INTEGRATING TRICKLE-DOWN AND BOTTOM-UP APPROACH FOR INCLUSIVE ECONOMIC DEVELOPMENT ON THE WINGS OF INNOVATION IN GLOBALIZED ECONOMY

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*[**Abstract**: Though Adam smith (1776) had articulated about productivity gains through technology and R&D, Economists in general started studying in quantitative terms the role of technology, entrepreneurship, human capital and its quality in different stages only after Second World War when there was flow of reliable data on inputs and outputs. A definite co-relation of the influence of these parameters along with the policy of states was established with productivity and the triggering factor among these was found to be technology coupled with the creativity of the members of society in devising innovations in not only in application of technology but also in its adaptation and devising business models for financing and marketing in conjunction with a class of persons who would take care of associated risks. Educationists and other studied the system of education and also the lives of innovators who had life transforming achievements to their credit. Various designs are being applied to encourage creativity, innovation, and scientific thinking yet it has not been found possible to have a structured approach for achieving this objective. Rather it has been noted that achievers were generally not graded as good students but were relentless in their pursuits and undeterred by failures and setbacks. Pursuits of such achievers finally resulted in laying the foundations of industry and industrial empires that, with their structured approach started administrating innovation also and making the gains secretive with the growth of industrialization; the innovative approaches at the grass root level did not find expression for wider applicability. However, latecomers like India and emerging economies had the benefit of co-existence of industrial development and also availability of grass root innovators nourished on scarcity and motivated to accomplish something with limited resources. However, such grass root innovators' potential remained dormant under the pressure of industrialization and in the hope that with rapid industrialization the bottom end participants would benefit from trickle down effects. With the onset of globalization long gestation periods of structured research were not suitable for maintaining competitive edge on a continuous basis in the disaggregated production networks. Innovation at the local level became crucial and commercially viable and such a situation would be evolving more and more. The local innovators also have demonstrated that industrial excellence can be created through their initiatives which would help the top end of the economy. Therefore emerging economies have demonstrated a virtuous cycle, fuelled by grass root innovations, in which bottom up approach and trickle down approach sustain each other giving a new meaning to inclusive growth and these giving a food for thought to policy makers to lay equal emphasis on encouraging grass root innovations and industries otherwise the goal of inclusive growth would be far distant.]*

Theoretical link between innovation and growth has been written about by economists since at least Adam smith (1776). He articulated about productivity gains from specialization through division of labour and also from technological improvements in capital, equipment and processes. Adam smith recognized the role of technology transfer from suppliers to users and a distinct role of R&D in the economy when he wrote,

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> "All the improvements in machinery, however, have by no means been the invention of those who had occasion to use the machines. Many improvements have been made by the ingenuity of the makers of the machines, when to make them became the business of a peculiar trade, and some by that of those who are called philosophers or men of speculation, whose trade is not to do anything; but to observe everything; and who, upon that account, are often capable of combining together the powers of the most distant and dissimilar objects. In the progress of society, philosophy or speculation becomes, like every other employment, the principal or sole trade and occupation of particular class of citizens and the quantity of science is considerably increased by it".[1]

For Schumpeter (1942), it was evolving institutions, entrepreneurs, and technological change that are at the heart of economic growth. Continued growth of output could no longer be explained only on increase in inputs used in the production process as understood in the industrialization[2]. Peter Drucker (1985) highlighted the role of innovative entrepreneurship for bringing prosperity and generating jobs when he wrote,

> "The mistake that people make is automatically equating innovation with high-tech. In fact, it is often improvements in doing business (rather than inventing new gadgets) that bring prosperity and generate jobs. Devising new ways to manage an organization to change a process, to bring a service to customers—all these things should be viewed as forms of innovation. The 'technology' is not electronics or genetics or new materials. The new technology is entrepreneurial management"[3]

Economists would be curious to determine and quantify the effect of various driving forces of economic growth such as, labour, capital, innovation, entrepreneurship etc.

[1] Innovation: Is the Engine for the Economic Growth? by Hasan Torun-Cumhur Çiçekçi, http://tcmb.give.tr./yeni/iletisimgm/innovation.pdf

[2] Schumpeter, Joseph, Capitalism, Socialism, and Democracy (1942)

[3] Peter Drucker, Innovation and entrepreneurship (1985)

Though empirically the impact of such driving forces had been articulated for long, it was after Second World War only such an exercise could be initiated as it was only after the war reasonable accurate estimates of inputs and outputs for the American economy, over some very long period, became available. Various studies, done through different methodologies, came to a finding that the measured growth of outputs (i.e. in capital and labour) between 1850-1950 could only account for 15 per cent of the actual growth in the output of the economy and thus there was an unexplained residual of the order of 85 per cent which could be only because of technological innovation in highly industrialised economics[4]. In later studies economists, also included the variable of human capital as well to refine the earlier findings and offered insights into the critical role of highly skilled workforce for long term growth to define endogenised innovation in the growth model by introducing knowledge spill over's, which resulted in deep implications for scholars to study the phenomenon of growth and how there could be unintentional growth factors in an economy/firm investing in R&D for a specific output and yet there may be spin-offs of the efforts which may benefit unintended areas besides improving the calibre of those engaged in R&D and its adaptation. Such a phenomenon has been termed as technology/knowledge spill over which is valuable to overall economy and is in the nature of public good for the entrepreneurs in the society to take advantage of. However, there would be factors specific to countries who can take better advantage of such spill overs while others remain less advantaged. There may be many path dependency reasons for this[5]. One such, pathway has been, particularly in respect of developing countries, the technology policy they have followed and with what ends in view in their endeavour to 'catch up'.

Latecomer countries seeking to catch up grew by effectively exploiting an international pool of existing technologies available from developed countries. Such countries not only borrowed/purchased technology and ready-made solutions but also through an active effort mastered various elements of technology and accumulated technological knowledge in growing sectors and product groups

[4] Innovation and Economic growth by Nathan Rosenberg, OECD (2004)

[5] *op. cit.*

particularly those which were considered main drivers of economic growth. In the process, it has been possible for the late entrant countries to develop their own capability to generate technical changes. An important input for such a process to take stronger roots came from markets, which generate continuous demand for better products and processes particularly those situated abroad where there is intense competition. Foreign markets are not only source of demand but are also source of knowledge and competitive pressures. Buyers abroad are often a source of knowledge on technical and marketing aspects of products. Linkage with export markets requires capital goods and thus technological mastery of foreign technologies in different forms and capacity to adapt such technologies to suit local conditions through innovations. Imports of technology and autonomous innovative efforts are not alternatives but compliments.[6]

The globalization regime is changing relationship between finance, trade, and production. The interaction between financial and trade internationalization (shallow integration) and production and technology at the level of networks (deep integration) is generating dynamics distinctively different from 1960s/1970s. Trade patterns are increasingly determining the distribution of production tasks across national borders. These processes are facilitated through financial globalization which enables new modes of interlinking of production and foreign capital in developing countries through mergers and acquisitions and quasi equity as well as outward investment strategies of enterprises from developing countries. 'Deep Integration' has been facilitated by liberalization of the international frameworks governing the flow of technology[7]. The importance of local or national system of innovation remains undiminished as it remains an important factor of deep integration. In a liberalised trade and investment environment the capability of developing countries' local innovation potential would continue to be an advantage which would be boosted by the transfer of knowledge and its accumulation through the process of deep integration. Thus an emerging policy agenda would be to build

6 Radosevic, Slavo, International Technology Transfer and Catch up in Economic Development, Edward Elgar.

7 *ibid.*

mechanisms of technology accumulation and technology transfer appropriate to a new phase of globalization particularly when the disintegration of production chains in globalized economy into constituent functions has allowed individual tasks to be increasingly contracted out to independent producers wherever capabilities exists. The participant entities in the production chain get into a dynamic mode of an arrangement which puts them on a firm path of technology accumulation in order to forge ahead. The most durable interlinking during the production chain would be the one which would be in the nature of technology enhancing relationship which may lead to the formation of innovative and productive capabilities greater than the sum of the technological capabilities of the individual participant partners.

Technology transfer issues for developing countries in a globalized context evolve a set of issues:

(i) the issue of simultaneous market and technology access which is essential for dynamic learning.
(ii) The roles of the firms of developing countries as the main carriers of technology transfer and the ways they compensate for the disadvantages in their immediate environment.
(iii) The position of national firms in regional or global production networks and the possibilities of dynamic learning.
(iv) The issue of macro organizational and networking strategies of the governments in order to enhance production and technology integration of the domestic economy.

Dynamic effects of imported technology are felt through continuous access to foreign markets through sub-contracting alliances and FDI. New technologies are systemic and their adoption and assimilation occur at multiple receiving points and via several channels. The driving concern of the policy, therefore, towards nurturing such multiple channels by increasing connectivity between national systems of innovation base across a wide range of contact points. Developing countries capable of combining market access and technology access would be quicker in ‘catching up’.

Domestic firms would be crucial agents of technology transfer as they complement foreign technology transformation with their own technology effort. The firms' S&T infrastructure would be important to assimilate the transfer and enhance the value of technology by its contribution on the firms' current and future needs which would also enhance the chances of the participation of the firm in an arrangement when complex technology transfer is sought to be effected in realignment of production chain. S&T capabilities are similarly continued updated with stronger links with the national S&T and innovation infrastructure.

In the above scenario, the use of FDI and sourcing links as tools of domestic technology may result in increase of local capacity and create a virtuous circle for the domestic economy. However, the reverse may also happen when the developing country gets locked into a low value added activities and inward FDI drives out local competitors and local supplier is restricted from creating new technology. Government of the developing countries and the firms in these countries would be required to be vigilant and maintain partnership with one and other through a mix of policy instruments, without circumventing the free play of globalized networks, that local firms with appropriate support of national S&T and innovation framework does not let the process of 'Deeper penetration' of the national firms in the production interlinks suffer any hick up. Best safeguard for this not to happen would be continuously demonstrating the capability of appropriate response through local innovations and keep the international players on toe who find it advantageous to avail of such innovative capabilities to remain competitive themselves in international trade.

Innovative capacity of a society would also be endogenously determined by the technological change resulting from decision of profit maximizing agents i.e. entrepreneurs. Entrepreneurship would not only benefit from internal innovations by rational, profit maximizing policies which would be dependent upon the knowledge base, knowledge spill overs and technical substitutions but would also be sharpened by the competitive behaviours that drive the market process which would also include introduction of new economic activity to the market place as an instance

of entrepreneurship. The entrepreneurship is manifested not only by market entry of new firms, but also by innovative and initiative entries into new markets by established firms. From this perspective technological innovation is form of entrepreneurship[8].

Societies in developing countries and their governments would have to devise and place in position dynamic policy instruments for educating the societies in a manner which spurs innovativeness on a continuous basis and in dynamic mode. Multilateral agencies like OECD have been engaged in highlighting the role of education in developing skills for innovation driven societies by way of improvement in the process of thinking and creativity and the manner of measuring and assessment of improvement of such skills. Intelligence and creativity are distinguishable capacities of humans. While with the exercise of intelligence one can become expert in basic skills which are developed by the application of intelligence one possess, a creative person would use his intelligence and skills to raise new questions; to come up with new methods, to evaluate unexpected results. In their pursuit of creativity such persons would be perceived to be making errors but would be undeterred by such setbacks and rather absorb them as learning processes in their path. On the other hand, experts would remain error free and attain the status of specialists but they would not be performing the role of life-transforming innovators or inventers. Intelligent persons with penchant for life-transforming creativity that came to be admired do not distinguish themselves by the conventional standards. One can look back and recall many distinguished personalities in the field of spirituality, science, art, literature, architecture, mathematics, engineering, software development etc. who were adjudged misfits in the conventional sense but they left such imprints that transformed the society meaningfully. One common trait among such distinguished persons has been that they push for what they are good at and rarely worry about what they are not good at—they regard every defeat as an opportunity—they are ambitious for their pursuit regardless of hurdles. Lesson of creativity in formal education are hard to come by. It is in ample measure in streets-people constantly

[8] Entrepreneurship, Innovation and Economic Growth: Evidence from GEM data, Pohkanwong, Yuen ping Ho, Erkko Autio, *Small Business Economics* (2005)24 : 335=350.

try out new things but often lack in directions to convert their creativity to bigger and valuable ventures. May be such creative persons do not enjoy substantial freedoms which are essential for affording free play to creativity[9]. Formal education system confuses prodigies with creativity. Prodigies are young people who very rapidly acquire the same mastery of discipline as an adult can have. Prodigies have immense potential of becoming experts. Most highly creative individuals are not prodigies. They view the world and environment around differently and develop a personality away from the system. Academics do not tolerate divergence and mistakes and thus creative individuals are termed mediocre and sometimes are categorized as idlers and wastrels. The energies of such individuals need orchestration[10]. For bringing about orchestration, one has to characterize individual players. A uniform educational system for a diverse country like India would be unequal to the task at hand. For the sake of simplicity, let us view India in three layers—(i) moffusil India (ii) India of cities & towns and (iii) India of metros and around. The basic awareness of individuals and parents situated in these distinct layers would be distinct. The *first layer* of moffusil India would have concentration of disadvantaged youth, the *second layer* of heart land would have limited opportunities, and exposure to world outside and the *third layer* would have preponderance of socially and politically aware youths, capable of organization and collaborating with a fair sprinkle of wealth and affluence. If education, skill development, innovation and entrepreneurship in fair combination is to result into excellence, engaging each of these distinct layers would present different challenges. In the first layer, individuals lack literacy skills and disciplinary skills to participate in numbers in the opportunities waiting in the areas which the market is looking for. In the heart land layer, there may be literacy skills and also fair level of other skills but they lack opportunities to push themselves ahead. The individuals in the layer around the metros are in too much of a hurry and ready to cut corners in order to be rich, successful, and famous. They are becoming ethically illiterate and would not

[9] Amaritya Sen's Ethics of substantial freedom, by Dr Jan Garrett, http://www.wku.edu/Jan.Garret/ethics/senetise.htm

[10] Educating for innovative societies, EDU/CERI/CD (2012), Directorate for Education, CERI, Governing Board, OECD

mind coming in the way of the success of deserving and capable. Formal education system may marginally innovate itself to cater to the potential of its target groups but would remain inadequate to provide free play of creativity. Beside there would always be an issue of dynamic programme of training of teachers to respond to the demands of curriculum that may be devised in the formal education system to encourage creativity. Traditional forms of assessment would not do and alternative mechanisms may continue to have short comings. Influence of ICT in the market and immense potential of these technology remains untapped, education planners should be laying emphasis on curriculum which enables the students in all levels to be at ease with the language of computers enabling them to interact with ICT systems to fathom immense wealth of data being generated and interpret the same for converting the output into useful applications for value added services and products. Students need to thus get orientation of being dynamically innovative[11]. Modern phase of globalization has taken strides largely because of ICT technology applications which have brought together excellence of geographically dispersed centers across the globe to generate the level of excellence far in excess of the arithmetic total of excellence of such centers. Thus the group of innovators would need to learn the trait of collaboration to create a circuit of win-win link ups. As markets expand and open up; people would be coming up with ideas every day, there would be opportunity to mould and create. Flight of brains is not taking place in unidirection to west but also it is taking place in the reverse direction to countries like China, India, Brazil, and Russia. A phenomenon of 'brain circulation' is in the offing. Young entrepreneurs and highly educated professionals sow their knowledge and skills abroad and acquire experience abroad and build networks carrying it back to US or elsewhere[12].

Learning takes place outside the formal education system also. Such a learning, termed as informal learning, takes place in many places and in many forms and such opportunities as they come are deliberately availed and should not be constrained

[11] ISID Discussion Notes DN1209, Information Explosion, Challenges and Opportunities, M.M.K. Sardana, http://isid.org.in/DisN.html

[12] American dream to Indian energy: Brain circulation replace brain drain. kook sample, *The Telegraph Calcutta*, India, April 17, 2012.

be there be at home, in school, in extracurricular activities. Most creative people rarely recall their school curricula with fondness but they also talk of mentors (ustads in colloquial north Indian languages) who modelled their behaviours and sometimes they also recall figures whose path they would not tread.

A research study summarises that what distinguishes innovative graduates—i.e. graduates who contribute to innovation in their workplace-from non-innovative graduates is not so much their disciplinary back ground, as the fact that innovative graduates make use of large number of (non-disciplinary) skills at work. The critical skills of distinction are creativity i.e. coming up with new ideas and solutions, and willingness to question ideas followed by the ability to present ideas in audience, 'alertness to opportunities' ability to co-ordinate activities 'analytical thinking' and ability to acquire new knowledge[13]. To empower students for innovation, therefore, students should not only be equipping themselves with the content and procedural knowledge of their discipline but also with good skills in thinking and creativity, along with the habit of curiosity, perseverance and with collaborating skills and create a paradigm linking various disciplines.

About five years ago, Government of India, in its endeavour to impart quality opportunities in science to young talents started five Indian Institutes of Science Education and Research (IISERS) with a specific brief to attract scientific talent from among the youth to nurture them to become world-class researchers in science. There are two major challenges with this approach. The most difficult problem in identifying scientific talent is the enormous number of potential applicants. Currently the eligibility for application to IISERs is determined by a 'merit list' from three channels, a joint entrance test conduct by the Indian Institutes of technology (IITs); a test conducted by Kishore Vaigayanik Prothsahan Yogna, a national scheme for encouraging scientific talents; and performance in the 12th grade Board Examination. Gathering of a merit list thus would be on the basis of familiarity of the students with knowledge concepts and their ability to apply these concepts to standard text book scenarios. Quality of mind needed for scientific research is not

[13] *op. cit*. 10

assessed. The system filters out the students whose strengths may not be with memorizing and mechanical application, but whose potential for scientific research would emerge if they were exposed to the excitement of scientific inquiry.

Besides, IIT joint entrance examination relies on multiple choice questions-formats which students must complete at high speed which discourage the exercise and assessment of thinking abilities and creativity.

Expert and government advisors are aware of the above shortcomings yet the selection goes on the above inadequate criterion as alternative selection criterions are yet to be arrived at.

Once the students are selected, the next challenge would be to have a curriculum with a competent faculty to inculcate the spirit of scientific inquiry and nurture them to have the capacity of independent inquiry which would become the foundation for developing research skills and thinking and decision making. As the students progress, they should be developing the capacity for scientific inquiry they pursue and should be transcending other disciplines if it has impact in their domain and similarly should have the capacity to benefit as applicable, from the developments in other fields. Cross pollination of ideas that transcend narrow confines of disciplines would provide greater insight into the scientific inquiry sought to be pursued.

IISER-Pune is endeavouring to conceive of a curriculum on the above basis. Compulsory courses in mathematics, physics, chemistry, and biology are complemented by compulsory course on rational inquiry to help students develop the capacity for knowledge construction, validation, and evaluation across a broad terrain of domains and ranging from, mathematics, and physics to philosophy, history, and art. In due course faculty may audit each other's courses and discuss their teaching to make connection across courses with a view to provide a glimpse to students how seamlessly the different courses flow into one another[14].

[14] Rethinking science education: creating tomorrow's researchers, by K.P. Mohanan, *East Asia Forum Quarterly*, and January-March 2012

Creation of such elite institutions of limited reach may be perceived only as incubation centers for conceptualization requirements for facilitating the inquiring and creative minds towards the spirit of innovation and scientific research. While such initiatives have their place, the rationale of such institutions that of encouraging scientific inquiry and creativity through free play of interdisciplinary mix should get integrated at all levels of education across the country with a view to fructifying the creative potential to the full measure and in all fields from literature, art to manufacturing on the one hand and on the other to unravel the mystery of data being churned out by ICT technology applications through the internet of the ICT based applications[15].

Creativity and spirit of innovation at already available levels in the country is finding expression in the changed environment in which innovative capabilities have become applicable; multinational companies are moving away from having one large research and development (R&D) center in their home country to a more distributed global model. India has a large base of scientifically and technology trained base and skilled manpower in SME's and manufacturing sectors, India in the estimation of many has emerged as a global innovation hub. Multinational corporations have established more than 600 captive R&D centres across India. These include not only centres for information technology firms such as Google and Microsoft which are drawn to India's specialized knowledge, but also engineering firms such as General Electric and Philips, and increasingly pharma firms. India, however, remains not visible as the source of R&D as these India-based R&D centers are part of intra-firm R&D supply chain that is visible only to other business units of the firms[16].

Much of India's R&D innovation, as described above, serving the global model, there is also expanding innovation focused on modifying global research to Indian conditions particularly in agriculture towards increasing yield and improved methods of irrigation through the combination of the efforts of farmers and entrepreneurs in the agriculture sector. Thanks to poor quality of public services, there have been a

[15] *op. cit.* 11

[16] India: unleashing potential in innovation and creativity, Devesh Kapur, 5th April, 2012. *East Asia Forum*.

range of delivery model innovations *e.g.* franchises have come up for providing potable drinking water over a smaller command area in replacement of complicated water supply system requiring network of pipes, metering billing etc. The sheer heterogeneity and diversity of Indian society makes it a fertile ground for ideas and creativity. Largely focusing on creativity and innovative capability of Indians at grass root levels, away from R&D mandarins and making to do with meagre resources. Navi Rajdou, Jaideep Prabhu, and Simone Ahuja have made comprehensive analysis of these capabilities in India[17]. They have referred to the Honeybee network run in India by Prof. Anil Gupta who identify and cross pollinate grass root innovations across India and have included in their data base over ten thousand innovations of such entrepreneurs leading to ingenious solutions for addressing pressing problems of local communities. Innovators like Parjapati in remote Gujarat and a school dropout who had commercialized miti cool—a refrigerator made of clay and creating low temperatures without the need of power supply has been cited as an example of life transforming innovation as an illustration of India's creativity potential. This entrepreneur without resting on his laurels has gone on to produce clay non-stick fry pan costing only $2. He further forayed into industrial pottery techniques indigenously to give employment to several households and has had the distinction of being recognized by Forbes' magazine among the most influential rural Indian entrepreneurs. Parjapati converted adverse circumstances into an opportunity largely because of his creativity and never say die attitude—a distinct trait of innovators and creators. He started with a spirit of *jugaad*—locality solution within the resources around and with application of mind and went on to convert his *jugaad* into innovation when through his pursuit he stabilised the solution and combined within him entrepreneurship to commercialize the same.

Traditional societies all over the world including in India develop an uncanny sense of finding alternate uses of apparently looking waste and convert waste into wealth. These societies have their own locomotion techniques by cobbling up wheel based contraptions and carry persons and wares to distant places in most ingenious ways

[17] *Jugaad* Innovations: Thinking frugal, Be Flexible, Generate Breakthrough Growth, Navi Rajdou, Jaideep Prabhu, Simone Ahuja, ISBN; 978-1-1182-4974-1

though they may not have formal literacy to explain the physics behind their contraptions. Such innovations bordering *jugaad* actually were the precursors of greater innovations to follow and create goods of mass consumption and multi utilities in the era of industrialization. Most of the agricultural implements that are in the market widely have interesting stages of evolvement from *jugaad* to innovations. During the process of such an evolution there comes a character who single mindedly pursues relentlessly the need to improve upon without being deterred by failure, such a person would finally succeed to take the contraption to a higher level capable of making an entrepreneur interested in mass production of the same for wider application not only for the process for which the original contraption was being used but also is capable of yielding other uses which were earlier not conceived. For example, two generations of father and son worked for thirty years or so to perfect modern type grain harvesters. There would have been such efforts in almost all societies during their evolution but the devices that would become of mass use would be when there is an environment of entrepreneurship and market supported by innovative financing and sales techniques. Therefore a relentlessly pursued *jugaad* has the potential of creating employment and opportunities manifold. So much so that it gives birth to altogether new industrial activity. Industry arising out of *jugaad* innovation is development of economy through bottom up approach as distinct from trickle down approach. In fact bottom up approach and trickle down approach are interconnected and inseparable if viewed in context. Such a view actually gives fuller meaning to the commonly spoken concept of inclusive growth as this concept has come to be equated with the approach of developing the top end of economy and the development of lower end would take place through trickle down. In fact development at the bottom end can also enrich the top end as exemplified above. When one talks about inclusive growth, the potential of overall growth through bottom end growth needs to be kept in view. In a buoyant economy bottom end approach would sustain the top and development at the top would sustain the bottom. After all agriculture based and related industries have developed from the bottom up approach. Bottom up approach and trickle down approach present scenario of a virtuous circle in countries like India where grass root innovations are acknowledged as significant and the R&D supported innovation is

considerable. Of late Government and civil society groups have come to recognize the significance of the grass root innovations and institutions like National Innovation Foundation and many such initiatives in government as well as in private sector have come up to accord national recognition to these types of innovations with a view to broaden their applicability with the addition of inputs from professorial scientific research groups. Such initiatives whenever combined with the entrepreneurship skills and marketing strategies have brought forward commendable efforts. For example, the innovation and entrepreneurship demonstrated by A. Muruganatham in introducing low cost sanitary napkins at affordable prices has opened an enormous market not only for the product but also a distinct market of machinery manufactures, marketing consultants and health communicators has come up besides addressing an important issue of health of women of all strata and doing away a major cause of dropout of girls from school. This is an illustrative example when a grass root innovator through his relentless efforts, casting aside many rejections and failures, has laid the foundation of life saving industry with an impact on society. Many state governments have initiated scheme of distribution of sanitary napkins free of cost to school going girls as the costs are affordable for the government[18]. One can imagine the potential of industry and job opportunities that would come up. Being aware of such success stories, the group engaged in encouraging grass root innovations need to set up yearly targets undertaking to put the selected innovations on industrial and commercial routes by pollinating the efforts of the innovators with R&D groups and risk taking entrepreneurs through innovative financial instruments and equally innovative marketing techniques. Failures encountered on the path are recognized as opportunities to have a relook through analysis and lessons learnt. After all nations bears costly loss due to failure in launching of satellites and takes such losses as the cost of development and learns lessons through proper analysis. The grass root innovations would also beg for such equanimity though at a considerably less cost.

[18] http:// new innovation in Jayaashree industries, A. Muruganatham

Commenting on the potential of grass root innovations, peter H. Diamandes, founder and chairmen X-prize, foundation noted[19].

> "We are entering an age when humanity's grand challenges are being solved by a new generation of 'do-it-yourself' innovators employing *jugaad*-style thinking".

Marce benioff, chairmen, and CEO, salsforce.com[20] recognizes that business must move away from top down organizational hierarchies that have defined the past and transform themselves into social enterprises built on bottom-up, agile models based on collaboration.

India's development process was initiated by groups of elites whose motivation was to seek civilization recognition with respect to India's capacity for development and in the process become heroes in the eyes of nationalists throughout India since they provided evidence of how splendidly Indians could grow themselves[21]. West had progressed through industrial revolution and therefore industrialization came to be understood as development and this concept has remained with us[22]. With the onset of industrialization, in the twentieth century, as North American and European economics expanded, western corporations began institutionalizing their innovation capabilities, creating their dedicated R&D departments and standardizing the business processes needed to take their ideas to market. They focused on 'managing' innovation just as they managed any other business activity and there developed a structure opposed to innovation which included controlled access to knowledge as well[23]. India, following the western world of development through industrialization also developed similar structures with similar effects. However, such a structural approach in relation to innovations is not only expensive and resource consuming and is elitist and insular which does not yield to individual's initiatives in

[19] http:/www.rountable.com/lile/file/jugaad%20Innovation-20%exercise
[20] *ibid*
[21] Gowda, Chandan (2010) Advance Mysore: The cultural logic of a developmental state, *Economic & Political Weekly*, July 17, Vol. XLV No. 29.
[22] ISID Discussion Note DN1004: Democracy, Development and Growth: The Indian Experience, M.M.K Sardana, http://isid.org.in/DisN.html
[23] o*p. cit*. 21

innovation. The drawbacks of such an approach have been felt resoundingly in the fast moving 21st century globalized economy when decisions are required to be taken at no notice and competitive edge has to be constantly renewed by saving on resources and working out more and more efficient production and marketing networks supported by matching financial instruments. The continuation of elitist approach in R&D being controlled by a select group of R&D scientists and engineers with selective or no collaboration cannot yield dividends when immediate encashment of technology through its commercialization requiring knowledge of fields and designs becomes paramount and any delay in the process would weaken the production network in a highly competitive market. Market has realised that innovation may not be an invention but may be towards conclusion of an idea to customers' delight and hence profit. Therefore even in the western economies particularly in the era of ICT applications more and more innovations are being brought about by smaller groups collaborating among themselves and structural research remains relevant in areas where significant innovations are being contemplated and where commercialization can await. So there is increasing realisation that while structural research would have its place and role innovative and creative abilities at grass root levels would be paying not only commercial dividends but also become relevant in structured R&D as well.

India and other emerging economies are at a stage where the process of industrialization is taking roots and yet all these countries have enormous numbers of active grass root innovators where designs and concepts are under implementation in limited way and may be not yet be conducive for wider replication. It would be prudent that policy initiatives include significant provisions for development and flourishing grass root initiatives in expectation of such initiatives fructifying into industrial activities capable of generating employment and new products. This would be contribution to economy from initiatives in bottom up approach through which top end may discover new avenues of its growth. Similarly inputs as they are already being infused at the top end in expectation of trickle down would also be necessary to keep India competitive in the frontier areas and generating feedstock for the activities at bottom end of the economy. Perfect

conditions exist in India and other developing and emerging economies to create virtuous cycle in which the top end approach and bottom end approach are in win-win relationship due to the general innovativeness of its people at different strata and in essential disciplines which are cross pollinating constantly.