

4. DIEM: DISRUPTIVE INNOVATION EDUCATIONAL MODEL FOR TECHNOLOGICAL UNIVERSITIES

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Abstract

This article presents the 21st Century Challenges before the Higher Education, in general and Technical and Management Education; in particular. The major issues faced by this sector like proliferation, affordable, access, equity and equality, quality education, etc., are presented. The features of sustaining and disrupting innovation models and their impact on industry world are highlighted. Traditional universities and business models like solution-shops, value-added processing and facilitated users networks, are considered. The proposed recommendations for policy makers suggested by Christensen et al are listed. It has been argued that disrupting innovation model can afford low-cost education with quality as perceived by students and other stakeholders in terms of say demonstration of skills and knowledge acquisition rather than merely obtaining a paper degree certificate. The emphasis is not on building of buildings but on building of minds. A few suggestions like use of lean philosophy, reduction in teaching work-load, revising faculty qualifications, implementing process and performance management, in-service industrial training, superannuating age, etc., are made. It is believed that the article will be of interest, thought provoking and disrupting the status quo of Indian traditional universities.

Key words: *solution shops* (organizations charging service fees for giving solutions to customers using intuitive and/or otherwise personal/group expertise), **sustaining innovation** (innovations that help maintain status quo like traditional universities), **disruptive innovation** (innovations that help capture untapped market through affordable cost with quality as perceived by customer), **Direct labor** (Direct manpower involved in yielding output like faculty, etc), **Burden Rate** (Overhead burden rate other than direct and indirect labor), **Hire to do** (hiring somebody/agency to do a job). **Seat Time** (Total time the student attends the classes).

1.0 Introduction

The Honorable Prime Minister of India on the eve of the National Education Day, i.e. on 11th November 2011 addresses the nation as 'Education is a magic wand that can help us meet any challenge. Education is necessary not only because it can get us jobs or status in society. Education is essential as it enables us to build a new world. It is magical because it helps us rediscover ourselves. I am confident

that education will help you scale new heights".

Right from the time immemorial, education is considered as a key to the economic growth, prosperity of an individual and community as a whole. Life in the 21st century, with world and Indian population crossing over 700 b and 120 b, in an interconnected, globalized world, essentially demands work-force with such skills as critical-thinking and a sense of international mindedness. It is estimated that by 2020, India

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will need 500m technically competent workforce and the world will face a shortage of such a workforce to the tune of 45-60m. Thus, the main challenge posed before the Education Sector is to churn out competent Human Capital professionals to cope up with the 21st Century challenges. The world has completed one decade of the 21st Century and heading speedily towards global economy. The rules of the game have totally changed inviting new strategies and risk-full venture to be competitive in such an agile environment. In case of industrial houses, it has been proved and time again that sustaining innovation hardly brings out desired outcomes, competitiveness, prosperity and good market share. And therefore disruptive innovating models are being adopted by industry for not only survival alone but for prosperity and growth as well.

However, instead of striving for world class education, India is facing several challenges. Hardly 7% student-population goes to Higher Education, GER of India is hardly 12.5% compared to 50% of advance countries, the quality of education at all levels- UG, PG and doctoral- is deteriorating day by day, 15% employability of graduates [1-4], premier institutes churning out 20% quality students (Narayan Murthy's speech in New York, 3rd Oct 2011), pathetic research quality [5-10], inadequate number of universities, affordability, lack of inclusion, not a single Indian institute/university appear within 300 rank of the world top universities [11], the need for alignment of primary-secondary-tertiary education sectors, etc [12]. Government have already taken some initiatives like privatization of professional education, improving budget for education, establishment of number of institutes/universities of national importance, more provisions planned during 11th five Year Plan [13], Sarva Shiksha Abhiyan, Right to Education, Foreign University Bill, establishment of State wise Technological Universities [1], fast emergence of State Universities, etc.

Nevertheless, it appears to be a Herculean

task for Higher Education to be competitive internationally in as India is far behind even compared to Asian countries like China, Japan and Asian Tigers. The major issues faced by the Indian education system are presented in the next Section.

2.0 The major issues before relating to Higher Education in India

The major issues faced by the Technical and Management education system in India can be summarized as given below:

- i. How to go for proliferation improving enrolment?
- ii. How to churn out 'thinkers' through the system rather than examination centered students?
- iii. How to improve quality of education and employability of graduates?
- iv. How to make education cost effective and affordable to masses?
- v. How to tackle the principles like inclusive, equity and equality?
- vi. How to make up shortage of faculty and improve their quality?
- vii. How to go about for effective Human Capital Management?
- viii. How to go about fund raising and resource generation?

Though privatization of education in mid-90s has helped unprecedented expansion of education in terms of number of institutes and students [1-3], this has raised several issues. Since the last 5-7 years, it has been argued that the conventional universities are overburdened and hardly do justice to technical and management education. Two ways are worked out: establishment of State Universities and emergence of state wise Technological Universities with anticipation that some of the issues listed in this Section can amicably be resolved [1], as presented in the next Section, by deploying either sustaining or disrupting innovation models.

3.0 Sustaining and disruptive innovation models [14]

World over education policy is shifting from how to enable more students to afford higher education to, how can we make a quality education affordable. "No Child Left Behind" policy of US, the disruptive innovation of online education and Sarva Shiksha Abhiyan of India are some of the initiatives in this direction. The challenge is to redefine the meaning of quality in HE and make a quality education affordable. Therefore, traditional universities including Technological or State universities are subjected

to seismic shift in how society, broadly speaking, has judged high quality, moving away from a focus on research and knowledge creation and instead moving towards a focus on learning and knowledge proliferation.

A study of the disk drive industry shows that the leading companies are unable to sustain their leadership from one generation to the next (see Table 1 and Fig. 1) [14]. The outcome of this study is the theory of disruptive innovation. Disruption is the casual mechanism behind this phenomenon and Joseph Schumpeter, the great economics, terms this 'creative destruction'.

Generation of Computer	Characteristic Unit Volumes produced per year	% Gross Margins to Cover Overhead	Typical Sales Price in US \$
Main-frame	Thousand	60	2,000,000
Minicomputers	Tens of thousand	45	2,00,000
Desk top computers	Millions	30	2,000
Notebook computers	Tens of millions	15	1,000
Smart-phones	Hundred of millions	15-40	300

Table 1 : Differences in the economic models for each stage of disruption (14).

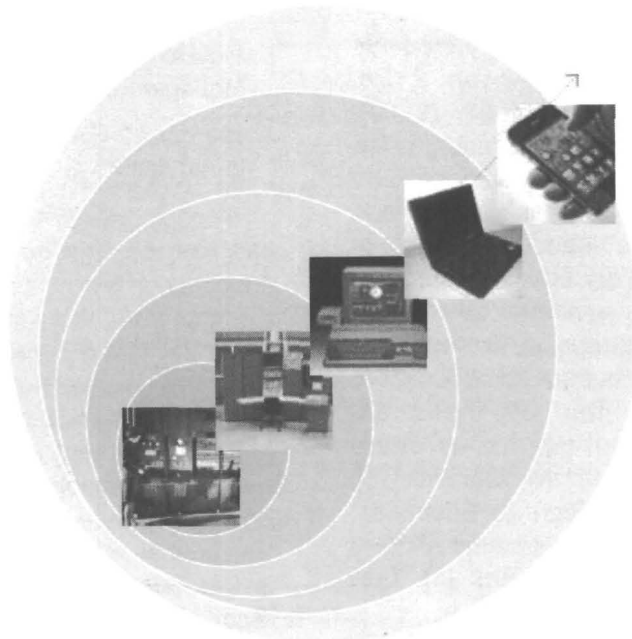


Fig. 1: How complicated & expensive computers became affordable and accessible [14]

Fig. 2 presents study of the steel mini-mills supporting the theory of disruptive innovation

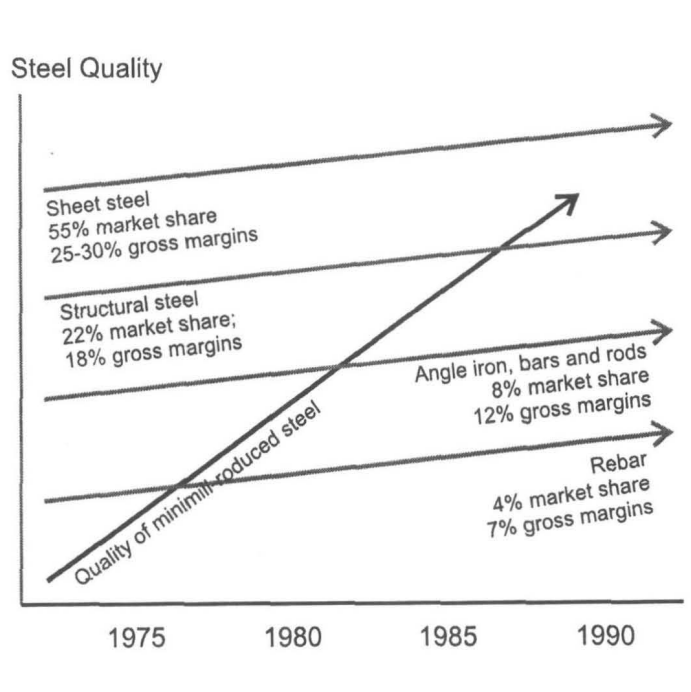


Fig. 2: The disruptive attack of steel mini-mills(14).

Thus, disruption is the process by which Toyota overtook General Motors; Cisco Lucent and Nortel, Wal-Mart and Target toppled the departmental stores, and Apple seized music distribution. Disruptively attacking world markets is the engine that drove, for instance, Japan economic miracle from 1960 to 1990, the economic transformation of Korea, Taiwan and Singapore from 1980 to 2000 and ongoing economic growth of China and India.

Fig. 3 presents the theory of disruptive innovation relating customer level of wealth and skill. A very small percentage of customers fall in the category having both high wealth and skill. Organizations serving such customers can maintain their leadership by adopting sustaining innovation meant either through incremental or breakthrough types of technologies. However, one can serve the remaining customers having low wealth and skill through disruptive innovation

making services/products accessible at affordable prices. In other words, disruption is the process by which product/services become affordable and accessible to those lying in the outermost circle, reaching to the last man in the society. Disruptive innovation, therefore, does not necessarily represent a radical or breakthrough in the process, rather it replaces the original complicated expensive product/services with something different that is so much affordable and simple that a new population of customers in the next larger circle now has enough money and skills to buy and readily use the product/services (see Fig. 3). Why are the odds of success at the two types of innovation? It is the pursuit of profit and prestige. In case of not-for-profit organizations, the ambition to do more and have a bigger footprint- an ambition driven both by administration and often alumina in case of education- precipitates precisely the

same behavior as profit maximization in the for-profit world [14].

Depending upon the mode of functioning; an institute/university can be considered falling in one or more of the generic business models: solution-shops, value-adding process businesses (VAP) and facilitated user networks.

Physical, organizational and information navigation are the essential elements of any business model that needs proper integration for organization's effective-efficient-economic functioning [3]. University faculty research is a shop-like activity.

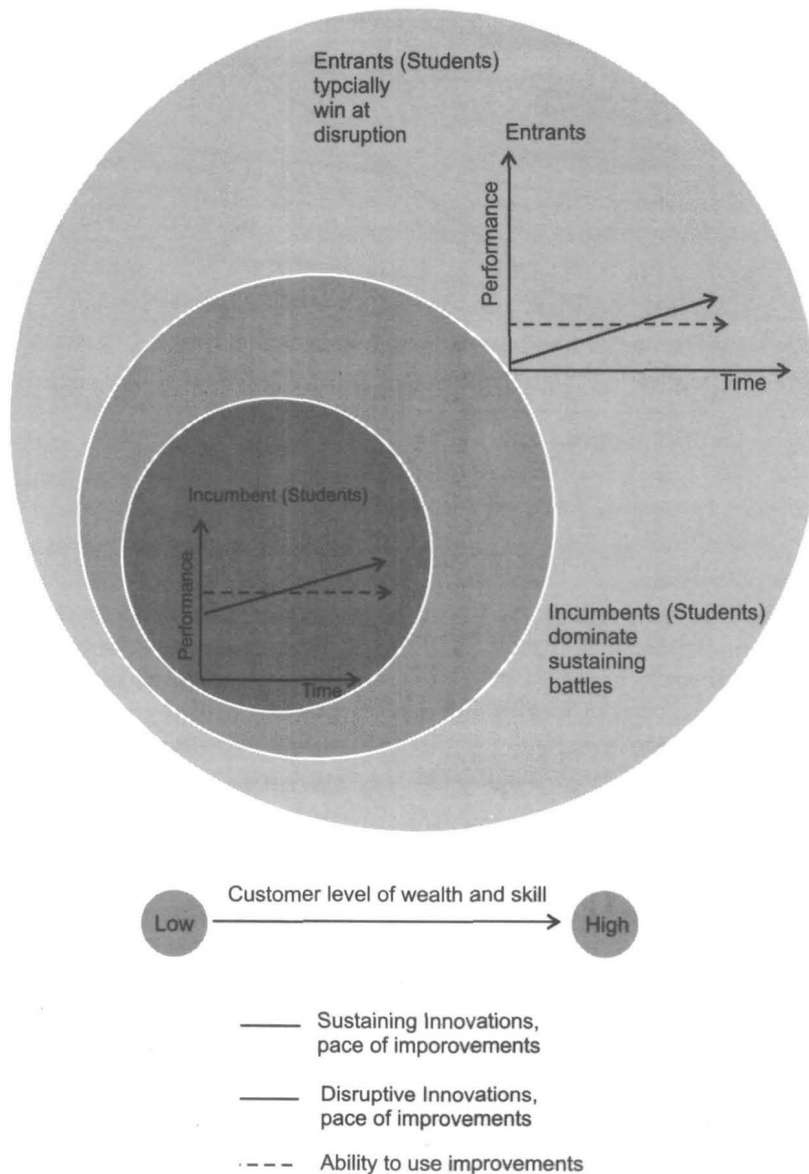


Fig. 3: The theory of disruptive innovation (14).

Solution-shops tend to be a fee-for-service model. VAP does its business in relatively repetitive ways so that the capability to deliver value tends to be embedded more in processes and equipment rather than in intuitive expertise of people as seen in solution-shops. VAP charges the customers for the output of their work, not their inputs to it. Facilitated user network permits participants exchange of things with each other. The revenue model for this network is fee for membership, or fees for use. Today due to internet many of the university activities are switching over from solution-shops and VAP to facilitated users networks among students and faculty [14].

Traditional universities are organized into departments like a functional/job-shop plant layout. A few universities can compute 'direct labor content' but hardly 'burden rate'. It is estimated that in conventional universities overhead burden rate is in between 4 and 5, i.e., five rupees on overhead for every rupee spent in teaching, assessment and research. Traditional universities trying to emulate the prestige of Harvard or IITs or IIMs in India are structured to optimize the 'solution-shop' activities of their faculty and VAP activities of teaching students are sub-optimally force-fit into this structure. Low cost- amount spent per student that is different from low-tuition or low-price-universities are structured like VAP rather than 'solution-shops', thereby optimizing flow of students through university. The cost advantage of disruptive low-cost universities is found to be more than 40% though they charge the same tuition fees charged by traditional universities. Some may disparage the quality of education offered by this low-cost business but the following counter-arguments will clear the cloudy sky [14]:

- a. The definition of quality depends upon the consumer's perspective, e.g., in traditional universities little research is done, but students define quality in terms of convenience and cost including opportunity costs.
- b. The job that students hire their universities

to do, e.g., out-of-home transition to independent adulthood, learning and receiving degree, getting better employment, etc.

- c. Online learning technologies are adopted by low cost-universities.

Obviously, leaders of universities and policy makers need to evolve more permanent solutions rather than just relying upon such means as increased fundraising or increased tuition fees. The evolution of university is best managed at the corporate level rather than the business unit level as units can hardly be organized to evolve on their own. One, therefore, has to address the questions like:

- i. Is the traditional universities' business model sustainable? Such universities are considered historically as non-disruptable that have adopted sustaining innovation models.
- ii. Whether universities primary stewardship is to facilitate the best possible HE and training for the people in their states or whether they are appointed to be caretakers of the specific university that have historically provided HE? The leaders are appointed to serve the people rather than simply acting as custodians of universities. The low-cost disruptive universities need public-private partnership that foster new models of HE in autonomous business units different from the existing universities/institutes [14].

Evolve and encourage a campaign for competency-based next-generation learning models. A student progresses when s/he demonstrates mastery of a set of skills or of knowledge rather than completing credits and appearing examinations. Many of the conventional ways of measuring education do not apply to disruptive innovation because they focus on inputs like seat time, rupees spent/student (thereby rewarding those institutes that cost more), and faculty-student ratio. Online learning, for instance, offers advantage of the

inherent time variable-learning constant nature of the medium. Naturally one has to move beyond acquiring a degree, merely for the sake of degree.

Accreditation plays a significant role today that is seen as a stamp of quality but the process of accreditation needs to be revamped [15]. Brand name, competition, benchmarking and standardization are some of the issues that can be tackled effectively through disrupting innovation. Allowing students to afford what is an unaffordable education is no longer a viable proposition because of heavy financial duress and only serving a very limited slice of the population.

4.0 Some major recommendations for policy makers

The recommendations proposed by Christensen et al [14] for evolving disrupting innovation model for HE; are summarized as given below:

- i. Eliminate barriers that block disruptive innovations and partner with the innovators to provide better educational opportunities.
- ii. Remove barriers that judge universities/institutes based on their inputs such as seat time, credit hours and student-faculty ratios.
- iii. Not focus on degree attainment as the sole measure of success.

- iv. Fund HE with the aim of increasing quality and decreasing cost.
- v. Recognize the continued importance of research institutes.
- vi. Apply the correct business model for the task,
- vii. Drive the disruptive innovation.
- viii. Develop a strategy of focus. The historical strategy of trying to be great at everything and mimic institutions such as Harvard is not a viable strategy going forward.
- ix. Frame online learning as a sustaining innovation, i.e., disrupts the existing classroom model to extend convenience to many more students as well as provide a better learning experience.

5. Some suggestions (action programme) for DIEM model

Over 46 Technological universities and a few State Universities are already functioning in India since the last five years and many more are an anvil [1]. It is suggested that the functioning of these universities need to be on disrupting innovation model rather than the traditional university model in India. This will enlarge the circle of influence taking under their wings the untapped large population of students aspiring for HE (see Fig. 4).

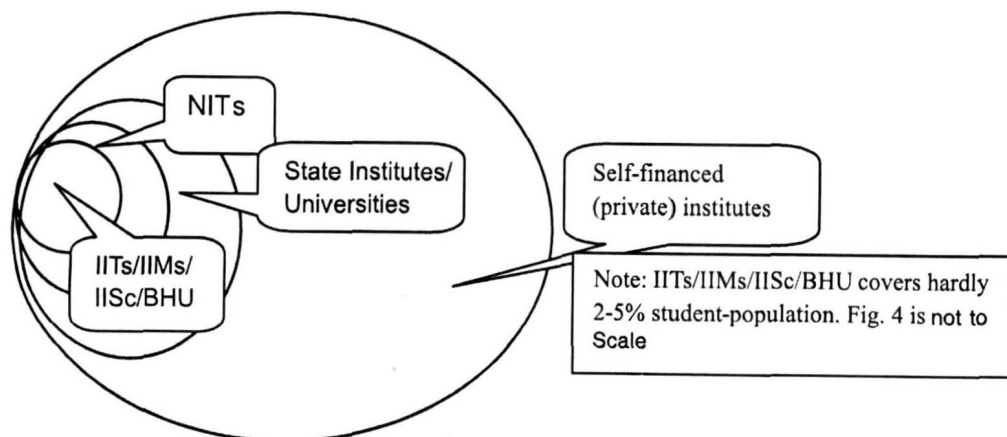


Fig. 4: DIEM for Technological universities: NITs, State and Private professional institutes.

This model is not focused only on getting degree but also for providing quality education- demonstrating competency-based skills and acquired knowledge- at low cost, affordable to the last man in the society. The suggestions (action programme) for disrupting (disruptive) innovation educational model (DIEM) for HE; are listed as given below:

5.1 Adoption of lean philosophy

The universities' functioning need to be based on the principles of Lean Manufacturing deploying duly all 22 tools, using productivity improvement or Industrial Engineering approach to one and all activities of universities [16-17]. The waste elimination will drastically reduce burden, may be lab-work, purchase, maintenance, energy management or in-service training. This may improve equipment/amenities/ physical infrastructure utilization by 30%, cost saving by 40% through waste elimination enhancing quality at low cost to a great extent [3].

5.2 Blending approach, e-learning, lecture capturing, etc.

Minimize classroom teaching and implement tools like blending approach (face-to-face and e-learning blended), e-learning, lecture capturing and smart class rooms. Faculty will use extensively websites (online education) for lecture notes, tutorials, quiz, assignment, laboratory manuals, counseling, examinations, and like purposes.

In a conventional institute investment in computer assets (including hardware and software in all departments put together) can be in the range 50-60 % of institute's total investment in equipment. Utilization of computers is low in the sense that the institute functioning is not paper-less, computers are hardly utilized for any research purpose, students submit their submission mostly copying from others in hand, no online examination/unit tests or communication, etc. In fact, during the program duration say of four

years; every student needs to breathe-in and breathe-out only IT and generic skills. This will help students to be 'thinkers', autonomous imbibing the habit of independent study that will automatically improve the quality of education eliminating the need of coaching classes [18].

To achieve such a culture, all fresh students admitted must possess their own laptops and other e-learning kits including lecture capturing. Laptops need to be provided at affordable cost, say Rs 5000 to Rs 10000. Banks will be encouraged to provide soft loans for this purpose. And students will be using their laptops in and out of institute premises. This will lead to a great reduction in overheads, say 20-30%, requiring less PCs, less lab areas, and other amenities.

5.3 Work load norms and academic audit

Regulatory bodies like UGC, University, AICTE and State Government have prescribed work-load norms. For example, AICTE in its Notification No. F-65/CD/NEC/98-99 of May 3, 2000 has prescribed that the working hours/week should not be less than 40 hours with 180 actual teaching day's p.a., i.e., 90 days of actual teaching per semester. Further AICTE stipulates, actual contact hours, teaching load per week cadre-wise, from lecturer (16 hours/week) to principal (4 hours/week) considering 2 practical hours equal to one theory hour. The ground reality is something different: one practical hour is treated as one theory hour (note that prior to 1986, the faculty load calculation was done in terms of theory hours/week considering two practical hours equal to one theory hour), the effective teaching per semester in case of UG and PG seems to be in the range 30-60%, submission of lab-work, project, seminars and workshop practical has become merely a matter of ritual, no process management or performance management, academic audit done hardly, students' attendance in classes is miserably low (as per rule UG and PG attendance must be 75% and 90% respectively), etc. Adhering to the directives of regulatory bodies (including statutes, ordinances and rules) will certainly enhance the quality of teaching.

Assessment of student's achievements/learning outcomes (including online- continuous assessment) is an essential component of a teacher's job. The present system of formation of syllabi by someone, teaching by another, paper setting by third and answer-books assessment by fourth is most undesirable for teacher is the only person who can authentically speak about the quality of students s/he taught and no one else. Then why not to make assessment as an essential component of teacher's duties? This will not only reduce the overheads, but improve quality as teacher is accountable for the quality of his/her students.

5.4 Faculty-student ratio

Institute faculty is divided into three cadres: Assistant Professor, Associate Professor and Professor, later two are placed in the same Pay Scale under 6th Pay Commission. AICTE has improved the cadre ratio from 1:2:4 to 1:2:6, keeping faculty: student ratio unchanged as 1:15. The budgetary provision for faculty (direct labor) works out to be more than 60% of revenue collected by institutes. Generally for any program, university structure prescribes 35 hours/week, normally half for theory and remaining half for practical. Drawing, seminar, project, etc. In view of the proposed adoption of e-learning technologies where faculty work as facilitator- involving more counseling, interaction rather than chalk-board business- the programme load can be reduced to say 20 hours/week/programme keeping faculty-student ratio to say 1:20 to 1:30 and cadre ratio as 1:2:12.

5.5 Faculty recruitment, qualifications, appraisal, training and superannuation

Adherence to the faculty recruitment norms is the first step towards quality education. Recruitment procedure and qualification norms appear to be often violated. Since mid-90s, for instance, professor/principal is required to possess PhD, but many candidates having PG qualifications are recruited against these posts, since 2005 or so, lecturer is required to possess

PG qualifications but many institutes nominated candidates with BE/B Tech qualifications as lectures who are now placed in Assistant Professor pay scale and earlier Assistant Professor with PG qualifications are placed in Associate Professor pay scale. Because of the Court intervention since the last couple of years principals/professors with PhD qualifications are appointed due to fear of closure of institute. In fact, AICTE as per the Notification mentioned earlier, has prescribed four components of a teacher's job: Academic, Research & Consultancy, Administration and Extension. R & D activities are at very very low ebb, even PhD holders are almost stagnant. Thus, one can infer the quality of education is suffered by such easily earned degrees at PG and doctoral level [5-9], and value-addition to teaching and research is almost missing. Thus, the quality of education does not solely depend upon the degree a teacher possesses but it depends how s/he is passionate for teaching and life-long learning. What is important: build minds or buildings? [18]. Only paper qualified faculty can hardly build quality education. Faculty appraisal (360 ° appraisal preferred) is hardly done (else why is like other public servants the percentage of faculty who are terminated during probation period almost zero?). Hence, it is necessary to revive the definition of quality of education as perceived by students and other stakeholders and frame the policies accordingly. With due in-service training to faculty like placement in industry for 3 months in a block of two years, updating and refreshing faculty from time to time [19-21], stringent promotion policies, salary linked with performance, removing vacations, etc., market driven quality can be built in. Like in industry world, the youngest CEO is of 14 years old and the eldest of 94 years old, a teacher needs no age bar if such senior faculty do real value-addition to the knowledge. But such teachers are exception, very small in number. Rest needs consideration. No teacher with 55 years of age and above is allowed to continue his/her job unless s/he proves the metal in terms of international publications, teaching skills, and mind set for lifelong learning and

dealing with emerging subjects.

5.6 Fund raising

Fund raising appears to be a big issue in India but in fact it is not so. Interestingly enough, State Government bears the cost of education over 60% of students admitted under various categories as SC/ST, OBC, EBC, etc. The UG and PG tuition fees are generally in the range of Rs 60000-Rs 160000 pa and Rs 80000 to Rs 180000 pa respectively. Thus, major funding comes from public, tax payers. This funding can be reduced to minimum required and Government can offer several other benefits to institutes like they provide to industry and agriculture, say, tax exemption, energy, gas, other materials like papers, equipment and grain at subsidized rates, etc. India is perhaps the only country where education is considered as charity that can boost up fund raising from alumni, stakeholders and public (not through capitation). Especially the religious places like temples, churches, masjeed and Ashrams can contribute their might to educational institutes in the region/country. Consultancy and R & D activities can hardly raise the fund because of the obvious reasons. Can we devise a mechanism so that like Gurukul system both tuition and living for all students will be free? What about getting funds from passed outs, alumni, to the tune of 2.5% pa of their income throughout their earning period? 5.7 Autonomy

Granting institute autonomy is considered as a sure shot remedy for the ills in education sector. Autonomy in such functional areas as admission, administration, finance, teaching-learning, etc., is advocated. Autonomy can help grow an institute if in real sense the autonomy is adhered to [22]. Autonomy is expected to help excel in certain local/global fields, market driven delighting the stakeholders. Faculty, the backbone of education sector, needs to possess four attributes: pious or good conduct/behavior, knowledge, teaching skills (including those required for e-learning) and love and affection for students, profession. Unprecedented expansion

of education after mid-90s, without providing a proper mechanism in place, has lost the spirit of educating our kids [23]. Autonomy was introduced through World Bank in a large scale two decades ago, but rarely one comes across a success story. For instance, are education leaders serious about learning outcomes? Most of the universities and institutes have adopted CGPA system of evaluation; can education leaders implement comprehensive and continuous assessment of students, the heart of CGPA? Neither India could adopt a right philosophy for education process [24] nor could our education system generate Steve Jobs [25]. Benchmarking, competition, craze for imitating brands like IIT/IIM, standardization, role of regulatory bodies, etc., are the road blocks for reaping the (real) fruits of autonomy: excel in what locally available with one. Ancient Indian Gurukul system was based on eco-friendly environment, to one according to one's potential, tuition and living free, scientific and spiritual and renunciation based, teaching through experience and on-job training, etc. Therefore, Gurukul system could do wonders: Arjuna was the best warrior and the best dancer and Bhima was both the best wrestler and chef! University of People, US, has successfully introduced online free education [26]. Even in India, a few decades ago NGOs like Pune Anatha Vidyarthi Griha, Pune, used to educate youths coming from poor families almost free of cost and society had taken responsibility to provide free food termed 'madhukari' to these students. Succinctly, autonomy needs to exploit local wealth and skills in terms of agriculture produce, local needs, export opportunities, human capital, etc., thereby excelling in certain unique local based domains, say, agro-based industry, and improving global market share. The real perspective of autonomy, therefore, will lead to low-cost education with market driven quality as perceived by the students and other stakeholders.

The list of points discussed above is not exhaustive in itself and many more points can be added, modified making HE cost effective with quality education and training delivered well

in time. The above presentation is equally applicable to entire tertiary education sector as well; and primary and secondary education can be aligned appropriately.

5.7 Scope for future work

Disruptive innovation is an on-going process and can vary from time to time and place to place. Many avenues are open for further research and local education leaders can evolve acceptable solutions. Academics have no alternative but to evolve and grow.

6 Conclusions

Traditional universities follow sustaining innovation so that they can maintain their brand and competitiveness. But the cost of education is high and quality is not market driven leading to heavy national losses. Moreover, such universities can cater their services to those who can afford for their high-cost education. Disruptive innovation on the other hand tries to cover the big chunk unattended, untapped (who cannot afford for education due to lack of wealth or skills) by traditional universities. Disruptive innovation in case of, for instance, disk drive industry and steel mini-mills, has proved rewarding serving the people who cannot afford for high price/cost. Such industry provides product/services to customer only not at low-cost but also with quality as perceived by customer. In this article, it is argued that disruptive innovation education model can do a great service to a larger section of untapped students making for them education both affordable and with quality. The features of these two models are presented. The recommendations for policy makers and education leaders made by Christensen et al are also presented but in brief. The article also presents business models like solution-shops, value-added processing and facilitated user networks. Research universities are like solution-shops. Disruptive innovation based on e-learning can lead to facilitated user networks where teacher works as a facilitator. A few suggestions like introduction of blending approach, e-

learning, lecture capturing, revised work load norms, reduction in actual contact hours, removal of vacation, recruitment norms, reconsideration for faculty qualification norms, 360 ° faculty appraisal, academic audit, fund raising, autonomy, in-service industrial training of three months in a block of two years, do away with competition, no imitation of branded institutes, redefining market driven quality of education, superannuating age, etc., have been made. This will hopefully lead to low-cost, making quality education affordable to the last man in the society. Scope for further research is also presented. The article, it is believed, is thought provoking and is of interest and concerned to education leaders and policy makers

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