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Computing & Allied Engineering Domain in India with Reference to Private Universities: A Case **Study of Masters Programs**

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Abstract – Computer is one of the important and valuable devices today. Almost all the affairs these days are governed by the Computing and Information Technology. Engineering is a field and areas of knowledge that deals with the design, development, building, use of engines, machines, and structures for doing a specific task. Engineering previously called and treated as a field f hardcore activities and dealing but in recent past, the concept of the same has been changed and today many other emerging areas have been started in academics. Among these few important are Bio Technology, Nano Technology, Computer Technologies etc. Computing in today's context treated as a designing, developing, building and applications of hardware and software systems in different context. In India also Computing and allied domains especially Information Technology has been started in engineering track as well. Many universities have started Computing, Computer Sciences, Information Technology and allied sciences in their Science and Engineering track, both. Engineering program in the context of Computing is offered in Engineering Colleges, Universities and other National and Autonomous institutions and universities. This is a conceptual study and deals with the detailed study of computing field available in Private Universities throughout India.

Keywords: Computing, Computer Sciences, Information Technology, Allied Sciences, Applied Technologies, Education, New Age Programs, Universities, India.

I. INTRODUCTION

Today's age is fully governed by the Information Technology and Computing Systems. It is a fact that equipments, institutions, services and common people these days are surrounded by the computing and digital systems. Computing and allied fields therefore become an important domain in the field of Applied Sciences and Technology. The common affairs are purely dealt with the Informatics practices. Information becomes a vital resource today and is essential for each and every affair, objective. Services are very much associated with the information and similar type of contents namely collection, selection, organization, processing, management, dissemination are governed by the tools, techniques, and technologies. And these affairs are purely deal by the Computing and Information Technologies (Altbach, 1993), (Gladwin, et. al., 1995), (Pau1, 2013a). In other words, Computing is a kind of goal-oriented activity which deals with computation and automation activities with the help of devices and systems e.g. through computers. In other words, Computing deals with or responsible for the following-

- Processing, structuring, as well as managing (a) information, data, and contents of various kinds.
- (b) Engagement with the scientific research with computers and similar systems.
- Creating and electronic systems for intelligent (c) systems/ environment.
- (d) For the use of communications as well as entertainment and media communication.

As far as in terms of field is concerned computing is included and closely associated with the computer

enaineerina. software engineering, computer science, information systems, and information technology etc. India is gaining as a nation with developing tag towards developing nation. As mentioned in the Wikipedia that, "A developed country, industrialized country, or more economically developed country MEDC), is a sovereign state that has a highly developed economy and advanced technological infrastructure relative to other less industrialized nations. Most commonly, the criteria for evaluating the degree of economic development are gross domestic product GDP), gross national product GNP), the per capita income, level of industrialization, amount of widespread infrastructure general standard of living". Hence the and development of the GDP and nation many ways responsible in today's context with the use of Information Technology product, services and proper information infrastructure creation. The educated products play a vital role in the development of such information systems for the complete development. In India, Computing manpower is offered by the universities, colleges, and institutions of different kinds (Basak & Sathyanarayana, 2010), (Broko, 1969), (Pau1, 2013a). They offered a different kind of programs of various levels as well viz. Bachelors, Masters, Doctoral. Though certain programs with MPhil or DSc/DLitt degree are also important programs but offered limited and rare. In engineering context initially, programs were offered only at Bachelors level but gradually different level started to keep better sustainability in education.

II. OBJECTIVES

The paper is conceptual in nature and deals with following attributes and features (but not limited to)—

- (a) To provide information to learn about the basics of Engineering and Engineering in the context of Computing and Information Technology.
- (b) To learn about the universities, colleges and other educational systems (higher) in India and changing pattern.
- (c) To dig out the Universities in India and private universities with reference to engineering programs.
- (d) To learn about the available Computing and allied programs/ degrees available in India and abroad.
- (e) To dig out the areas/ subjects of Computing and Information Technologies available in India and abroad with Masters in Engineering Sciences.
- (f) To learn about the higher education systems in India and enter into the research of challenges and issues in this respect.

- (g) To dig out the contemporary concepts of emerging engineering and professional education and research with Masters in Engineering Sciences.
- (h) To learn about the concept of Major, Super Specialty in the context of Computing and engineering with Masters in Engineering Sciences.
- To learn about the emerging trends in collaboration format in higher education in India specially in the areas of engineering and computing with Masters in Engineering Sciences.

III. METHODOLOGY & PROCEDURE

For each and every kind of research work, a scientific method is needed. As far as this paper is concerned some of the important and vital methodologies areuse of the literature review, to learn about the background of Engineering research and degrees in India and abroad. The review also played a lead role to analyze and evaluate the changing nature of Computing and allied fields. Though to reach the concrete decision and hypothesis of the research Web Survey play a great role. Hence in this regard official portal of UGC (University Grants Commission), AICTE (All India Council for Technical Education) were studied in detail. As the study is concentrated on Private Universities thus the site of UGC was studied properly. The link given by the UGC of private universities websites were referred in detail between August-October, 2017 and the required information were collected, analyzed, and researched. All the findings later on incorporated in this paper used adequate scientific research methods. The main web link used is https://www.ugc.ac.in/privatuniversity.aspx. All the Technology faculties related to Engineering/ education of each of the private universities (279 in numbers distributed in 23 states of India) was studied to reach the destination and formulate hypothesis.

IV. COMPUTING AND ENGINEERING BASICS

Engineering is also called Engineering Sciences. Many universities worldwide practiced the term synonymously with Engineering. Though according to experts Engineering Science directly denotes a field of study whereas Engineering concept is far different, it may be a subject or may be a tool, mechanism etc. According to the ABET "The creative application of scientific principles to design or develop structures, machines, apparatus, or manufacturing processes, or works utilizing them singly or in combination; or to construct or operate the same with full cognizance of their design; or to forecast their behavior under specific operating conditions; all as respects an intended function, economics of operation and safety to life and property". As far as emerging studies are concerned CS is important one. **Computer Science (CS)** is a core of Computing that deals with the following affairs—

- (a) Computer Science is a study of mathematical affairs for computation and Computer Engineering is about hardware–software integration rather only software engineering and/ or electronic engineering related affairs or concentration.
- (b) Computer Science is theoretical in nature and responsible for the areas of microprocessor, operating systems, artificial intelligence, pattern recognition etc.
- (c) Writing software and firmware for the designing of chips, VLSI, sensors, mixed circuits boards etc. are the core of Computer Science and many ways Computer Science and Engineering.
- (d) Computer Science is though somehow related to the Software designing, programming but Computer Engineering is purely concentrated with the supercomputing, robotics etc. (Brown, 1998), (Juell-Skielse & Enquist, 2012), (Paul, 2013b).

The combination of Computer Science and Computer Engineering created Computer Science and Engineering and available in the many universities of the world. Computer Science and Engineering is using digital systems in a huge manner to control as well as monitoring electrical systems. Among the systems, few important are motors, communications, and sensors etc. Information Technology is an applied science and less focused on mathematics. It is larger and in general than Computer Science or Computer Engineering. Information Technology term may be considered as both education/study area and tools/technology for any activities. The facets and attributes of Information Technologies include-

- (a) Collection, Selection, Organization, Processing, Management and Dissemination of Information and other contents viz. Data and Knowledge with appropriate tools, mechanism, and technologies.
- (b) Use of Software Technologies, Database Technologies, Networking Technologies, Communication Technologies, Multimedia Technologies are most vital for information systems retrieval and management.
- (c) In Information Technology some of the areas such as Business, Management play a vital

role. IT integrates management components so that it helps in organizational process, management and promotion. Project management is also included in many cases as far as IT is concerned.

Though country wise the areas, importance, and values of Information Technology is different. Information Technology with greater components of Business/ Management is also called as Information Technology Management. Though closely associated fields are available in this regard i.e. Information Systems. The domain of Information Systems is designing, development, concerned with the organization, processing, management of information systems and services. Information Systems is similar to the Information Technology and importantly Information Systems is deal with all the technologies which are related and associated with Information Additionally, Technology. it is also about management strategies, policy making, designing, development of IT services, Information Services of an organization. Hence here organizational focus is important and rigid. Although internationally another domain became popular called Information Science dedicated to the information affairs and activities with information management proper techniques. technologies similar to the Information Technologies. According to the experts and academician, it is an interdisciplinary science additionally apart from IT deals with management, laws, social sciences for better information and IT governance. Worldwide these subjects are popular and available in many universities (Gladwin, et. al., 1995), (Paul, 2013b), (Richards, 1992).

V. ENGINEERING AND COMPUTING EDUCATION IN INDIA

India is one of the important democracies in the world and also moving towards better economy in the world. development economy The of and sustainability is purely depends on education. And in the sector of education, research and training India is moving towards better position. Science and Technology especially mathematics is in better position in India. There are many developing countries (refer table 1) and India is also gaining rapidly towards a developed nation. To reach a developed nation apart from Science and Mathematics, India needs more attention in Engineering Sciences. Hence here in the context computing as well apart from Science platform engineering segment need to strengthen.

Table 1

Few Developing Countries at a glance

	Few Developing Countries						
Argentina	Banglad esh	Brazil	Bulgaria	Colombia	China	Hungary	Malaysia
Mauritius	Mexico	Nigeria	Oman	Pakistan	Philippines	Poland	Qatar
Russia	South Africa	South Korea	Taiwan	Thailand	Ukraine	UAE	India

When internationally in computing and allied fields are available as Computer Science, Computer Engineering, Computer Science and Engineering, Information Technology, and some of the interdisciplinary fields (viz. Information Science, Management, Information Information Systems, Information Engineering and also few merged/ combined fields- Information Science and Technology, Computer and Information Science, Information Systems and Technology); in India, only areas mentioned above without parenthesis are available (Kling, 1983), (Farkas-Conn, 1990), (Paul, 2013c).

Computer Science is offered mainly as science programs with the degrees of Bachelor of Science, Masters of Science. Internationally it is abbreviated as BS and MS while in India it is BSc and MSc. Duration wise internationally BS and MS is 4 years and 1-year programs respectively while in India it is 3 years and 2 years. However, the subject additionally also offered in the large number of Engineering colleges (about 3000+) with Engineering track with following nomenclature—

- (a) Bachelor of Engineering
- (b) Bachelor of Technology

These programs are popularly called as BE and BTech respectively. Though fewer universities and INI (Institute of National Importance) categorized institutions also offered BTech/M.Tech programs. The concentration of the programs (CS and CSE) in India is same as practiced internationally i.e. core, mathematical and deals inside into the mechanism and high level of programming languages. However, CSE is also treated as more on hardware centric domain (Pau1, 2013a), (Richards, 1992).

Though internationally when academics were moved into Information Technology domain for the applied solution of informatics and computing in Industry and academia but Indian academics moved for a different nomenclature and concentration called Computer Application (software technology focused). The flagship program in this segment is called MCA (Master of Computer Application). It is designed for graduates of diverse disciplines. But the program should not be confused with IT (which is also opened for all type of Bachelors holders) programs available worldwide. Instead of concentration of Database Technologies, Networking Technologies, Communication Technologies, Multimedia Technologies, the Computer Application subject/ program is mainly concentrated on Software Technologies.

The case of Information Technology is also differs from the global context, internationally all the components mentioned in previous section play a lead role for information related affairs while in India the focus is same of Computer Application with little additional enhancement of other allied technologies. In USA, UK, and Australia, Information Technology program is concentrated on Business enormously and management components. These components are interdisciplinary and offered in concentration with technologies/computing/informatics. Like CS/CSE it is also offered in BSc & MSc, BTech & M.Tech, BE & ME platform with the duration of 3 & 2, 4 & 2, 4 & 2 years respectively.

Interesting to note that, few universities also offered Information Science in India. Though the curricula and focus of the programs differ from most of the universities practiced internationally. Indian Information Science is focused on software technologies (programming) and few on other technologies but worldwide the concentration lies in networking technologies, database technologies, multimedia technologies etc with strong liaison with information systems. Though, academician believes that Indian academics need to introduce Information Technology Business, Management with components. Even Information Science needs to merge with the few more components (apart from IT) such as Information Basics, Information Management, Social-Ethical Issues in Information, Computing and Information Technology. For better economy and sustainable development of the society and governance, India needs revamping curricula and introduction of such social technologies.



Fig. 1-Developing, Newly developed and newly economic countries (derived from Wikipedia)

India is in developing stage hence a collaborative effort is highly required. The Fig 1 showing the Developing Countries (colored as Green), whereas newly developed nations (colored as Red), Newly Industrialized countries (Blue).

VI. PRIVATE UNIVERSITIES EMPHASIZING MASTERS PROGRAM

Indian Higher Education Systems is governed by the Universities, Colleges, Autonomous, Institute of National Importance, Research Centres etc. Though, Universities are treated as a centre of apex learning. India has different types of universities Private Universities (established by the state legislative assembly but managed and financed by the private body), State Universities (Legislated, Managed, Governed, Funded by the concerned state), Central Universities (Legislated, Managed, Governed, Funded by the state government), Deemed Universities (an institute of excellence basically listed by the UGC as similar to the University). Though Apart from these Institutes of National Importance also an important body offers education, research, and training etc. In all these universities and engineering colleges (which is governed by the AICTE) run Engineering programs leading to BTech/BE & M.Tech/ME Degrees. As this study is mainly concentrated on Private Universities hence now we looked upon concentrated on engineering education at Masters level.

According to this study, it is noted that India (among its 29 states) holds 23 states established private universities. The state Rajasthan ranked first in terms of a number of universities (i.e. 46), while Gujarat and Uttar Pradesh ranked second (30) and third (29) respectively. It is worthy to note that among these private universities more universities offered BTech courses than M.Tech courses. As per the study it is noted that among 279 Universities in India total BTech/BE offering institutions are about 180 while M.Tech/ME is offered in 141 Institutions.

In Rajasthan 26 Universities offered M.Tech program while Uttar Pradesh ranked second with 23. It is interesting to note that, few states do not have options available for M.Tech viz. Jharkhand, Mizoram, Nagaland, Manipur. Details of such universities offering M.Tech program is listed in Table 2.

Table 2

Private Universities offering M.Tech Degree (State wise)

Serial No.	States	No. of Universities	Universities with Engg. Unit (M.Tech)
1	Arunachal Pradesh	7	3
2	Assam	5	3
3	Bihar	2	1

4	Chhattisgarh	9	5
5	Gujarat	30	10
6	Haryana	20	10
7	Himachal Pradesh	17	13
8	Jharkhand	7	Absent
9	Karnataka	14	7
10	Meghalaya	8	1
11	Mizoram	1	Absent
12	Madhya Pradesh	24	12
13	Maharashtra	9	2
14	Manipur	1	Absent
15	Nagaland	3	Absent
16	Odisha	4	1
17	Punjab	15	11
18	Rajasthan	46	26
19	Sikkim	5	1
20	Tripura	1	1
21	Uttar Pradesh	29	23
22	Uttrakhand	13	6
23	West Bengal	9	5
Grand 1	Fotal	279	141

In such institutions, most common degrees and subjects are Computer Science (also called as Computer Science and Engineering) and Information Technology. Some of the Universities also offered Information and Communication Technology (ICT) program concentrated on communication and networking technologies in computing. Interestingly few universities also offered all three domains Computer Science, Information Technology, Communication Information and Technology programs. In West Bengal among 9 private universities, 5 offers M.Tech Program. Though, M.Tech-CSE is offered only in 4 universities. A total 21 universities among 279 offered two track of M.Tech (i.e. Computer Science and Engineering, Information Technology), Madhya Pradesh stands 1 in terms of number of universities offering both CS/CSE and IT. In South India and Eastern India (including West Bengal), not a single universities are offering both the track of computing sciences.

Table 3

Private Universities offering M.Tech Degrees both CSE/ IT track

Serial No.	States	No. of Universities	Universities with M.Tech- CSE & M.Tech-IT
1	Arunachal Pradesh	7	2

2	Assam	5	Absent
3	Bihar	2	Absent
4	Chhattisgarh	9	1
5	Gujarat	30	3
6	Haryana	20	Absent
7	Himachal Pradesh	17	Absent
8	Jharkhand	7	Absent
9	Karnataka	14	Absent
10	Meghalaya	8	Absent
11	Mizoram	1	Absent
12	Madhya Pradesh	24	6
13	Maharashtra	9	1
14	Manipur	1	Absent
15	Nagaland	3	Absent
16	Odisha	4	Absent
17	Punjab	15	1
18	Rajasthan	46	5
19	Sikkim	5	1
20	Tripura	1	Absent
21	Uttar Pradesh	29	1
22	Uttrakhand	13	Absent
23	West Bengal	9	Absent
Grand Total		279	21

Surprisingly, though Karnataka is developed in Information Technology sector but among its 14 private universities not a single offered M.Tech in the areas of CSE and Information Technology sector. Similarly, Haryana and Himachal Pradesh both stands well in terms of number of private universities (20 & 17 respectively) but not a single university offer M.Tech in both the fields. A detailed picture is depicted in Table 3 whereas Fig 2 showing top states in terms of offering both CSE and IT in M.Tech level.



Fig. 2 -Developing, Newly developed and newly economic countries (derived from Wikipedia)

The Information Technology field is gaining and research in academic innovations as well. The trend is going on for offering skill based and emerging technologies. Among the emerging technologies, few important are include—

- (a) Cloud Computing
- (b) Big Data Analytics
- (c) Data Sciences
- (d) Cyber Security etc.

However, in this study, all the individual components of Information Technology (viz. Database Technology, Software Technology, Multimedia Technology, and Networking Technology) considered and apart from the emerging areas which are listed above. Though Multimedia and Database Technologies found absent among the universities and some of the universities offered innovative programs in the concentration of Software Technology and Networking Technology. Table 4 is depicted detailed report of such innovative concentrated programs analyzed from 279 universities in M.Tech level.

Table 4

Private Universities offering M.Tech-CSE program with concentration

S. No.	States	No. of Univer- sities	Universities with M.Tech- CSE	Univer- sities with M.Tech- CSE with Concen- tration Programs
1	Arunachal Pradesh	7	3	Absent
2	Assam	5	2	4
3	Bihar	2	1	Absent
4	Chhattisgarh	9	4	2
5	Gujarat	30	5	2
6	Haryana	20	9	6
7	Himachal Pradesh	17	11	5
8	Jharkhand	7	Absent	Absent
9	Karnataka	14	5	9
10	Meghalaya	8	1	Absent
11	Mizoram	1	Absent	Absent
12	Madhya Pradesh	24	11	Absent
13	Maharashtra	9	1	3
14	Manipur	1	Absent	Absent
15	Nagaland	3	Absent	Absent
16	Odisha	4	1	1
17	Punjab	15	9	3
18	Rajasthan	46	23	3
19	Sikkim	5	1	Absent
20	Tripura	1	Absent	Absent
21	Uttar Pradesh	29	20	7
22	Uttrakhand	13	5	Absent

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23	West Bengal	9	4	Absent
Grand Total		279	116	45

Such programs offered with CSE Concentration like M.Tech-CSE (Networking), M.Tech-CSE (Software Engineering). For example, the Assam Royal Global University, Assam is offering following programs—

- (a) M.Tech-CSE (Intelligent Computing)
- (b) M.Tech-CSE (Networking & Web Engineering)
- (c) M.Tech-CSE (Data Analytics & Engineering)
- (d) M.Tech-CSE (Software & Web Engineering)

VII. SKILL, COLLABORATION, AND EMPLOYMENT: CHANGING & EMERGING PROGRAMS AT M.TECH LEVEL

Skill has become important and most valuable aspects of today's age. It is required in all the areas and sectors of business, healthcare, governance, public administration, education and so on. As far as Information Technology is concerned it is noted that many new areas are emerging viz. Cloud Computing, Virtualization, Human Computer Interaction, Data Analytics. Big Data Management, Usabilitv Engineering, Network and Cyber Security, Database Systems, Web Technologies etc. It is worthy to note that Computer Science deals with internal and core affairs of Computing and mathematical areas for designing and development of computers and similar systems, and most of the above mentioned skilled areas are from Information Technology. But most of offering such areas of the universities are specialization/ concentration as a part of Computer Science/ CSE. The reason behind this may be the popularity of CSE programs and availability of the domains in different institutions and universities. As per this study among 279 universities 41 are emerging and skill based (Table 5).

Table 5

Skill and emerging technology based institutions based on M.Tech

Serial No.	States	No. of Universities	Skill based Emerging Institutions
1	Arunachal Pradesh	7	Absent
2	Assam	5	1
3	Bihar	2	Absent
4	Chhattisgarh	9	2
5	Gujarat	30	4

6	Haryana	20	2
7	Himachal Pradesh	17	5
8	Jharkhand	7	Absent
9	Karnataka	14	4
10	Meghalaya	8	Absent
11	Mizoram	1	Absent
12	Madhya Pradesh	24	4
13	Maharashtra	9	2
14	Manipur	1	Absent
15	Nagaland	3	Absent
16	Odisha	4	1
17	Punjab	15	2
18	Rajasthan	46	8
19	Sikkim	5	Absent
20	Tripura	1	Absent
21	Uttar Pradesh	29	5
22	Uttrakhand	13	Absent
23	West Bengal	9	1
Grand Total		279	41

However, as far as this study is concerned it is noted that total 41 institutes among the private universities fall under this category. Rajasthan, Himachal Pradesh, Uttar Pradesh has a large number of private universities with skill based institutions based on M.Tech program (refer Table: 6).

Table 6

Skill and emerging technology based institutions based on M.Tech

Skill Based Specializations				
States	No. of Universities	No. of Skill based Institutions		
Rajasthan	46	8		
Himachal Pradesh	17	5		
Uttar Pradesh	29	5		

It is important to note that the Assam Royal Global University, Assam, Ansal University, Haryana, PES University, Karnataka among the few universities offering a large number of M.Tech programs in skill and emerging areas of study. However, few universities also offered only one or two M.Tech programs and they have started skill based degrees instead of general M.Tech-IT/CSE such as MIT Art Design & Technology University, Maharashtra, Dayanand Sagar University, Karnataka. Details on universities and programs in emerging Information Technology areas listed in Table 7.

Some of the universities in this regard are NIIT University, Rajasthan, Guru Kashi University, Punjab, Amity University, UP.

Table 7

Universities offering good number of M.Tech super specialty programs

M.Tech	(In Skill Based)	minimum 3 programs
Serial	Universities	Programs
<u>No.</u> 1	The Assam Royal Global University, Assam	M.Tech-CSE (Intelligent Computing/ Networking & Web Engineering/ Data Analytics & Engineering/ Software & Web Engineering)
2	Ansal University, Haryana	M.Tech-CSE (Software Engineering/ Data Analytics/ Network & Information Security/ Tele-commutation & Mobile Technology)
3	PES University, Karnataka	M.Tech-CSE (Cloud Computing/ Web Technology/ Software Engineering/ Big Data/ IoT/ Cyber Security)
4	Sharda University, Uttar Pradesh	M.Tech-CSE (Networking/ Software Engineering/Mobile Computing/ Cyber Security & Information Assurance)
5	Eternal University, Himachal Pradesh	M.Tech-CSE (Software Engineering/Information Security/ Computer Applications)
6	Dayanand Sagar University, Karnataka	M.Tech- CSE (Big Data/ IoT/ Cloud Computing)
7	JSS Science & Technology University, Mysuru	M.Tech-Data Science/ Software Engineering / Network & Internet Engineering
8	MIT Art Design & Technology University, Maharashtra	Intelligent Systems & Analytics/ IoT)
9	Guru Kashi University	M.Tech-Remote Sensing/ Software Engineering/ Cloud Computing

Some of the universities also offered M.Tech specialization and emerging areas not as a major or concentration it is directly as M.Tech, for example M.Tech- Data Engineering & Cloud Computing, M.Tech-Data Science, M.Tech-Cyber Security etc.

Table 8

Universities offering emerging full-fledged M.Tech Degrees in IT/CSE areas

SI. No	Emerging M.Tech		
	Universities	Full-fledged	
1	Marwadi University	M.Tech (Cyber Security) Pure MSc Eligible with PGDCA	
2	Bahra University, Himachal Pradesh	M.Tech-Cyber Security	
3	Reva University, Karnataka	M.Tech- Data Engineering & Cloud Computing Computer Network Engineering	
4	Dr. A.P.J. Abdul Kalam University, Madhya Pradesh	M.Tech- Cyber Security	
5	Oriental University, Madhya Pradesh	M.Tech-Computer Network	
6	People's University, Madhya Pradesh	M.Tech-Cyber Security	
7	Sandip University, Maharashtra	M.Tech-Cloud Technology & Information Security	
8	Centurion University of Technology and Management, Odisha	M.Tech-(Internet Security)-Le Innovate M.Tech-Data Science (Silicon Lab)	
9	Guru Kashi University, Punjab	M.Tech-Remote Sensing/ Software Engineering/ Cloud Computing (MSc eligible)	
10	Career Point University, Rajasthan	M.Tech- Mobile Computing	
11	Maharishi Arvind University, Rajasthan	M.Tech-Computer Design/ Digital Design	
12	Manipal University.	M.Tech-Advance Computing &	

	Rajasthan	Data Science- with CDAC / Information & Network Security- with CDAC
13	NIIT University, Rajasthan	M.Tech-Education Technology/Cyber Security (with PwC) M.Tech-GIS/ Education Technology
14	Amity University, UP	M.Tech-Geo Informatics M.Tech- Computer Network & Information Security
15	Seacom Skills University, West Bengal	M.Tech-Web & Game Designing/ CAD

The above M.Tech programs become good alternatives to the aspirants not only holding BTech degrees but also the equivalent qualifications like Computing degree holders in Science stream with the degrees such as MSc-CS/IT/CA, and MCA. Hence if one has interest in obtaining Engineering at Post Graduate level (ME/M.Tech) they can get not only conventional ME/M.Tech but also super specialty and emerging subjects. Table 8 depicted

Universities offering emerging full-fledged M.Tech Degrees in IT/CSE areas. Like full-fledged M.Tech in emerging information technological/computing areas, many private universities are also offering M.Tech only in emerging areas instead of any other general M.Tech-CSE/IT/ICT. Among such institutes, few are NIIT University, Rajasthan, Sharda University, UP, Sandip University, Maharashtra etc. A detailed analyzed programs and institutions are listed in Table 9.

Table 9

Private Universities offering only skill based Engineering (Masters) programs

Serial No.	Universities	Programs
1	The Assam Royal Global University, Assam	M.Tech-CSE (Intelligent Computing/ Networking & Web Engineering/ Data Analytics & Engineering/ Software & Web Engineering)
2	The Northcap University,	M.Tech-CSE (Cyber Security/

	Haryana	Data Science)
3	PES University, Karnataka	M.Tech-CSE (Cloud Computing/ Web Technology/ Software Engineering/ Big Data/ IoT/ Cyber Security)
4	Sandip University, Maharashtra	M.Tech-Cloud Technology & Information Security
5	Chandigarh University, Punjab	ME (Hons) CSE (Cloud Computing/ Big Data/ Information Security)-IBM
6	J.E.C.R.C. University, Rajasthan	M.Tech- CSE (Software Engineering/ Computer Network & Security)
7	NIIT University, Rajasthan	M.Tech-Education Technology M.Tech-Cyber Security (with PwC) M.Tech-GIS
8	Sharda University, UP	M.Tech-CSE (Networking/ Software Engineering/Mobile Computing/ Cyber Security & Information Assurance)
9	ITM University, CG	M.Tech-CSE (Cyber Security)
10	Babu Banarasi Das University, UP	M.Tech-CSE (Computer Networks/ Software Engineering)
11	Seacom Skills University, WB	M.Tech-Web & Game Designing M.Tech-CAD

Among the institutes/universities which are offering a large number of only skill based M.Tech degrees, important are The Assam Royal Global University, Assam, PES University, Karnataka, Sharda University, UP etc. In these areas both skill and technology and also domain based information sciences/ technological major or concentrations are exits (Paul, 2013c).

VIII. FINDINGS

(a) India is growing rapidly with many universities during last decade which have been established by both the central and the state governments. In terms of the private universities also significant changes are noticeable. About 300 (279) universities are established spreading 23 states in diverse fields.

- (b) Engineering education has become an important part of these private universities. As far as private universities are concerned M.Tech degrees are available in 140 universities.
- (c) Skill based degrees are emerging rapidly. In this segment programs on Technology based and Domain based; both are available. In popular courses in Technology segment are Cloud Computing, Big Data, Cyber Security etc. whereas in Domain based segment the popular courses are Education Informatics (available as Education Technology), Geo Informatics (available as Remote Sensing as well).
- (d) Industry-academia collaboration noticed during this study. Many universities have followed the academic style that is practiced worldwide. Among the universities which are offered M.Tech in emerging areas notable are NIIT University, SOA University for introducing collaboration for training, internship, and placement etc.

IX. SUGGESTIONS & DIRECTIONS

- (a) The universities which have not yet started M.Tech degrees among the private universities may start the program with emerging innovative specializations.
- (b) Proper industrial tie-ups are required for better exchange of training, internship (even placement if possible) including curricula development etc.
- (c) Finishing schools may be started on campus so that they not only learn emerging skills but also which are currently practicing in Industry.
- (d) Corporate visit and stay is always better for healthy output creation. The universities in this regard may choose industry as the first option for collaboration then HR companies (companies responsible for skill product creation).
- (e) In private universities fees normally higher than public institutes and thus it is better to create an environment for the privileged.
- (f) Universities need to introduce some of the more emerging areas as specializations viz. Human Computer Interaction, User

Experience Design, Healthcare Informatics etc.

(g) Instead of full-fledged degrees, the specialized/ major based degrees may be offered to keep them ready for all types of industries and government sectors.

X. CONCLUSION

Universities are playing a good role in terms of the development of skilled manpower in recent past. Many universities have established industry-academia cell in recent past including those are offering general BTech-M.Tech as well. Initially, a majority of such interested universities have started specializations in the areas of sub fields of Information Technology (viz. Networking Technology, Database Technologies etc.). But gradually universities were moved these listed super specialty programs. Interestingly many of these M.Tech programs started in collaboration with leading industries. Among the key collaborative institutes, few important are include IBM, PwC, Le Innovate, Silicon Lab, CDAC, iNurture etc. Cloud Computing is one of the important specialization noticed as per this study and among others few important are Big Data, Cyber Security, IoT. However due to related nature and more prospects combine programs and specializations may also be offered such as Cloud Computing & Big Data, Cloud & IoT, Cloud & Cyber Security etc. It is better to start these programs in other state universities and central universities as well. It is important to note that planning, collaboration is must for the success of any such emerging programs. Organizing seminar, workshop, and other knowledge event are essential to keep more updated to the students and faculties both for this type of emerging innovative programs. From government context proper governing and control etc. are essential for the success of engineering programs of private universities.

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