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Developing Human Capital for Sustaining the Growth of Indian Software Industry

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Developing Human Capital for Sustaining the Growth of Indian Software Industry

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Abstract: *The growth of Indian software industry till date has been mainly due to the availability of highly competent and cost competitive software professionals in India. Software organisations, national educational institutes, corporate private training institutes and the central and state governments have been taking a number of initiatives to develop the human capital for sustaining the growth of Indian software industry. The paper examines these initiatives related to development of human capital and suggests further measures to be taken by different agencies.*

Key Words: 1. Software Industry 2. Human Capital 3. India

Indian software industry had a phenomenal growth in the last decade and in spite of worldwide recessionary trends in the software industry, is expected to play a much bigger role in the new millenium in the growth of Indian economy. Indian software industry achieved 29% growth and an export turnover of Rs. 36,500 crore in financial year 2001-02. By the year 2008, the exports from Indian software industry are projected to be about US$ 50 billions (NASSCOM.ORG).

The growth of Indian software industry till date has been mainly due to availability of highly competent and cost competitive software professionals in India. For sustaining the projected growth for Indian software industry, the manpower in the industry should increase to 2.2 millions by the year 2008. India has been training about 68,000 software professionals per year (NASSCOM, 1999). The Government of India and the state governments have been taking initiatives to triple the output of engineering students by the year 2008. Since Indian software

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professionals have proved their competence and worth in the international market, they have been in great demand in USA, Europe and other developed countries. As a consequence, Indian software industry has been losing experienced software professionals to developed countries. Attrition rate in Indian software industry before recession in the year 2000 was about 16 percent (NASSCOM, 2001). This high rate of attrition and very high planned growth rate led to shortage of human capital in Indian software industry.

Superior growth opportunities in software industry and shortage of human capital led to many universities and academic institutions increasing number of seats in software courses. Large number of corporate and private software training centers have come into existence to meet the increasing demand of software professionals in India. It has increased the supply of software professionals but many of them are either not employed or underemployed. Informal interactions with software organisations suggested that quality of software professionals from many universities as well as from many of the corporate and private software training centers was not upto the mark and did not meet the industry requirements.

The growth pattern of Indian software industry in the year 2001-02 reveals some interesting patterns. As reported by NASSCOM, the top 5 software companies from India accounted for 55 percent growth of the industry and the top 10 software companies accounted for 73 percent growth of the industry in the year 2001-02. It implies that many of the small companies had literally nil or negative growth in the last one-year. Many small and medium size companies have resorted to substantial lay off. Even quite a few large companies after making employment offers at different colleges withdrew the offers. This has led to some loss of confidence in Indian software industry and its ability to provide attractive and stable career opportunities in the mind of young aspirants.

Another interesting feature of the growth of the Indian software industry is that the substantial growth has been at the lower end of the value chain in IT enabled services (71%) as against the comparatively low growth (22%) of IT services (NASSCOM.ORG). It implies that Indian software industry would need to examine its strategies and composition of manpower to grow on the value chain.

It is in the above context that this study examines deficiencies experienced and likely to be experienced in human capital and the initiatives being taken by various organisations and agencies to bridge the gap between requirements and supply of human capital for Indian software industry. The paper makes recommendations for the software industry, academic institutions and software training centers for improving the supply, composition and quality of human capital for sustaining the growth of Indian software industry.

1.0 Objectives and Scope of the Study

The study focuses on achieving following specific objectives:

- To identify deficiencies experienced and likely to be experienced in human capital in the software industry
- To understand the initiatives taken by software organisations, academic institutes, government and software training centers to bridge the gap for human capital.
- To suggest measures to further strengthen the quality of courses offered by academic institutions and software training centers.
- To define measures to increase the number and quality of teachers for software courses.

2.0 Methodology and Sample

Since the study is positioned as an exploratory study, in-depth open-ended interviewing was primary source of data collection. The data was collected from the following sources:

- In-depth interviews with Professors and Head of Computer Science Department from academic institutions. We visited a total of eight institutes namely, Indian Institute of Technology (IITs) at Chennai, Delhi, Kanpur and Mumbai, Indian Institute of Information Technology (IIITs) at Bangalore and Hyderabad, Indian Institute of Science (IISc.), Bangalore and Center for Development of Advanced Computing (C-DAC), Bangalore. In addition, we also visited four engineering colleges affiliated to Bangalore and Anna University.
- In-depth interview with a total of eight executives from large software organisations employing more than 500 employees and four executives from small firms employing less than 200 employees were interviewed.

- Interviews with executives from software-training centers NIIT and APTECH.

In addition, we collected data from secondary sources such as published reports and Internet. This report is only an interim report and does not claim to be exhaustive in its listing of all the initiatives being taken by different software organisations, national institutes and other agencies.

3.0 Deficiencies Experienced and Challenges in Developing Human Capital

Some major deficiencies and challenges presently being experienced by the Indian software industry, which emerged from the study are as listed below:

- Due to shortage of qualified software professionals, the software organisations in India have been recruiting engineering graduates irrespective of their disciplines based on their analytical and learning capabilities. These fresh engineering graduates need to be given substantial inputs in software engineering.
- The computer and IT courses that are taught in different university colleges need to be expanded to cover not only the fundamentals but also to expose the students to current practices in the software industry.
- Since university colleges do not provide knowledge about current tools, technique and industry practices to software students, fresh graduates joining the software organisations need to be exposed to these aspects before they can be put to work on live projects.
- In the university colleges and even in recently started Indian Institutes of Information Technology (IIITs), there is substantial shortage of teachers. Teachers in many university colleges do not have enough exposure to the problems and requirements of the industry. Due to substantial differences in pay and other facilities being offered by academic institution vis-à-vis software companies, academic institutions are not able to attract and retain bright software professionals as teachers.
- In the last few years, students from Indian Institutes of Technology and other better colleges have been getting jobs with excellent salaries in software organisations. As a consequence, registration for post-graduate and doctoral programmes was extremely poor in the last decade even in IITs. A few students who aspired to study further in IT and software related fields preferred to study in US universities rather than in Indian universities. Apparently, most of them settled in USA after completing their post-graduation/ doctoral programme. As a consequence, supply of professionals with higher qualifications in software related fields

were very meager in the last decade. This in turn has affected the availability of professionals who could join teaching professions in national institutes, university colleges and corporate and private training centers.

- Large software organisations are able to create in-house training facilities for providing orientation as well as career based training inputs to its software professionals. However, medium and small software organisations generally do not have any worth while training facilities. They have to either recruit people with necessary expertise or rely on the external training agencies.
- A number of Indian software companies, large as well as small, exclusively work only in export market. Many of the software export projects are small by international standards and Indian software organisations work simultaneously with a number of clients. And hence, Indian software companies require a number of software professionals who can perform leadership responsibilities early in their career. Indian software industry is comparatively young and many of the experienced software professionals who can handle these responsibilities have been moving to USA and other developed countries for better career prospects. As a consequence, in India, capable software professionals with work experience of about 2-3 years are expected to handle leadership responsibilities. While these activities are very important for the success of a software project, many of the software professionals perceive it to be a non-value adding activity and do not enjoy performing them (Agrawal, 2000).
- Since Indian software industry essentially works as service provider in different domains, the industry at middle management level needs professionals who have software expertise, domain knowledge and managerial capabilities.
- Software industry in India needs to move up on the value chain for maintaining its growth. This in turn requires that software professionals should have not only superior software engineering and design skills but also should have skills pertaining to product and technology development related competencies.
- Indian software industry will be able to work on product or technology development projects only if it could retain its experienced software professionals for a long period. In the past, a large number of software professionals with a few years of experience used to move to USA and other developed countries. The recent slow-down in the global economy has reduced the

movement and attrition of experienced software professionals in Indian software industry. But the problem of retaining talented software professionals continues to remain.

- The recent battering of the stock markets has resulted in the Employee Stock Option Schemes losing their attractiveness for Indian software professionals. New innovative compensation and reward packages need to be designed to motivate and retain superior software professionals.
- The recent withdrawal/postponement of job offers to fresh software and management graduates by Indian software organisations have resulted in retrenchment and de-motivation of these professionals. It is felt that this has led to casting a shadow of doubt on the commitment of employers. And as a consequence, attractiveness of the software industry as a career option seems to have been partially affected by these actions.

Indian software industry is striving to overcome many of the problems discussed above. In the remaining part of the paper, we discuss some of the initiatives taken by software organisations, national institutes, government, and corporate and private software training centers to overcome the problems and challenges related with human capital for sustaining the growth of Indian software industry.

4.0 Software Industry Initiatives

4.1 Software Training and Finishing School Training for Fresh Recruits

Many of the large software organisation recruit engineering graduates exclusively based on analytical and learning capabilities of the applicants. These engineering graduates can be from any discipline and need not be from computer science or a related field. After selection, these fresh engineering graduates from different disciplines need to be put through long duration software courses. In addition, fresh graduates with software education from university colleges, aspiring to join software organisations do not have necessary exposure to industry tools, techniques and processes. Hence, the fresh graduates need to have finishing school training so that they can acquire expertise to work on live organisational problems.

Large software organisations such as Infosys and Tata Consultancy Services (TCS) have been providing in-house software and finishing school training. Infosys Technologies provides

intensive training for a period of three and half months to its fresh recruits. This includes software basics as well as project and organisation specific induction training. As a part of the training programme, the participants work on a project, which provides them hands-on-training. Tata Consultancy Services (TCS), the largest software company in India in terms of revenue and manpower conducts a similar programme of about six months duration for the fresh recruits at TCS Training Center at Trivendrum.

4.2 Finishing School Training for Software Professionals at Small and Medium Size Software Organisations

Due to shortage of infrastructure as well as faculty, small and medium level software organisations are not able to provide long duration finishing school training to their freshly recruited software engineers. Some corporate software and IT training centers such as Boston Training Institute have come up with a unique scheme to help these organisations for providing finishing school training. These centers interact with small and medium size software organisations to understand their requirements in terms of the syllabus for fresh recruits. Based on the syllabus developed by these participating software companies, these centers design a six-month duration "Software Application Engineers Programme" (SAE). All the potential applicants are assured that those who get selected and successfully complete the programme will get a guaranteed job with a certain minimum salary. These software-training centers also inform the applicants about the participating software organisations. This in turn leads to a large number of fresh graduates applying for the course. All the participating organisations get the opportunity to scrutinise the application forms of the different applicants. Those candidates, who are selected by the participating companies, are issued an appointment letter subject to their successfully completing the course.

The candidates who join the course pay the programme fees. Since the candidates selected for the programme have an appointment letter from a software company, they can get a bank loan to support themselves during the training period, if they want. Some of the companies reimburse the course fee to the candidates when they join the organisation after completing the course or after spending about six months in the company. The software training centers update the course structure regularly based on the industry needs. A similar six-month finishing school training is

also provided by the Center for Development of Advanced Computing (CDAC), an agency created by the Government of India, discussed in a subsequent section of the paper.

4.3 Sandwiched Academic Programmes in Collaboration with Academic Institutions

A number of software companies such as Wipro and Cognizant Technology have started sandwiched academic programmes in collaboration with reputed academic institutes. Wipro has started an academy of its own known as Wipro Academy of Software Excellence (WASE) to train and create its own software professionals. It offers a four year sandwiched postgraduate programme in collaboration with a well-known engineering institute, namely Birla Institute of Technology and Science (BITS), Pilani. The programme is meant for fresh science graduates with specialization in Physics, Mathematics, Computer Science or Electronics. The applicants should have less than one year of experience. The programme consists of alternate modules of classroom inputs by BITS faculty and on-the-job training in different Divisions of Wipro. The participants for the programme are selected through a rigorous selection process on an all India level. During training period they are paid attractive stipend. Once a person joins the programme, he or she must complete the programme but no service bond is taken for serving Wipro after completion of the programme. After successful completion of the programme, participants receive postgraduate degree in computer science from BITS Pilani. In the first batch, in 1995, Wipro had taken a small group of 23 participants and presently about 500 participants every year join the programme (Agrawal, 1999).

4.4 Training the Teachers

In the last decade, most of the Indian educational institutions inclusive of national institutes such as IITs did not have many students for post-graduate and Ph.D. programmes in software related disciplines. This has led to a severe shortage of teachers in university colleges teaching software and IT related courses. In addition, existing teachers in these colleges, partly because of being busy and partly due to lack of opportunities, were not exposed to current tools, techniques and practices from the software industry.

For attracting candidates for the post-graduate and doctoral programmes in software and related subjects, a number of software organisations, in the recent past, have offered very attractive scholarships for post-graduate and doctoral programme students in software and IT related

disciplines in IITs and IIMs. Some software organisations have taken the initiative to share their expertise with software teachers and have provided faculty support to academic institutions. Infosys in collaboration with national institutes and universities has been offering a short duration course for computer science and information technology teachers at different locations in the country. Presently, the course is offered at Bangalore, Mumbai, Chennai and Pune. The course is of three-day duration and it focuses on creating awareness about current assignments and challenges being experienced by the industry. Every year about one hundred teaches get an opportunity to participate in this programme. Infosys also encourages university teachers to participate in its fourteen-week training programme offered by it for its fresh software engineers.

4.5 Faculty Support for University Programmes

Some software organisations have adopted colleges teaching computer science and information technology courses located in their vicinity. These organisations provide infrastructure support to these colleges. But more importantly, many of them, on a regular basis, provide faculty support to these colleges. This helps the university colleges to teach the latest tools, technologies and work practices to their students. Many of the Indian Institutes of Information Technology (IIITs) extensively rely on faculty support from software organisations. Organisations that have adopted these colleges offering computer science and information technology programmes, have also benefited. While making career choices, students from these colleges tend to prefer the organisations from where software professionals had taught them as teachers for different courses. This model seems to be a good model whereby both the industry and the teaching institutions seem to be benefiting by collaborating with each other.

4.6 Employment to Teachers in Software Companies during Summer Vacations

Some software companies offer employment to computer science and information technology teachers during summer vacation. If planned properly, the scheme provides opportunity for university teachers to work for about three months per year in software and IT companies. Three months is a reasonably long period for university teachers to update themselves with what is current in the industry. Industry also gets additional manpower for those three months. Teachers while being in organisations, work for part of the time on live projects and use the remaining time to offer software and IT related relevant courses for the organisation.

Effective implementation of the model in a large scale will require planning and discipline both in the university set up as well as in the software organisations. Universities will need to ensure that academic course work and final examinations are planned well in advance and are completed as scheduled. Universities should consider teachers working with the industry as summer attachment and allow the teachers to keep the extra earnings. However, participating-organisations should avoid the temptation to look at these teachers as possible source of additional manpower. Thus if effectively implemented, all the agencies associated with the programme, namely, software organisations, university colleges and teachers will stand to benefit from the programme.

5.0 Initiatives by National Institutes of Education (IITs/IISc/IIMs) to Provide Leadership in Software and IT Related Education

The Government of India created Indian Institutes of Technology (IITs) in late '50s and early '60s in collaboration with developed countries so that they can provide leadership in technology field. In the field of software and IT, these national institutes have trained world-class professionals who are in leadership positions in India as well as in the USA, in industry as well as in academics. In the last decade, these national institutes have taken a number of initiatives to provide leadership to colleges teaching software and IT related courses in the university set up. Some of the innovative initiatives by these national institutes have been in the area of developing course material for software courses, training the teachers, offering their degree programmes at multiple locations and providing short-duration training programmes for the software industry. In addition, these national institutes have been offering a number of courses in distant education mode. Some of these initiatives are discussed below:

5.1 Developing Course Material and Training University Teachers

The Department of Electronics (DOE) and the World Bank funded the Impact Programme at Indian Institute of Technology (IIT), Bombay. The programme was initiated in 1991 and was concluded in 1997. IIT Bombay started the programme in collaboration with Jadhavpur University. Subsequently, sixteen other colleges had joined the programme. As part of this effort, nine courses were developed at graduate level in computer engineering programme. Each

course was for about 60 hours duration. For each course, the syllabus, course material and classroom exercises were developed. In addition, IIT Bombay trained teachers from the colleges that participated in the programme.

The review of the programme suggested that the programme did help in improving the quality of computer education in the participating colleges. However, it was found that some of the faculty in participating colleges had discontinued the use of course material. A need was also felt to upgrade the course material on a continuous basis. Also, faculty from the participating institutions need to be provided short duration inputs on a regular basis to upgrade their knowledge and skills. Continuous networking amongst the participating colleges and IIT Bombay would help in sustaining the motivation of the participating institutions.

5.2 Distant Education Initiatives

The Indian Institute of Technology Kharagpur (IIT Kharagpur) has been a pioneer in distance education. In addition to the M.Tech and Ph.D. programmes, IIT Kharagpur offers a full time Postgraduate Diploma in Information Technology in three locations viz. Kharagpur, Calcutta and Bhubaneshwar. It is a two-semester programme on the foundations of information technology. The programme provides inputs in cutting edge technologies and applications. A combination of distant and contact modes is used to deliver the programme.

IIT Bombay is planning to offer a one-year postgraduate diploma in information technology through distance education programme. The course is meant for practicing software professionals and university teachers. The course will be offered in collaboration with university engineering colleges at multiple locations. The first course is planned to be offered in collaboration with Visvesvaraya Regional College of Engineering (VRCE), Nagpur. In the beginning, the course will be offered as a post graduate diploma, but subsequently the course will be upgraded as a post graduate degree course. Those participants who successfully complete the post graduate diploma can do a project work and get a M.Tech degree from IIT Bombay. Practicing managers from the industry who do not have a graduate degree in the relevant field to register for a post graduate level course, may attend and audit the programme by paying the programme fees. Faculty from the centres where IIT will offer these courses would be

encouraged to register for the programme. This will help in upgrading the quality of computer and IT teachers in those colleges.

5.3 Educational Programmes for Practicing Software Professionals

In 1992, the Indian Institute of Technology Delhi (IITD) had set up the Foundation for Innovation of Technology Transfer (FITT) with a view to enhance considerably the level of interaction and collaboration with industry. The FITT is partnering with DACP (P) Ltd. for implementation of the initiatives taken by IIT Delhi to promote off-campus mode of education. Continuing Education Programme has been a sustained activity and one of the focus areas of FITT. The trainees participating in this course are from the industry and the course structure is designed as per the industry needs.

DACP (P) Ltd. had earlier set up the El Net Academy, which is well known for conducting off-campus distance education courses, offered by IIT Kharagpur. IIT Kanpur also has a separate center to cater to the educational needs of practicing professionals from software industry.

5.4 Nurturing Entrepreneurship in Academic Institutions

The Indian Institute of Science (I.I.Sc.) in Bangalore is a premier research institute offering postgraduate programmes in Science, Engineering and Management. The I.I.Sc permits its faculty to start and own companies that develop products and provides services in high technology fields inclusive of software and IT. This initiative will undoubtedly promote entrepreneurship in academic institutes in software and IT related fields. The development of Simputer and the necessary software are examples of this entrepreneurship. Other national institutes and universities should adopt and nurture this model for developing entrepreneurship in software and IT related fields. Such initiatives will also facilitate in retaining competent faculty with entrepreneurial mindset at academic institutions.

5.5 Leadership Competencies for Software Professionals

Indian software industry being mostly in service business requires that software professionals early in their career should start handling leadership and managerial responsibilities. IIMs have been regularly offering software-related courses in their post-graduate programmes. They have

been conducting a number of management programmes for practicing mangers in software and IT industry.

In the recent past, the Indian Institute of Management Calcutta (IIMC) and the Indian Institute of Management Bangalore (IIMB) have taken two major initiatives to provide leadership and management training for software professionals. IIM Calcutta conducts an exclusive two-year full time programme to develop managers and leaders for software industry. The first year courses are similar to the core courses in a post-graduate programme in management. The second year courses are exclusively oriented towards software development and software management skills.

Indian Institute of Management Bangalore in collaboration with the software companies located around Bangalore has started a two and half-year part-time post-graduate programme in software management (PGSM) for practicing managers. The programme has been designed to provide management and leadership skills for experienced software professionals. PGSM is delivered over ten terms of eleven weeks each. Every week participants meet for about nine hours, 3 hours on Friday mornings and six hours on Saturdays. The first five terms cover about fifteen core courses. In the remaining five terms, participants take 15 elective courses and work on an individual project relevant to their companies.

Software companies have been conducting regular in-house programmes on leadership and related subjects. Infosys has opened a leadership centre to provide leadership training to its software professionals. Wipro has been working with the concept of competency-based progression and has been conducting a five-day training programme, the 'Wipro Leaders' Programme'. Three Sixty degrees feedback and out-bound training are some other initiatives by software companies to provide leadership skills to its software professionals. However, as compared to software and IT related training, efforts for providing leadership training to software professionals is much less. The task becomes much more complicated as software professionals also tend to prefer technical training much more as compared to leadership and managerial training.

5.0 Government Initiatives

In addition to providing support to national institutes for furthering the cause of software education, the Government of India has taken two major initiatives to promote software education in the country. The Ministry of Human Resource Development and some State Governments have provided support for starting national level autonomous institutes for IT education namely, Indian Institute of Information Technology (IIIT). Secondly, the Centre for Development of Advanced Computing (CDAC) is partly funded by the Government of India and has been doing significant work in the field of finishing school training.

6.1 Indian Institutes of Information Technology

Indian Institutes of Information Technology (IIITs) have been started as autonomous institutions with support from central and/or state government and the participation of major national and international IT companies located in the area. These institutes combine the innovativeness of autonomous academic institutions and, the experience and market responsiveness of corporate world.

Seven institutes have started functioning during the last three years in Karnataka (Bangalore), Andhra-Pradesh (Hyderabad), Madhya-Pradesh (Gwalior), Uttar-Pradesh (Allahabad and Kanpur), Orissa (Bhubaneshwar) and Kerala (Trivendrum). Each of these institutes seems to be different in its offering. At present, the Bangalore based institute offers only a two-year post-graduate programme. The Hyderabad based IIIT institute offers undergraduate as well as post-graduate programmes. Some other institutes are presently offering only under-graduate level programmes. Each of these institute has plans to offer short duration educational programmes for practicing managers, teachers' training programme and conduct major research activities in the field of IT. Some of these institutes are located close to IT organisations and hence are able to actively draw on the practicing mangers as visiting faculty. However, many of these IIITs at present do not have enough faculties and would need to find ingenious ways to get quality faculty to support their academic activities.

6.2 Training Course by CDAC

The Center for Development of Advanced Computing (CDAC) is funded partly by the Government of India. The Centre is responsible for developing and promoting advanced computing facilities and education in the country. It offers a number of programmes in software and IT related field. CDAC's six-month duration finishing school programme has been highly successful. Based on the feedback from the industry, it seems that CDAC is doing a good job of providing training in computer science and information technology. Some of the factors that facilitate CDAC to deliver quality in its courses are:

- Selection for the course is based on a written test assessing the applicant's basic knowledge of computing. The selection is on an all India basis and the successful candidates are allocated to CDAC centers located in different parts of the country. A few of the centres are run by CDAC itself and the other centres are run by colleges/agencies franchised by CDAC.
- Course syllabus and course content is designed by CDAC.
- The schedule of the courses is strictly adhered to and there is on line evaluation on a continuous basis.
- The final evaluation is common to all the centres and is conducted by CDAC.

7.0 Corporate and Private Software Training Centers

Corporate and private software and IT training centers came in to existence during the '70s to provide education for computer awareness. Advanced training was imparted only in engineering and computer science courses offered by university colleges/institutes. The growth of IT industry during the '90s led to an increase in demand for software professionals. In addition, development of new proprietary technology on a massive scale has led to demand for these courses. As a consequence, corporate and private software and IT training centers started offering career oriented training programmes, both in generic as well as proprietary technology. This has led to 30-35 percent growth of corporate and private software training centers in the last five years.

Presently, the Indian software training market is about US$ 350 million (Rs. 17 billion). Indian software training market is about 2 percent of the total global training market which is estimated to be about US$ 16billion. Though the Indian training market is rather small, NIIT, one of the

Indian major software training companies is ranked as the thirteenth largest IT training company in the world for the year 2000, according to an IDC survey (indiainfoline.com, July2001). NIIT had a revenue of US$139 million for the year 2000 and has 2,200 training centers and proposes to add another 750 centers in the year 2001. Leading Indian training companies have set up training centers/ franchisees in several other countries such as China, Hong Kong, Indonesia, Middle East, Philippines, Singapore, Sri Lanka and USA.

Looking back at the Indian training companies, it seems that they have done significant work in terms of creating computer awareness at multiple levels in different strata of the society and literally in every part of the country. Being autonomous agencies, these training centers are able to adopt quickly and offer courses in new and proprietary technologies. However, due to absence of any regulatory authority, unscrupulous operators have also entered the training field in a big way and have deceived the public by charging high fees and giving false hopes of highly attractive jobs subsequent to the training. The franchise system has helped in the faster growth of the training industry. However, it has also led to dilution of quality standards. The course design and the course content of many of these programmes are quite good. But many of these training centers do not have adequate infrastructure and faculty. Quite a few of them also feel comfortable to use illegal software packages. It seems that the corporate and private training centers will continue to play a significant complimentary role for providing human capital for the growth of Indian software and IT industry. However, the training industry should proactively develop certain professional norms, which will make it difficult for unscrupulous agencies to enter into the field. Further the industry should avoid the temptation of over selling training programmes to people who do not have the basic competencies to meet a course requirement.

8.0 Analysis and Recommendations

We have argued that fresh software professionals should have superior knowledge of basics of software engineering. In addition, they should also have finishing school training as a part of their degree programme so that they can start working from the day they join a software company. However, as discussed, presently a number of university colleges are not able to provide superior basics of software engineering as well as knowledge of the current tools, techniques and practices. Large software companies such as Infosys, Wipro and TCS are able to

train fresh graduates recruited by them in software basics as well as in current tools and practices. However the medium and small size enterprises do not have trainers and training infrastructure and they are not able to spare a critical mass of trainees who could constitute a viable learning group. Even the large organizations would stand to benefit if fresh graduates had superior level of knowledge and skills relevant to Indian software industry. This could be facilitated by a number of collaborative efforts between university colleges, and large and medium size software companies.

Hence, it is proposed that on a voluntary basis

- **Large software organizations should adopt colleges teaching software-related courses and should encourage their executives to share current tools, industry practices and specialised knowledge.**
- **Large software organizations should offer attractive scholarships for postgraduate and doctoral level students in software and IT related fields.**
- **Large software organizations should actively explore the possibilities of providing jobs during summer vacation to university teachers.**
- **Academic institutions with good credibility and infrastructure should strive to offer sandwiched programs for software industry.**
- **If large and medium sized software companies could invest equivalent of atleast one percent of their manpower for interacting with academic institutions on part time or full time basis, it would go a long way to improve the quality of education in university colleges. This would ensure availability of superior manpower to the software industry and would eliminate the need for finishing school training for fresh graduates. The software professionals working as resource person for these colleges would also have a superior understanding of the subjects being taught by them. In addition organizations that take such initiatives will be remembered by the students and these organisations would be better placed to attract superior software professionals.**

National Institutes of education such as IITs, IIMs and IISc have played a significant role in creating technical and managerial manpower in different disciplines. In IT related fields, these institutes have created professionals who are part of world-class organizations in India and

abroad. These national educational institutes have made contributions towards providing support and guidance to universities and colleges as well as software and IT organizations.

Based on the discussions in the paper, it is argued that:

- **National Institutes should actively provide leadership to university based colleges by working along with them to develop course materials and by training university teachers.**
- **National institutes should use distance education technology to deliver post-graduate and specialised courses and programmes for academic institutions as well as for working software professionals.**
- **The Government and the governing bodies of the national institutes and the university colleges should nurture entrepreneurship amongst faculty and should evolve policies which, would help in attracting and retaining competent faculty.**
- **National Management Institutes such as IIMs should work with the software industry and design and offer degree and short duration programmes focusing on business knowledge and leadership skills relevant for the industry.**

Indian Institutes of Information Technology (IIITs) have the unique advantage of being autonomous institutions and being close to the industry leaders in the field of software. These two factors help them to be in touch with what is current in the industry and to imbibe and to build on that knowledge. Hence, it is argued that:

- **IIITs should ensure that the course contents of the programmes offered by them are being updated on a continuous basis in consultations with software industry leaders.**
- **IIITs should work on research topics relevant to the Indian software industry and should help the industry to grow up on the value chain.**

As discussed in the paper, corporate and private software and IT training centers have played a significant role in creating computer awareness at multiple levels in the Indian society. However, the fast growth of the industry has also led to unscrupulous operators entering in the field. The desire for the fast growth and profitability has led to overselling of the courses offered by these training centers.

Hence, it is argued that

- **The corporate and private software and IT training centers should proactively develop professional norms, which will ensure that unscrupulous operators do not enter the field.**
- **The corporate and private software and IT training centers should avoid the temptation of being every thing to every body. Further, before admitting students for a course, they must ensure their eligibility for the course.**
- **The corporate and private software and IT training centers offering career-based courses should work towards third party evaluation of their students. These training centers should work towards creating a professional body consisting of national institutes and industry representatives who would be responsible for design and conduct of such an evaluation system.**

9.0 Conclusions

Inspired by the growth of Indian software industry in the last decade, everybody has been expecting the software and IT industry to lead the Indian economy in the new decade. The recent recessionary trends have slightly shaken the confidence of people in the industry's ability to provide leadership to the Indian economy. However, Indian software industry continues to be quality and cost competitive in the world market. Having said that, Indian software industry needs to grow on the value chain. It needs to acquire competencies to design and deliver software products. It needs to nurture and grow in the new technology markets. It needs to strengthen its competencies to work on complex technical and managerial projects. Further, it needs to work with and increase the use of IT in Indian organisations. In turn this would require the Indian software industry to continuously upgrade its competencies in technical, managerial, leadership, project management and domain related disciplines. All the major stakeholders namely, IT industry, national institutes, corporate and private training centers and the government agencies have to actively collaborate with each other and contribute towards the development of human capital for sustaining the growth of Indian IT industry. As discussed in the paper, different initiatives, which facilitate collaboration and interaction between industry and academics, contribute towards improving the quality of human capital. Recessionary periods such as the existing time should be used as an opportunity to further strengthen such initiatives.

References:

Agrawal, Narendra M. (2000)
Human Issues and Challenges in Indian Software Industry,
A Working Paper, **IIM Bangalore**
Bangalore: Indian Institute of Management Bangalore

Agrawal, Narendra M. (1999)
Managing Knowledge Workers: Benchmarking Indian IT Organisations
IIM B Management Review, June, pp 81-92

NASSCOM (2001)
The IT Software and Services Industry in India: Strategic Review 2001
New Delhi: NASSCOM

NASSCOM (1999)
The Software Industry in India: A Strategic Review
New Delhi: NASSCOM

Web References:

http://www.nasscom.org/articles/india_software_exports.asp

http://www.indiainfoline.com, July2001