge workers from the available pool. Many companies operate with multiple locations in India and globe therefore the students employed or who work as interns do not remain in the city.

The role of the university in the initial stages and now has not changed much. It has remained a hub for producing research oriented individuals and research publications. The collaborative research does not seem to take-off due to lack of interaction between U-I and more importantly the Intellectual property protection that the companies seek out of the research output, but publication is essential for academics and their doctoral students. Thus university is limited to the generational role and not a developmental role in Cyberabad. This is true of many universities in the country.

Conclusions

The factors that contribute to variation in the levels of interaction are: the nature of activity of the industrial units, institutional framework or a lack of such framework, policy initiatives of the regional

and national governments, clustering of the industrial units and clustering of the R & D institutions and their mandates. There is a specific pattern in the cities of Hyderabad – Cyberabad and Cyberjaya. The IT firms, both national and multinational incorporated outside India and Malaysia take benefits from policy concessions. However, in terms of outputs the national firms tend to provide software services and training whereas the development centres of the multinational companies tend to produce products and processes and patent them. In this context, the role of the universities in knowledge generation and development becomes minimal as the firms that provide services and training do not require new knowledge. The development centres of the multinational units tend to depend more on in-house R&D personnel and consult with experts abroad for developmental needs.

The service and training firms are subject to the fluctuations in global demand for the tool-based services. The impact of this pattern of linkages has implications for the development of regions. This pattern also results in the minimal or no developmental or productive linkages between the universities and industry, in spite of the pro-active policies of the governments. Product development requires not only higher levels of investment but also a cultural ambience which attaches value to research, future gratification and a positive attitude towards calibrated risk-taking. The firms which specialize in providing services and training do not seem to internalize this culture of innovation. The UIL in this context is restricted to industry receiving human resources trained in using tools. In Cyberjaya the university waits for the industry to interact whereas in India the industry tends to have reservations to interact with the universities for collaborative developmental role. In the research collaboration, the anxiety in the interaction between IT firms and university exists regarding the credit sharing and disclosure of research findings and output. The university gives importance to publication and industry wants to restrict disclosure of research output to any third party because of intellectual protection. The interview with the industry professionals also pointed out to the need for clear collaborating terms and a forum or platform for such association. The annual turn out of engineering graduates is rather high approximately 200.000 across the country according to the U.R. Rao Committee, which has reviewed the performance of the All India Council for Technical Education (http://www.wes.org/ewenr/07jan/feature.htm#). However, the industry finds that only about 30% of the graduates are employable. As a result there tends to be a large pool of young, job seeking engineering graduates. In other words it has become a buyers' market for the industry recruiters. The CGPA required is set higher every year for screening, though there is no such need for skills in the service based software industry in Cyberabad (informal interview with the faculty coordinator for placements in UoH).

Cyberjaya and Cyberabad thus offer interesting insights into the processes of knowledge production, knowledge consumption and the emergence of knowledge intermediaries in the two countries which needs further exploration.

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Appendix 1. Chart of Collaborations of Multimedia University

Collaborators	Scholarships	Research Grants	Laboratories	Sponsorships	Joint R&D / Ventures
NTT	✓	✓	✓	✓	✓
Microsoft	✓	✓	✓	✓	✓
SUN			✓	✓	
Lotus			✓	✓	
Lucent Technologies				✓	✓
Siemens	✓			✓	✓
Fujitsu				✓	✓
Intel	✓	✓	✓	✓	
Marconi			✓	✓	
Optidigit			✓	✓	✓
MIMOS (TEMAN)					✓
Hewlett Packard	✓			✓	✓
National Semiconductor	✓			✓	✓
Alcatel	✓		✓	✓	✓
Lensa			✓	✓	✓
Marconi	✓		✓		✓
Ericsson					✓
MACRES		✓	✓	✓	
MIMCED					✓
Cisco	✓		✓	✓	
Fore			✓		
Aonix/Lexical					✓
Nortel					✓
Motorola	✓	✓	✓	✓	✓
Likom	✓	✓		✓	
Digital			✓	✓	
Waterloo Maple					✓
Bates			✓	✓	✓
Anderson Consulting			✓	✓	✓
Comscape	✓				✓
Autodesk			✓	✓	✓

Fakespace			✓	✓	✓
SGI			✓	✓	✓
Avid					✓
Compaq	✓		✓	✓	
Neuronet					✓
Transtel			✓	✓	✓
	8	6	22	26	27

- **Source:** Mohan V. Avvari and Ismail, Isshammudin. 2005, "Support Institutions In Development of R&D Activities In An ICT Cluster – The Multimedia Development Corporation In Malaysia's Multimedia Super Corridor Cluster, Science, Technology and Society (STS), (Sage UK), Vol. 10-1.

Notes: The multi-partner international project Science, Ethics and Technological Responsibility in Developing and Emerging Countries supported by the European Union's Research Commission provided opportunities through various capacity building workshops and focus group discussion to collect data from representatives of industry, government and civil society organizations on issues relating to innovation, academia-industry interaction during 2008-2010.