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From the Editor's Desk

The genesis of a genius

Are we going to have another Darwin or Einstein, or the world has stopped producing scientific geniuses. Some believe that we will not have another Darwin or Einstein, but they think the world will need 'paradigm- Read more...

Purnendu Ghosh
Chief Editor of Publications

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The genesis of a genius

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Are we going to have another Darwin or Einstein, or the world has stopped producing scientific geniuses. Some believe that we will not have another Darwin or Einstein, but they think the world will need 'paradigm-shatterers', as there are still many unresolved fundamental questions. For the emergence of a genius, some think the world must fall into some kind of a crisis. The good thing is that our world always is always amidst some kind of crises, and so we should always hope for the emergence of geniuses amidst us to resolve them. Dean Simonton says that 'raw genius' is generally a necessary but not a sufficient condition to make someone creative. He thinks creative geniuses, like Darwin, might not have scored especially high on a conventional IQ test. It seems there is nothing like a 'full-blown moment of inspiration' waiting for us. The 'moment of inspiration' often comes through freewheeling unstructured discussions. "Research and anecdotal evidence suggest that distant analogies lead to new ideas." Though we don't want to be overwhelmed by irrelevant information, we like to understand things by entering into other's minds. Oliver Sacks writes, "Memory is dialogic and arises not only from direct experience but from the intercourse of many minds."

Creative scientists are different from creative artists. Scientific creativity requires much more formal training than artistic creativity. "Indeed, some studies have found a curvilinear inverted-U relation between artistic creativity and formal education levels so that those with higher degrees are at a relative disadvantage," writes Simonton. Simonton believes, as you lengthen the required training, you narrow the base of expertise.

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The nominations for the above are requested from the Fellowship. In case the above forms have not been received, the same may be downloaded from INAE website www.inae.in and sent to the INAE Secretariat within the stipulated dates.

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Creation of Data for INAE Expert Pool

INAE expert Pool has been created with the aim of identifying domain experts in various disciplines of engineering. The creation of this pool was discussed in the recent meetings with DST and Technology Information, Forecasting and Assessment Council (TIFAC). During the meetings, it has been decided that the domain experts from the Expert pool would be identified and selected for initial peer review by a group of experts for screening and assessment of the project proposals received by DST and TIFAC, from time to time. In addition, the Fellows would also be identified from the Expert Pool to form part of the Project Monitoring Committees (PMC), for projects sanctioned under the aegis of DST and TIFAC. Similar efforts are ongoing for further utilization of the INAE Fellows as domain experts in ongoing programmes of national importance. A letter from Dr BN Suresh, President, INAE had been forwarded sometime back to all Fellows and Young Associates to upload their particulars on the link for the INAE Expert Pool. The INAE Fellows and Young Associates who have not uploaded their particulars are requested to submit their profile details online at the link http://inae.in/expert-search/index.php/inae-members-form .

Report on "Development of Scientific Recycling in India and the Role of Research and Development"

Dr BN Suresh, President, INAE presenting a copy of the report to Dr R Chidambaram

The report on "Development of Scientific Recycling in India and the Role of Research and Development' based on a study sponsored by the office of the Principal Scientific Advisor to the Government of India has been completed recently. The Principal Investigator of this study was Captain NS Mohan Ram, FNAE who presently chairs the recycling group of the Society of Indian Automobile Manufacturers (SIAM). The co-investigators of the study were Dr. Basudam Adhikari of IIT Kharagpur and Mr. Sugumar, Deputy Director and Head of the Central Institute of Plastics Engineering & Technology (CIPET) Chennai. A hard copy of the subject report was presented to Dr. R Chidambaram, Principal Scientific Adviser to the Govt. of India by Dr BN Suresh, President, INAE, during a meeting at New Delhi on Feb 23, 2016 in which Dr Sanak Mishra, Vice-President, INAE, Capt NS Mohan Ram and Brig Rajan Minocha, Executive Director, INAE participated.

The issue of environmentally friendly disposal of end of life vehicles has assumed center stage consequent to the deteriorating air quality in our cities and judicial pronouncements limiting the age of vehicles. These issues have been duly addressed in the report which deals with R&D required on disposal of rubber and plastics and reduction of recycling residues, which are very important in the long run for India. The report has resulted in pertinent, actionable, recommendations on automotive recycling in general and also generated specific recommendations on the methodologies for disposal of rubber, plastics and auto shredder residues.

Research Journal -INAE Letters

The Agreement for publishing the Research Journal "INAE Letters" has been concluded with M/s Springer as approved by the Governing Council. The website for the Research Journal "INAE Letters" to include facility for submission of papers online has been launched. The first issue of the Research Journal "INAE Letters" will be released shortly.

Meeting with Niti Aayog

A delegation of INAE led by Dr. BN Suresh, President, INAE met Dr. VK Saraswat, Member, Niti Aayog on June 10, 2015. Dr. Saraswat welcomed the suggestions from INAE and reiterated that Niti Aayog would like to work with INAE in the fields identified at national level. Some of the immediate areas of concern discussed are **Solar Energy**; **Manufacturing in Electronics Sector**; **Machine Tool Manufacturing** and **Manufacturing of Magnets**. A meeting with Dr VK Saraswat and selected domain experts from INAE was held on March 4, 2016 to take this forward.

Academia Industry Interaction

AICTE-INAE Distinguished Visiting Professorship Scheme

Industry-academia interactions have become essential with the world over technological changes in recent times which can impart relevant knowledge to the students in the engineering institutions that would be sustainable in the changing conditions. While industries could gain by using the academia's knowledge base to improve the industry's cost, quality and global competitive dimensions; thereby reducing dependence on foreign know-how and expenditure on internal R&D, academics benefit by seeing their knowledge and expertise being fruitfully utilized practically and also by strengthening of curricula of educational programs being offered at engineering colleges/institutions. INAE together with All India Council for Technical Education (AICTE) launched "AICTE-INAE Distinguished Visiting Professorship Scheme" in 1999. Under this scheme, Industry experts are encouraged to give a few lectures in engineering institutions. This scheme has become popular among industry experts as well as engineering colleges.

Brief details pertaining to recent visits of industry experts under this scheme are given below.

Dr Jayanta Kumar Saha, Deputy General Manager (Applications), Institute for Steel Development &	Indian Institute of Engineering Sciences and Technology, Shibpur	Delivered lectures on "Engineering Materials and Applications", " Steel and its Classifications" and "Understanding of Steel Market and Usage of Reinforcement Bars Concept in Startups in Metallurgical Engineering". As per the feedback

Growth, Kolkata	Jan 30-Feb 1, 2016	received from the engineering institution, the industry expert has guided a project on "Evaluation and Life Prediction of Coated Steel Sheets". His lectures have also helped the students gain knowledge of practical aspects.
Dr Chaitanyamoy Ganguly, Retired Distinguished Scientist, DAE	School of Nuclear Studies and Application, Jadavpur University Feb 23, 2016	Delivered lectures on "Conventional and Advanced Fuels for light-water reactors (LWRs) and pressurized heavy-water reactors (PHWRs)" and "Conventional and Advanced Fuels for Fast Breeder Reactors". As per the feedback received from the engineering college, the School of Nuclear Studies is planning to focus on new areas such as "Nuclear Fuels and Fuel Cycle" and "Radio Isotope Production and Applications" as part of the M.Tech program; based on the suggestions from the Industry Expert.
Mr KN Suryanarayana Rao, Formerly Engineer -H, Project Director, IRNSS, ISRO, Bangalore	Sona College of Technology, Salem Feb 23, 2016	Delivered lectures on "Software Defined Radios". According to the feedback received from the engineering college, the industry expert played a vital role in reformulating the syllabus as per industry requirements. The lecture by the industry expert also provided exposure to the faculty and students on various aspects of the industrial requirements.
Dr V Ramachandra, Vice-President (Technical Services) UltraTech Cement Ltd	Siddaganga Institute of Technology, Tumkur Mar 4, 2016	Delivered lectures on "Concrete Roads - construction and Maintenance" and "White Topping – A Sustainable Alternative for Pavements". According to the feedback from the engineering college, the lectures gave exposure to latest technological advances in construction. The Industry Expert has also given inputs on curriculum and for establishing a skill development centre.

International Conferences/Seminars being organized by IITs/other Institutions

To view a list of International Conferences/Seminars being held in the month of April 2016 click here.

International Conference in Recent Trends in Computer Science and Engineering on April 5, 2016 at Chennai
http://www.conferencealerts.com/show-event?id=165637

IEEE International Conference on Energy Efficient Technologies for Sustainability ICEETS-2016 on April 7-8, 2016 at Nagercoil, Tamil Nadu
http://www.conferencealerts.com/show-event?id=162871

2nd International Conference on Advancement and Recent Innovations in Mechanical, Production and Industrial Engineering (ARIMPIE-2016) on April 15-16, 2016 at Greater NOIDA
http://www.conferencealerts.com/show-event?id=166861

5th: International Conference on Applications in Electrical, Electronics, Computer, Civil and Mechanical Engineering on April 25, 2016 at Coimbatore
http://www.conferencealerts.com/show-event?id=164280

A Road Map of Journey from the Sloppy Enterprise in Landslide Management to India's Freedom from Landslide Disasters

R.K. Bhandari

Nothing in this world of ours is beyond India's reach, if only it has the will. If we dream for landslide-disaster-free-India, and have the necessary political will, clarity of ideas, a clear sense of direction, an excitement of being a part of the national challenge, and an unbending ambition to succeed, things will begin to fall in place, and results will show up. On the other hand, "If a man does not know to what port he is steering, no wind is favourable to him."[1] Moreover, "We cannot solve the problems we have created with the same thinking which created them". [2]

In so far as landslide (LS) mitigation and management is concerned, there is enough darkness in the Indian skies for us to see the stars and get a sense of direction; and foresee first-rate problems deserving critical attention. Also, there is no need for us to jog our memories to recollect complexities of countless horrendous tales of landslide disasters and recall lessons taught, because the pain inflicted by landslides is so persistent that it is hard to forget. India's vast expanse of landslide-prone landmasses, the rising frequency of landslide disasters, the lackadaisical management ethos, and the dysfunctional institutional mechanisms combine to keep the pot of trouble boiling all the time. And it is not only the people living in the landslide-prone areas who suffer; we too may be among the victims, if we happen to be in a wrong place at the wrong time. As the list of landslide disasters is getting longer by the year, India's national development plans are taking a severe beating, the public faith in our capacity to manage disasters is rapidly eroding, and the outer limit of the public patience is fast approaching its breaking point.

It is time that we introspect and ask the inconvenient, hard questions rather than keep brushing them aside, with business as usual. The first question that comes to our minds is whether the disaster could have been prevented, or averted? The real world of landslide disasters is far more complex than we can singly or collectively imagine. In the real world, we can be only as successful as our ability to foresee multiple scenarios of hazards, vulnerability and risk. For decades, we have been in the business of making hazard maps and printing atlases. Let us squeeze and stir all our hazard maps and atlases, and count the drops. Sorry, we will have to wait until someone more serious and scientific places the first, validated and user-friendly hazard map into our hands. Therefore, the moot question is that if we have already spent huge sums of money in mapping landslide hazards in order to be able to anticipate trouble in good

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[1] Seneca
[2] Albert Einstein

time, why the development planners, disaster managers, tourists and pilgrims have not already been given those hazard maps for use to prove to the nation the real worth of the maps being produced for decades? And imagine, if we can't reliably anticipate the hazards before they strike and early warn the public with sufficient lead time, how can we ever prevent them from happening?

The next logical question is: Where did we go wrong? Every time a disaster struck us, we went morally wrong in defending ourselves in the TV studios and outside even without knowing facts of the case by recourse to an honest investigation. In the process, instead of investing our efforts in protecting slopes and predicting landslide disasters for a stitch in time, we mastered the art of deflecting accountability, explaining away the events as natural calamities, and dousing the fire of the ensuing pain and suffering, by shedding crocodile tears. Let us not forget that "The most perfidious way of harming a cause consists of defending it deliberately with faulty arguments."[3]

Furthermore, If we were to bunch together the statements made in the aftermath of a disaster by the government of the day, and compare these statements with what was said before on the similar occasions, our predicted statement for the future event may read like this: "It is a very sad day for the country and the whole nation mourns those killed in the ghastly landslide tragedy. Hon'ble Home Minister is personally monitoring the situation and no stones will be left unturned to rush succour to the victims and do whatever it takes to save as many lives as possible. A special relief package has been sanctioned to meet the national calamity and government will provide monetary compensation for the lives lost and for the reconstruction of the houses destroyed. An investigation into the tragedy has been ordered, a team of experts will leave for the troubled spot soon and the government will act on the investigation report, as soon as it becomes available. Emergency helpline numbers are now operational and more relief camps are being set."This, all too familiar, ritualistic narrative is in a sense, an insult to the injury. The arrogant and unscientific attitude of ignoring the critical importance of search for the truth through scientific investigation must stop and our heart must beat for the victims more between two successive disasters!

It has become a matter of routine to blame Nature for disasters. However, it is neither scientifically true nor morally right to call landslide disasters as natural calamities, and that too, even before an investigation starts. That the causative factors like climate change, urban-sprawl, non-engineered construction, illegal quarrying and mining, deforestation and such other non-natural factors have emerged as game changers, is a fact which can no longer be ignored. And if we too are responsible in one way or the other, why not we candidly admit so and mend our ways? In theory and speeches, we talk of zero tolerance against any wrong doings, but in reality, do we have even the techno-legal environment in place to hold people accountable for their acts of omission and commission, and the political will to punish the guilty, strengthen dysfunctional institutional mechanisms and put our house in order?

Landslide studies fall in a multi-disciplinary domain and involve a large number of institutions and stakeholders. As professionals, regardless of the field we belong to, we will have to shun use of dishonest methods (chicanery) and sugar-coated populist approaches. Non-transparent investigation and knee-jerk reporting often sully the disaster case records and bury the truth even deeper. Recall Richard Bach to remember: "The world is your exercise book, the pages on which you do your sums. It is not reality, though you may express reality there if you wish. You

[3]Friedrich Nietzsche

are also free to write lies, or nonsense, or to tear the pages."[4] But by not being honest in thought, speech, action and reporting, we are in fact robbing the future generations of the lessons learned through awesome real stories as they unfold. By ignoring proof, logic and science, we are ignoring our own future and increasingly getting identified as the generation of editors rather than of authorship.

Much of the cult of aimless enterprise leading to Landslide mismanagement in India is perhaps because of the compromises being made by the professionals, including those in the related government ministries, departments and institutions working in their respective comfort zones. Those who disagree with the statement have the onus to prove by citing examples that the projects they delivered, the disaster investigation reports they wrote and the opinions they expressed at the meetings were indeed scientifically tenable, intellectually uncompromising and morally satisfying. The career prospects of upcoming young professionals in India generally depend on the frequency of monographs, papers and reports they write and this is certainly one of the reasons that most literature on landslide studies read more like newspaper reports rather than in-depth scientific contributions. Similarly, professionals in departments and ministries also succumb to such temptations. In the process, the search for truth gets aborted prematurely, quantity over-rides quality, culture of peer-review fades, trash gets published, intelligentsia gets marginalized and the wheels of progress keeps turning without any significant forward movement. Going by how the things have unfolded over the period of the last three decades, the scorecard of any path-breaking contributions of professionals has been disappointing to dismal. Their contributions in policy formulation, national capacity building, raising standards of engineering interventions, giving fillip to multi-disciplinary culture and building multi-institutional team work, leave much to be desired

In linking Landslide disasters with the people at large, media also plays a pivotal role in moulding opinions across the spectrum of society via the breaking news and the subsequent real-time reporting. Media independence is therefore equally critical. There are some soul searching lessons for the media personnel as well, in the following excerpts taken from the speech of one of their own leading lights– John Swinton, a hugely respected former Chief of Staffat the *New York Times*:

"There is no such thing, at this date of the world's history, as an independent press. You know it and I know it. There is not one of you who dare to write your honest opinions, and if you did, you know beforehand that it would never appear in print. I am paid weekly for keeping my honest opinions out of the paper I am connected with. Others of you are paid similar salaries for similar things, and any of you who would be so foolish as to write honest opinions would be out on the streets looking for another job."

"If I allowed my honest opinions to appear in one issue of my paper, before twenty-four hours my occupation would be gone. The business of the journalist is to destroy the truth; to lie outright; to pervert; to vilify; to fawn at the feet of mammon, and to sell the country for his daily bread. You know it and I know it and what folly is this toasting an independent press. We are the tools and vassals of the rich men behind the scenes. We are the jumping jacks, they pull the strings and we dance. Our talents, our possibilities and our lives are all the property of other men. We are intellectual prostitutes."

Independent strategic thinking and planning plays an important role but a part of sloppiness in

[4]Richard Bach, Illusions: The Adventures of a Reluctant Messiah

our management of landslides also come from our perpetual pre-occupation with planning that leaves hardly any time for implementation. Long years ago, when the Ministry of Agriculture was the nodal ministry for disaster management in India, floods, famines and cyclones filled-in most of its time and space. Attention to landslide disasters was at best fragmentary. The Malpa landslide tragedy of August 1998 proved to be a game changer and placed landslides back on the national agenda. The High Powered Committee on Disaster Management setup in August 1999, submitted its report in October 2000 with significant recommendations on landslide disaster mitigation. These steadily got erased from our minds by the time the National Disaster Management Act was signed on the 23 December 2005 and the National Disaster Management Authority took in hand the task of writing a fresh set of Guidelines on Mitigation of Landslides and Avalanches. It took almost three years and scores of meetings for the NDMA to write the Guidelines which were finally released in June 2009 with an impressive set of new recommendations. Six years down the lane of memory, these too have been forgotten in the sense that most of the projected work-plan in the NDMA Guidelines has remained either a non-starter or a part of work-in-progress, which is either uneventful or without deadlines to watch. Let us not forget that "The finest of the plans are always ruined by the littleness of those who ought to carry them out, for the Emperors can actually do nothing".[5]

Yet another challenge to overcome sloppiness in landslide management is to remove the hiatus between our scientific and operating tempers and lay emphasis on the anticipated end results. If the scientists tell us from the house-tops that, by taking recourse to a systematic programme of geological and hydro-geological mapping, geotechnical investigation, instrumentation, monitoring and real-time data analysis, many types of landslides can be predicted, prevented and controlled, why have we then not pinned them down with a free hand to demonstrate so on the ground, and why even after years of investments, India is still without best practice examples of landslide investigation, prediction, early warning, prevention and control? If the modern science and technology has the power of permanently fixing major landslides in any situation, why hundreds of the well-known landslides keep killing people and yet they remain unattended for decades and we remain silent spectators?

For putting the house to order, all of us– the politicians, the bureaucrats, the scientists, the technocrats and the people at large –will have to act as an organized *Team India* to wage war against landslide disasters. The primary responsibility in fighting this war is that of the government, which must give to the nation, a strong political will, vision, a sense of direction, functional and empowered institutions, and adequate funding. India can boast of an impressive pool of highly qualified human resource, but that perception is illusory in this case because the great majority of the current pools of professionals have merely switched gears and lack credible science-based experience and specialized subject-specific vision and training. The expertise in different sub-disciplines related to landslide studies is scattered across numerous institutions which virtually act as islands of sporadic activity of their own choosing. India badly needs a cohesive binding force strong enough to galvanize *Team India* to lead from the front.

Finally, most people ask -Is freedom from landslide disasters possible and if so, what needs to be done? The Indian National Academy Engineering (INAE) took *suo moto* cognizance of the current ground realties and organized a roundtable meeting of landslide experts on 11 May 2015 in New Delhi to address a variety of landslide related issues. The meeting concluded with a highly positive note that a pro-active-strategic and determined-approach, powered by a strong *political*

[5]Bertolt Brecht in Mother Courage, 1939.

and administrative will, can put India back on the track to safety because, unlike earthquakes and tsunamis, most landslides are predictable, preventable, and controllable, if managed with appropriate interventions of S & T.

Of the various recommendations made at the roundtable, the most significant is the one seeking the establishment of an autonomous and empowered National Centre for Landslide Management for focused, coordinated and holistic attention to landslide management. Currently, many institutions in India are engaged in pursuing diverse aspects of the subject, but there is no visible excitement, binding force, coordinated effort, and accountability to the nation. Under the National Disaster Management Act of 2005, we created National Institute of Disaster Management. It, *inter alia*, runs training programmes on landslide management, way below the state-of-the-art level. It being the disaster mitigation face of India, now is the time for a SWOT analysis to know how much it has delivered, what difference it has made on the ground, and how it could be re-engineered so as to be able to measure up to its responsibilities.

The Geological Survey of India is the declared national nodal agency for landslides. Its performance over the period of years is out in the open and it needs to tell to the nation by self-assessment whether it has delivered. Does it have the vision, necessary plans and programmes, multi-disciplinary expertise, institutional capacity, resources and the operational freedom to be able to make a dent on the ground? Just as the test of pudding is in the eating, the nation will judge the performance of the nodal agency by the number of disasters prevented, landslides fixed, lives saved, best practice examples established, human resource trained and sound engineering practices introduced. Before the disaster-torn nation begins to question the fate of the promises previously made and the investigation reports filed without action, it will be wise to learn from the past experiences and use those very lessons in forward planning, capacity building and proof-testing of the institutional mechanisms. In any case, with the present levels of engagement of the nodal agency, the need for an autonomous centre is not diminished because the existing institutional mechanisms have fallen short of delivering, all these years, and their mere cosmetic reorganization or strengthening will not suffice. The proposed Centre should play the role as an apex national institution for landslide management, and be accountable to the nation.

There are large parts of our country in which hazards due to landslides co-exist with other hazards, like floods and earthquakes. In these multi-hazard areas, the landslide risk reduction plans will necessarily have to be subordinate to the multi-hazard risk reduction plans. Currently no such plans and strategy exists. If they do, they are insensitive to the multi-hazard reality. It is in this background that the INAE roundtable has laid emphasis on preparation of short- (0-3 years), medium- (3-10 years), and long-term (10-20 years) landslide management plans at the national, state and district levels in the multi-hazard context, through multi-disciplinary teams, within one year. Besides frontally addressing the present and the emerging challenges, providing strategies for coordinated action, and promoting sound engineering practices, the roundtable saw the need for a standing order to ensure regular updating, reaffirmation and re-notification of the various plans, in keeping with their dynamic nature.

One wonders why India, with such a rich pool of human resource, has resigned to the option of living with landslides, relying for so long on palliative and quick-fix approaches to landslide remediation. Paucity of funds, absence of delivery capacity, and urgency to deal with immediate landslide danger are generally being cited as the reasons. The capital intensive nature of permanent measures and unaffordability are the arguments often advanced to justify inaction.

However, the truth is that the benefits of permanently fixing landslides far overweigh capital investments. It is with this thinking that a time-bound national programme for controlling all major landslides has been recommended with onetime funding by the Central Government. There is the need to ensure that the solution finally picked for adoption out of a plethora of technological possibilities, must necessarily pass through the process of comparative evaluation of all options, with the eco-friendly bias.

No matter what we do, the success will continue to elude us if we do not fortify landslide management by introducing innovative techno-legal and techno-financial practices. For all ongoing and new development projects involving landslide risk management, the project construction and the corrective action for countering the construction-related, visible or anticipated slope failures and environmental damage before, during or after the construction stage, ought to be considered in design as its inseparable parts. This could be achieved by discontinuing the conventional practice of reflecting the costs of corrective actions as separate budget items, and by creating innovative techno-legal and techno-financial enabling environment. Adequate budget for the above purpose, including the maintenance costs, must be sanctioned as a package and all major landslide projects should pass through a mandatory peer-review by independent panels of experts.

The INAE roundtable, *inter alia*, unmasked the contentious link between the poor quality of detailed project reports (DPRs) and the contractual disputes, and cost and time over-runs. Ensuring eco-friendly and techno-economically sound DPR's was therefore considered critical to efficient project implementation. The need for accreditation of consultancy firms, capacity building of technical agencies within the Government, strengthening of the institutional arrangements for vetting and approvals of DPRs, a Third Party Inspection and audit, Disaster Impact Assessment of all major projects, and permitting mid-course modification of ongoing sanctioned works (to account for the new information exposed during investigation) was underscored.

The INAE roundtable meeting also recognized the need to establish strong communication between senior professionals, development planners and decision makers for building teams and teamwork; create pace-setting best practices of community-centric early warning systems and accord the highest priority to R&D on topics such as earthquake-induced landslides, role of extreme weather events in landslide studies, approaches to landslide risk and damage assessment, development of innovative technologies for effective utilisation of landslide debris and other wastes, and unfolding of fundamental mechanisms of the most problematic Indian landslides.

Credible and comprehensive documentation of landslides and landslide disasters should become part of our routine engineering practice. The emphasis stems from the fact that the universe of landslides is fascinating because *every inch of landslide exposed*, deepens our questions and taxes our imagination. What a landslide reveals at its surface, if not explored deeper, may sometimes make us conclude at the expense of what is hidden, not-known, unseen or not-understood. Our ensuing research papers and study reports naturally reflect more of our own perceptions built on the pile of observations and past experience known for subconscious loyalty to the widely accepted trends and theories. In many cases, vital field evidences get erased even before landslide investigations begin and facts get lost until they resurface in some other landslide at some other time and location. Many landslide case-records published after due

process of scholarly studies and debate go seldom challenged because *the publications appear scholarly at their face value*. The need to write credible monographs is therefore critical.

The day *Team India* decides to forge ahead with a visionary plan, clock, compass and a deep sense of commitment, the freedom from landslide disasters cannot remain far behind. First and the foremost, we must vow not to allow small slope failures to grow into big landslides. The day we are able to take care of street level problems, those at the city level will vanish on their own. While we attend to the problems that stares us in the face, our focus must shift from mere problem solving to establishing the culture of safety against landslides. Antoine de Saint Exupéry's once said: "If you want to build a ship, don't drum up men to collect wood and don't assign them tasks and work, but rather teach them to long for the endless immensity of the sea." The real secret of success lies in his words of wisdom.

Innovative Engineering and Leadership for Achieving National Goals

Pradeep Chaturvedi

This paper can be appropriately started with an epilogue which is a quotation from Dr. Kalam's Book "Thoughts for Change – We Can Do It". He writes "Advances in Technology need to give a quantum jump in the Economical Status of the country. Industry developed countries have understood this fact. If we, too, understand it, then we will be one of the leaders in the world.....If we change our mindset then India certainly has a big chance of becoming a global leader in the knowledge age". His book then focuses on Creative Leadership to Support Innovation. Dr. Kalam has related innovation with economic development; technology and engineering.

Role of Innovation in Competitive Global Economy

Innovation is now the key to growth in the competitive global economy. Government and business have critical role to play in strengthening the Innovation Ecosystem. The government has to provide the enabling policy interventions; strengthen knowledge infrastructure: improve inter-institutional collaborations; provide mechanism of business innovation at all levels, especially medium, small and micro enterprises; and provide vision to a national level road map for innovations. The business organizations have to identify and project the necessary framework of support from the government for enhancing innovative efforts and undertake innovation. Innovation ecosystem when supported by the government as well as the business will have a better chance of survival and growth in developing countries.

Strategic and organizational factors separate successful big-company innovators from the rest of the field. Innovation is difficult for well-established companies. By-and-large, they are better executors than innovators, and most succeed less through game changing creativity than by optimizing their existing businesses.

According to McKinsey & Company since innovation is a complex, company-wide endeavour, it requires a set of crosscutting practices and processes to structure, organize, and encourage it. Often overlapping and non-sequential practices resist systematic categorization but can nonetheless be thought of in two groups. The first group which is 'strategic and creative in nature' helps set up priorities and terms and conditions under which innovation is more likely to thrive. The second group deals with how to deliver and organize for innovation repeatedly over time and with enough value to contribute meaningfully to overall performance.

Opinions differ though those involved in the process of innovation firmly believe that there is no proven formula for success when it comes to innovation. McKinsey & Company recently conducted a multi-year study comprising in-depth interviews, workshops, and surveys of more than 2500 executives in over 300 companies, including both performance leaders and laggards, in a broad set of industries and countries. They observed that a set of eight essential attributes are

present, either in part or in full, at every big company that's a high performer in product, process or business model innovation.

Leadership for Innovation

Corporate transformation through fostering innovation and ideas management is an important issue for discussion. Leadership is looked in the overall canvas of political leadership, corporate leadership and social leadership. At the same time, innovation is also viewed in terms of strategic relevance and developing innovative management practices and converting innovations into commercial reality. Though social innovation is much talked about but it does not dictate or transform the economic markets or set rules for them. Social innovation is globally playing an important role, but it will take time for social markets to make effective inroads into economic development model. Engineering interventions are important for success.

A corporate strategy for innovation needs to be evolved. Experts realize that corporate policies, processes, procedures and support tools should encourage and enable responsible innovation. Board should put a framework in place to encourage intra-preneurship as a viable alternative.

The Board should also identify and tackle obstacles to innovation, barriers to entry and factors that increase the cost, complexity and difficulty of doing business. They should be prepared to work with other companies and with governments to reduce or overcome the obstacles.

Board should agree on their appetite for various forms of risks, recognize that innovation involves risks, and take practical steps to reconcile the requirement of both new developments and maintaining prudent control. Boards need to establish an appropriate balance between entrepreneurship and risk taking; and between the formulation of strategy and its implementation. Building appropriate checks into support arrangements and tools can ensure that new developments do not infringe laws, rules, policies and license conditions.

Essential Attributes for Innovation

In the digital age, the pace of change has gone into hyper speed, so companies must get strategic, creative, execution, and organizational factors right to innovate successfully. It has been concluded that if companies assimilate and apply certain attributes – in their own way, in accordance with their particular context, capabilities, organizational culture, and appetite for risk – they will improve the likelihood that they can light the spark for innovation.

Following eight attributes have been identified by various management companies and experts.

i) ***Aspire:*** US President, John F. Kennedy's bold aspiration, in 1962, to "Go to the Moon in this Decade" motivated a nation to unprecedented levels of innovation. Indian Prime Minister, Narendra Modi's call for "Make in India" has similarly set in motion a large number of innovative actions both in terms of policies as well as programmes though technological and engineering innovations have still to catch on. A far-reaching vision can be a compelling catalyst, provided it's realistic enough to stimulate action today.

ii) ***Choose:*** Innovation is inherently risky, to be sure, and getting the most from a portfolio of innovation initiatives is more about managing risks than eliminating it. Executives must create some boundary conditions for the opportunity spaces they want to explore.

iii) ***Discover:*** Innovation also requires actionable and differentiated insights – the kind that excite customers and brings new categories in markets into being. One can look for insights by methodically and systematically scrutinizing three areas: a valuable problem to solve, a technology that enable a solution, and a business model that generates money from it.

iv) ***Evolve:*** Business-model innovations - with change of the economics of the value chain, diversity of profit streams, and/or modify delivery models – have always been a vital part of a strong innovation portfolio. Established companies need to reinvent their businesses before technology-driven upstarts do.

v) ***Accelerate:*** Virulent anti-bodies undermine innovation at many large companies. Cautious governance process make it easy for stifling bureaucracies in marketing, legal, IT, and other functions to find reasons to halt or slow approvals. Therefore, it is necessary to find pathways to accelerate actions.

vi) ***Scale:*** Some ideas, such as luxury goods and many smart phone apps, are dusting for niche markets. Others, like social networks, work at global scale. Explicitly considering the appropriate magnitude and reach of a given idea is important to ensuring that the right resources and risks are involved in pursuing it.

vii) ***Extend:*** In the space of only a few years, companies in nearly every sector have conceded that innovation requires external collaborators. Flows of talent and knowledge increasingly transcend company and geographic boundaries. Smart collaboration with external partners, goes beyond merely sourcing new ideas and insights; it can involve sharing costs and finding faster rules to market.

viii) ***Mobilise***: How do leading companies stimulate, encourage, support and reward innovative behavior and thinking among the right groups of people? The best companies find ways to embed innovation into the fibers of their culture, from the core to the periphery.

Research has also observed that big companies do not easily reinvent themselves as leading innovators. Too many fixed routines and cultural factors can get in the way. For those that do make the attempt, innovation excellence is often built in a multiyear effort that touches most, if not all, parts of the organization and getting time to mobilize all stakeholders to appreciate the effort.

Indian Model of Innovation

The focus obviously has to be on entrepreneurs or SMEs. This is not accepted conceptually but it is true. We need to trust smaller organizations for innovation.

At the onset of 21st Century a need was felt for the 'Indian Model of Innovation' that focuses on 'affordability' and 'inclusive growth' and which can be a model for emulation by

countries across the globe facing similar challenges for sustainable development. Indian entrepreneurs and policy makers have accepted this inclusive model of innovation.

Creative Leadership to Support Innovation

Whether innovation will be supported or not has a lot to do with the leadership.

Dr. A.P.J. Abdul Kalam, Former President of India, in his Book "Thoughts for Change – We Can Do it" (2013) has elaborated on the linkage between national economic development and creative leadership as below:

- Nation's economic development is powered by competitiveness.
- Competitiveness is powered by knowledge power.
- Knowledge power is powered by technology and innovation.
- Technology and innovation is powered by resource investment.
- Resource investment is powered by return on investment.
- Return on investment is powered by revenue.
- Revenue is powered by volume and repeat sales.
- Volume and repeat sales are powered by customer loyalty.
- Customer loyalty is powered by quality and value of products.
- Quality and value of products are powered by employee productivity and innovation.
- Employee productivity is powered by employee loyalty.
- Employee loyalty is powered by employee satisfaction.
- Employee satisfaction is powered by working environment.
- Working environment is powered by management innovation.
- Management innovation is powered by creative leadership.

Thus, a relationship has been identified amongst economic growth, management innovation and creative leadership.

Each element mentioned above needs to be understood in the contextual framework. The interpretation will depend on economic and social structures in which they are applied. These elements also need to be carefully interpreted in the corporate context. However, the above gives an indicative and broad framework of the role of leadership in a knowledge society where tangibles have been replaced by intangibles.

Achieving National Goals: Make in India, Digital India and Ease of Doing Business Initiatives

The Prime Minister is focused on these three initiatives and is looking forward for suggestions and solutions for implementation of these three initiatives through innovative processes and routes where engineering inputs are crucial.

Dealing with 'Make in India Initiative' first, it is a massive challenge and calls for creating strong capital markets, upgrading technological and engineering base and ensuring skills development appropriate for emerging production needs. 'Make in India' programme can only be a success when people have confidence and faith in 'Made in India' products. The key issue is how can that be ensured? This calls for defect-free and uniform quality production that performs to expected standards, create high level of confidence, first in the Indian consumer and later in foreign consumer. The Indian manufacturers have to understand that they have to follow only

one quality standard for consumer in India and abroad. There is no doubt that once the quality is established Make in India programme will become a success and larger number of foreign investors and producers will flock to India. They will not just come for supposed to be 'cheap labour', 'unskilled manpower' and 'poor quality standard enforcement regime'. This requires new platform and approaches for engineering applications.

'Digital India Initiative' is expected to have an overarching impact and on paper a number of plans have been developed which need to be detailed carefully. All stakeholders including the suppliers and vendors have to be brought in tune with the quality performance so that timely project completion is possible. Sustainable project management practices will have to be incorporated. Emerging fields of engineering will have to be carefully integrated, both for software as well as hardware. Needless to say this again calls for engineering interventions of the highest order.

'Ease of Doing Business Initiative' is generally being interpreted as getting licenses, getting clearances, ensuring taxation compliance and land, water and electricity acquisition. No doubt there are amongst the ten indicators on which the World Bank rates different countries for Ease of Doing Business. Currently India is rated 146 and the Prime Minister has called for an all out effort to improve India's position to at least 50. The Department of Industrial Policy and Promotion has launched an initiative with 14 indicators to support growth on Industry and business in India. The Parliamentary Committee on Ministry of Commerce has called suggestions on, 'Ease of Doing Business'. The issue is highly complex and many of the inputs can only be effectively planned by engineering interventions. It is time that highest platform of engineering professional deliberates on it and provides inputs. Unless the rating under Ease of Doing Business in India improves making India a global manufacturing hub will become a pipe-dream.

The last important issue is that inspite of two decades of 'market reforms' people still distrust the market. The debate is going on between 'pro-market' and 'pro-business'. Experts defined that pro-market is to believe in competition, which helps keep prices low, raise the quality of products and leads to a "rules based capitalism" that serves everyone. To be "pro-business", on the other hand, means to allow politicians and officials to retain power over economic decisions and this leads to crony capitalism.

Whereas the pro-market environment can be created through high level of innovate promotion through technological and engineering innovations, the pro-business model can be promoted irrespective of technological interventions but only through policies favouring a few interest groups irrespective of competitive market benefits accruing to the user.

All the initiatives are expected to create inclusive growth thereby the rural poor also come into mainstream of economic growth through appropriate skills development, digital connectivity and productive labour route.

Leadership of highest level is called to ensure such results through innovation in creating short duration effective skills development programmes for persons with low level of education; improving and disseminating digital literacy; and introducing higher productivity based manufacturing platforms.

Epilogue

Dr. Kalam's mission for the life was to uplift the common man out of poverty. In his book 'Target 3 Billion', Dr. Kalam wrote, "More than 3 billion people live in rural regions, and the empowerment of these 3 billion is an issue that needs urgent attention today as the world talks about inclusive development. The empowerment of rural regions of the world is critically important from the perspective of inclusive development, sustained peace and shared prosperity in the world".

Dr. Kalam has shown how the leadership can bring about a transformational change in growth pattern through innovative measures and its time his preachings are followed.

Conclusion

Innovation is the mantra for future growth and can only be supported by forward looking visionary leadership. The attributes of innovation and the leadership traits have to be matched to ensure that the knowledge society is fully utilizing the emerging technological and engineering prowess and do not hesitate to bring around factor changes through innovation and thereby prosperity to the mankind.

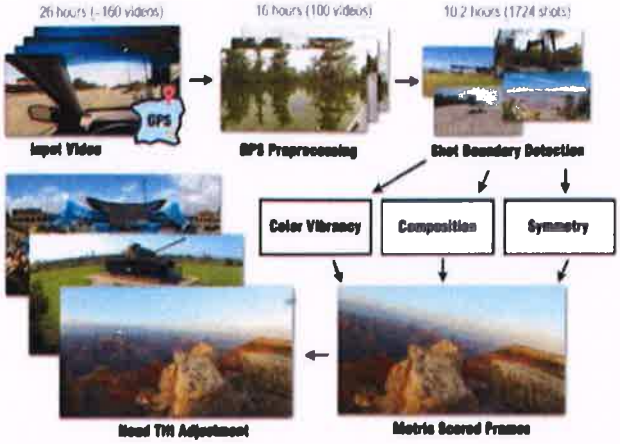
1. Designed for Sustainability

Created with a focus on energy and water-efficiency, the SKF office building's envelope material and lighting has helped it exceed LEED's baseline building standards by about 60 per cent.

SKF's office in Pune has been awarded the highest possible Leadership in Energy and Environmental Design (LEED) rating - Platinum - by the Indian Green Building Council (IGBC). The office space of SKF India in Pune has taken many actions to reduce environmental impact along the full value chain. It has amenities, which include both internal and external landscape, with water fountain, cafeteria, parking space and fire alarm system. With a project area of 35,000 sq ft and height of 35 ft, it is designed with a focus on energy and water-efficiency. The building envelope's material and lighting has helped it exceed LEED's baseline building standards by about 60 per cent. SKF India had undertaken measures to increase the green efficiency of the building including energy-efficient lighting, appropriate material for building envelope, DGU for the glazing to reduce energy consumption by HVAC, water-cooled HVAC system, installation of renewable energy system of capacity 100 kWp on the rooftop, etc. Besides, the orientation of the building helps avoid direct solar radiation from the east and west. By increasing the green efficiency, the total building power consumption has reduced considerably, which in turn has helped in cost reduction. A sun-path analysis was carried out while designing the building. It is oriented along the east-west axis, ie the larger facade of the building faces the north and south. The envelope of the building comprises AAC blocks with lower heat conduction and glazing, with better heat control. Double-glazing units have been used on the east, west and south facade. Also, heat-reflective paints have been used on the rooftop. The building design has an internal landscaped area, which has a north light. This light, designed on the roof, plays a vital role in providing optimum daylight and reducing consumption of artificial light inside the building during the day. Also, the project has used recycled material up to a minimum 15 per cent of total material costs; and more than 50 per cent are local materials. This has helped reduce the carbon footprint of the building. Most spaces, except the central atrium, have been provided with HVAC. Hundred per cent fresh air has been supplied to each space, which is more than the minimum fresh air requirement as per ASHARE standards. Operable windows have been used to take care of indoor environmental quality. The internal landscape also contributes to comfortable and fresh interiors visually. A water-cooled HVAC system has been provided, that is over 30 per cent efficient to the baseline provided by ASHRAE. The internal landscape increases the indoor air quality and reduces the CO_2 content inside the building. The power in this project has been drawn from rooftop solar panels. The power is generated using renewable resources. Architectural design is used to maximise daylight. Energy-efficient HVAC and electrical equipment have been used. The project has gained 60 per cent reduction in building energy compared to a baseline building. Also, a 100 kWp solar system has been installed on the rooftop. In total, 65 per cent of the building's electricity comes from rooftop solar panels, and at peak office hours, it is energy neutral, as 100 per cent of its power requirement is drawn from solar energy. A sewage water treatment plant (STP) has been installed on site to treat the sewage from the office building. One hundred per cent of the treated water has been reused by the building. The treated water is reused for flushing and irrigation. Besides, recharge pits have also been installed. The energy efficient equipment used include: Centralised chilled water based system; Highly energy-efficient centrifugal chiller; Energy-efficient water pumping system; Low power consumption and highly energy-efficient Turbocor chiller, with fan control, with variable air volume, with water cooling chillers.

Source http://www.constructionworld.in/News/Designed-for-Sustainability-/96869

2. Algorithm Allows a Computer to Create a Vacation Highlight Video



A flowchart of how the process works, from examining 26 hours to video, trimming it to 20 hours, choosing the best visuals and producing the finished product.

Researchers at the Georgia Institute of Technology unveiled a novel video-editing solution recently that automatically sorts and edits untouched footage into the most picturesque highlights for a vacation reel. The new approach is an algorithm that analyzes video for images with ideal artistic properties. It first considers geolocation, then composition, symmetry and colour vibrancy to determine what is important or picturesque. Video frames with the highest scores are processed into a highlight reel. The researchers analyzed 26 hours of footage of a scenic location from a wearable, head-mounted camera. "The data was essentially useless because there was just too much of it," said a researcher. "We liked the idea of being able to automatically generate photo albums from your vacation, algorithmically." The algorithm turned 26 hours of video into a 38-second highlight reel in three hours. Because the researcher had worn a head-mounted Contour Action Camera that captured GPS data, the algorithm could filter by geographical location. That reduced the footage to 16 hours. Shot boundary detection further reduced it into 1,724 video shots or about 10.2 hours of video. It then processed for artistic quality and provided an output of the most picturesque content. Processing time is variable and depends on the number of computers used. "We can tweak the weights in our algorithm based on the user's aesthetic preferences," researchers said. "By incorporating facial recognition, we can further adapt the system to generate highlights that include people the user cares about." They will continue to work together testing the algorithm with multiple participants to help generalize the approach, incorporate facial recognition, and develop data visualization techniques that make it easy to browse and search specific moments. The implications of future, successful tests could echo far beyond their initial work at Georgia Tech. "This research brings together multiple modalities to more efficiently understand large amounts of data," said senior researchers. "We are trying to optimize how easy it is to understand all of the data we have in an efficient manner because otherwise it would be impossible to do so", they said.

Source https://www.sciencedaily.com/releases/2016/03/160310125347.htm

3. One 3-D Printer for 21 Metals

A new technology for 3-D-printing metal parts could be a cheaper and more versatile alternative to common industrial metalworking techniques. It also opens the door to new kinds of parts with unique properties that arise from the precise combination of multiple metals. Possible applications include structural parts for things like car or airplane bodies, as well as components of engines, electrical devices, or other machines. That's according to AJ Perez, CEO of NVBOTS, the Boston-based startup that developed the new method. The company says the technology, which is capable of printing 21 different metals from aluminum, nickel, and tin to alloys like stainless steel and nickel titanium, is the only one that can use multiple metals during the same job.

A ring made of pure titanium is 15 millimeters in diameter and five millimeters tall.

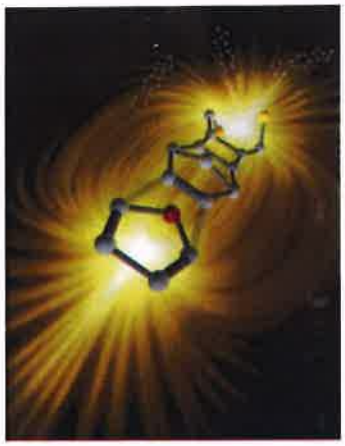
Using additive manufacturing to inexpensively make a wide variety of reliable parts out of metal would be a boon for many industries, since it would eliminate the cost of building the tools needed to manufacture new and unique parts by conventional means. Big companies like GE and Pratt & Whitney already use established additive manufacturing techniques to make high-value metal parts such as engine components, but the machines and metal powders required are very expensive. Perez says his company's technology, which employs electricity to melt metal wire, is not only cheaper and much faster but also more flexible and efficient than those techniques and, crucially, provides more control over the printing process. Printing metals is technically challenging for many reasons, but perhaps the most important have to do with heat. Large amounts of heat are required to melt the materials, and the way metals conduct heat complicates the process of building structurally sound parts layer by layer. The established techniques for doing this entail using either a laser or an electron beam to melt and fuse thin layers of metal powder.

These stainless-steel parts were made with the new printing method. The large hexagonal ring is 65 millimeters wide.

Perez says the new method can be thought of as a high-precision form of welding. The precision comes from a proprietary method of controlling the amount of heat used to produce every single voxel, or 3-D pixel, of a printed part. That provides a level of control over the final quality of the part that is not possible with the powder-based techniques, he says. Right now the technology, which is still in development, can only be used to make relatively small parts. But Perez says that for small, high-value stainless-steel and titanium parts, it is already a viable alternative to a common industrial metalworking technique called casting. Casting is used in a variety of industries, including auto manufacturing, aerospace, luxury goods, and oil and gas. The longer-term promise is the ability to print parts with unique properties that "you wouldn't be able to manufacture any other way," says Perez. For example, parts could feature corrosion- or heat-resistant metal on the outside and a very strong but susceptible metal on the inside. Or they could be designed to manage heat in specific ways. Companies aiming to build lighter-weight cars or planes could use the technology to make new designs that mix heavy, strong metals with lightweight but not-so-strong ones.

Source https://www.technologyreview.com/s/600876/one-3-d-printer-for-21-metals/

4. Scientists Exploit Nanotechnology Approaches to Speed up Chemical Reactions

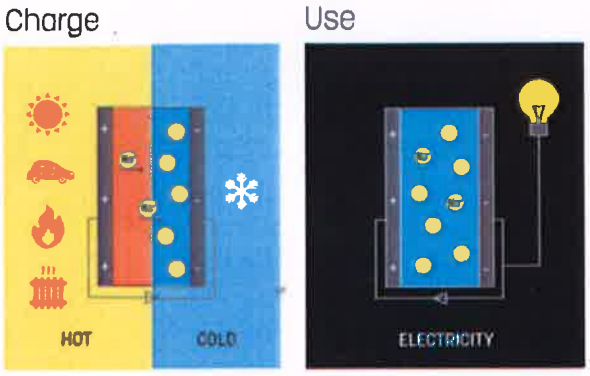


This image shows the first-ever catalysis of a chemical reaction in a nanoscale junction using an electric field, which could revolutionize the way we produce chemicals for daily life applications.

Researchers at the University of Barcelona (UB) and two universities in Australia have introduced a new way of catalysing-speeding up- chemical reactions by applying an electric field between the reacting molecules. This opens the door for the fabrication of chemical compounds, used in pharmaceutical products and materials, in a fast and cheaper way. The reaction studied was a classical Diels-Alder reaction that was promoted by applying an oriented electric field between two nano-electrodes containing the reacting molecules. This novel nano-chemical synthesis approach involves joining individual molecules to create new molecular backbones just like snapping "Legos" together, and might lead us to more efficient methods for the synthesis of challenging chemical compounds. "Theory suggested that many chemical reactions -- and not just redox reactions, as is often thought -- might be catalysed by applying an electric field," says a researcher. "We've provided experimental evidence for this for the first time." Being able to catalyse chemical reactions is essential, as it speeds up the reaction and thus makes it more proliferate -- and therefore cheaper to use -- in its many applications. Electrostatic catalysis is the least developed form of catalysis in synthetic chemistry, because electrostatic effects are strongly directional. The researchers in Spain and Australia overcame this by using state-of-the-art single molecule techniques that are based on scanning tunnelling microscopy. "Our modified STM approach allows recording direct signatures of individual molecules reacting," says a researcher at UB. "By controlling the orientation of the molecules with respect to the electric field, we accelerated a non-redox reaction for the first time," he said. "Using external electric fields as the 'catalyst' in this way means that challenging chemical reactions can be achieved that otherwise might not be possible by classical synthetic methods," adds a Marie Curie Research Fellow at UB. "This opens the door for future chemical technology."

Source https://www.sciencedaily.com/releases/2016/03/160303084347.htm

5. Supercondenser Stores Heat as Electricity



Storing heat as electricity.

Researchers at the Laboratory for Organic Electronics at Linköping University, Sweden, have created a supercondenser that can be charged by the sun. It contains no expensive or hazardous materials and it should be fully possible to manufacture it on an industrial scale. In the future we could have a completely new type of energy storage, charged by heat energy -- for example during the day when the sun shines, or by waste heat from an industrial process. The heat is converted to electricity, which can be stored until it is needed. Simply put, a supercondenser is energy storage: a type of battery that consists of an electrolyte of charged particles -- ions -- between two electrodes. The charge is stored next to the electrodes, most often in carbon nanotubes. One of the physical phenomena that the researchers make use of here is that if a supercapacitor is exposed to a temperature gradient -- that is, one end is warm and the other cold -- the ions rush towards the cold side and an electric current arises. The thermoelectric effect is used to make electricity of heat; how much heat is converted to electricity depends both on which electrolyte is used and how great the temperature difference is. For many years, researchers at the Laboratory for Organic Electronics have experimented with fluid electrolytes consisting of ions and conductive polymers. The positively-charged ions are small and quick, while the negatively-charged polymer molecules are large and heavy. When one end is heated and the other one cooled down, the small, quick ions rush towards the cold side while the heavy polymer chains stay where they are. Since they are ions, and not electrons, they stick to the metal electrodes. The charge that then arises is stored in carbon nanotubes next to the metal electrodes, and can be discharged whenever the electricity is needed. The researchers found the right polymers after years of fruitless experiments. They produced an electrolyte with 100 times greater ability to convert heat to electricity than the electrolytes normally used. The researchers claim that they can convert and store 2,500 times more energy than the best of today's supercondensers linked to thermoelectric generators. The electrolyte contains only non-hazardous, simple, and cheap materials that are stable and can be handled at room temperature. The ion-driven thermoelectric supercondenser therefore opens up new possibilities of storing solar electricity, to take one example. The researchers hope that the results will lead to an entirely new type of energy storage that can be mass-produced on an industrial scale.

Source https://www.sciencedaily.com/releases/2016/03/160311084114.htm

6. Microchip Shrinks Radar Cameras to Fit into a Palm

NTU Asst Prof Zheng Yuanjin holding the tiny radar camera chip on his index finger.

Scientists at Nanyang Technological University, Singapore (NTU Singapore) have developed a chip that allows new radar cameras to be made a hundred times smaller than current ones. With this NTU technology, radar cameras that usually weigh between 50 kg and 200 kg and are commonly used in large satellites can be made to become as small as palm-sized. Despite being small, they can produce images that are of the same high quality if not better compared to conventional radar cameras. They are also 20 times cheaper to produce and consume at least 75 per cent less power. "We have significantly shrunk the conventional radar camera into a system that is extremely compact and affordable, yet provides better accuracy. This will enable high resolution imaging radar technology to be used in objects and applications never before possible, like small drones, driverless cars and small satellite systems," said researchers. Current radar camera systems are usually between half and two metres in length and weigh up to 200 kg. They cost more than US$1 million on the market and can consume over 1000 watts in electricity per hour. Known as Synthetic Aperture Radar (SAR), these large radar cameras are often carried by large satellites and aircrafts that produce detailed images of the Earth's surface. Objects longer than a metre, such as cars and boats, can be easily seen by the radar camera mounted on an aircraft flying at a height of 11 kilometres. Unlike optical cameras which cannot work well at night due to insufficient light or in cloudy conditions, a radar camera uses microwaves (X-band or Ku-band) for its imaging, so it can operate well in all weather conditions and can even penetrate through foliage. These detailed images from radar cameras can be used for environmental monitoring of disasters like forest fires, volcano eruptions and earthquakes as well as to monitor cities for traffic congestions and urban density. But the huge size, prohibitive cost and energy consumption are deterrents for use in smaller unmanned aerial vehicles and autonomous vehicles. In comparison, NTU's new radar chip (2mm x 3mm) when packaged into a module measures only 3cm x 4cm x 5cm, weighing less than 100 grams. Production costs can go as low as US$10,000 per unit, while power consumption ranges from 1 to 200 watts depending on its application. It can also capture objects as small as half a metre which is twice as detailed as the conventional radar camera used in large aircrafts or satellites. The researchers said that when mounted on UAVs, it can take high quality images on demand to monitor traffic conditions or even the coastlines."Finally, with the space industry moving towards small satellite systems, such as the six satellites launched by NTU, smaller satellites can now also have the same advanced imaging capabilities previously seen only in the large satellites." Large satellites can weigh up to 1,000 kg, but microsatellites weigh only 100 to 200 kg. "Monitoring the environment with a clear image using a traditional optical camera is always very challenging due to clouds and changing light conditions," said the researchers. "This is especially the case for the tropics where the sky is always cloudy. With a miniature radar-on-chip system, it cuts down the required weight and size of the payload that a satellite needs to carry. "More significantly, the lower power consumption makes it very suitable for microsatellites such as the X-SAT or VELOX-CI which NTU has launched."

Source https://www.sciencedaily.com/releases/2016/02/160223074537.htm

7. India Launches Sixth Satellite, set to Complete own Navigational Network

ISRO's PSLV C-32 carrying navigation satellite IRNSS-1F lifts off successfully from the Satish Dhawan Space Centre, Sriharikota in Andhra Pradesh on March 10, 2016

Moving a step closer to completing the satellite network for its own location positioning system, India on March 10, 2016 successfully launched the IRNSS 1F, the sixth and penultimate of the series. The Indian Regional Navigation Satellite System (IRNSS) is to be a cluster of seven satellites that will provide location services over India and neighbouring countries, just like the Global Positioning Service (GPS) that most of the world, including India, currently uses. The IRNSS-1F rode into space on a Polar Satellite Launch Vehicle (PSLV) from the Satish Dhawan Space Centre in Sriharikota, near Chennai. "PSLV C-32 has put the satellite into the right orbit. We have only one more in the constellation to complete the regional navigational system, which we hope to do next month," Indian Space Research Organisation (ISRO) chairman A S Kiran Kumar was quoted by PTI as saying after the launch. The IRNSS network is already operational. It had started working after the launch of the fourth satellite in March last year. A minimum of four satellites are required to make the system operational. ISRO and some educational institutions are already receiving the data and using it for developing some location solutions. The fifth satellite was launched in January this year and has become operational. The first satellite in the series was launched in July 2013, followed by another one in April, 2014 and the third in October the same year. The IRNSS system is designed to provide location accuracy better than 10 metres. Once it becomes fully operational, the IRNSS would be used to provide terrestrial and marine navigation, help in disaster management operations, and offer voice and visual navigation services. The IRNSS 1F, besides having the navigation and ranging payload, is also carrying a Rubidium atomic clock, which will transmit navigation service signals to users.

Source http://indianexpress.com/article/india/india-news-india/isro-navigation-satellite-sriharikota/

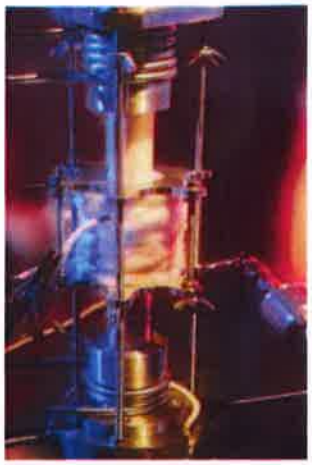
8. Mix and Match MOF: New Composite Material that Traps Oxygen Selectively could be Useful for Energy Applications such as Fuel Cells

Squeezing iron-containing ferrocene in the pores of the metal-organic framework known as MIL-101 lets ferrocene's iron snag oxygen from passing air.

Inexpensive materials called Metallic Organic Frameworks (MOFs) pull gases out of air or other mixed gas streams, but fail to do so with oxygen. Now, a team has overcome this limitation by creating a composite of a MOF and a helper molecule in which the two work in concert to separate oxygen from other gases simply and cheaply. The results might help with a wide variety of applications, including making pure oxygen for fuel cells, using that oxygen in a fuel cell, removing oxygen in food packaging, making oxygen sensors, or for other industrial processes. The technique might also be used with gases other than oxygen as well by switching out the helper molecule. Currently, industry uses a common process called cryogenic distillation to separate oxygen from other gases. It is costly and uses a lot of energy to chill gases. Also, it can't be used for specialty applications like sensors or getting the last bit of oxygen out of food packaging. A great oxygen separator would be easy to prepare and use, be inexpensive and be reusable. MOFs, or metal-organic frameworks, are materials containing lots of pores that can suck up gases like sponges suck up water. They have potential in nuclear fuel separation and in lightweight dehumidifiers. But of the thousands of MOFs out there, less than a handful absorb molecular oxygen. And those MOFs chemically react with oxygen, forming oxides -- think rust -- that render the material unusable. The new tack for researchers at Pacific Northwest National Laboratory involved using a second molecule to mediate the oxygen separation -- a helper molecule would be attracted to but chemically uninterested in the MOF. Instead, the helper would react with oxygen to separate it from other gases. They chose a MOF called MIL-101 that is known for its high surface area -- making it a powerful sponge -- and lack of reactivity. One teaspoon of MIL-101 has the same surface area as a football field. The high surface area comes from a MOF's pores, where reactive MOF's work their magic. MOFs that react with oxygen need to be handled carefully in the laboratory, but MIL-101 is stable at ambient temperatures and in the open atmosphere of a lab. For their helper molecule, they tried ferrocene, an inexpensive iron-containing molecule. The scientists made a composite of MIL-101 and ferrocene by mixing them and heating them up. Initial tests showed that MIL-101 took up more than its weight in ferrocene and at the same time lost surface area. This indicated that ferrocene was taking up space within the MOF's pores, where they need to be to snag the oxygen. Then the team sent gases through the black composite material. The material bound up a large percentage of oxygen, but almost none of the added nitrogen, argon or carbon dioxide. The material behaved this way whether the gases went through individually or as a mix, showing that the composite could in fact separate oxygen from the others. Additional analysis showed that heating caused ferrocene to decompose in the pores to nanometer-sized clusters, which made iron available to react with oxygen. This reaction formed a stable mineral known as maghemite, all within the MOF pores. Maghemite could be removed from the MOF to use the MOF again. Together, the results on the composite showed that a MOF might be able to do unexpected things -- like purify oxygen -- with a little help. Future research will explore other combinations of MOF and helper molecules.

Source https://www.sciencedaily.com/releases/2016/03/160308211756.htm

9. Chemically Storing Solar Power

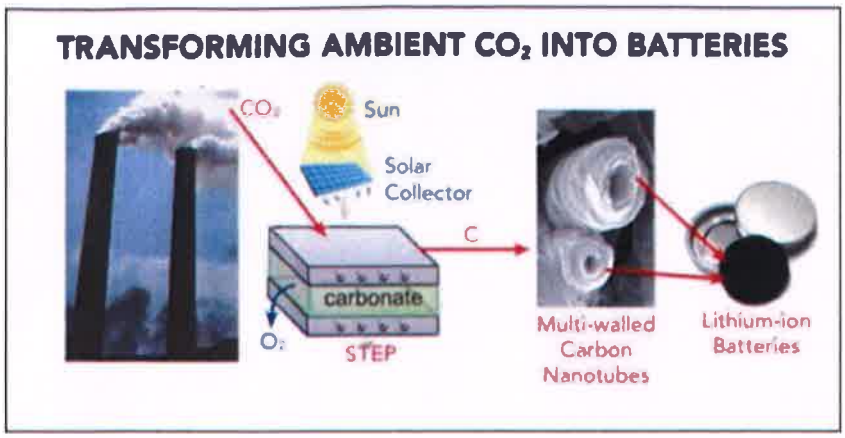


Heated reactor. A photo-electrochemical cell has been developed that can chemically store the energy of ultraviolet light even at high temperatures.

A photo-electrochemical cell has been developed at TU Wien (Vienna). It can chemically store the energy of ultraviolet light even at high temperatures. Nature shows us how it is done: Plants can absorb sunlight and store its energy chemically. Imitating this on large industrial scale, however, is difficult. Photovoltaics convert sunlight to electricity, but at high temperatures, the efficiency of solar cells decreases. Electrical energy can be used to produce hydrogen, which can then be stored - but the energy efficiency of this process is limited. Scientists at TU Wien (Vienna) have now developed a new concept: By combining highly specialised new materials, they have managed to combine high temperature photovoltaics with an electrochemical cell. Ultraviolet light can be directly used to pump oxygen ions through a solid oxide electrolyte. The energy of the UV light is stored chemically. In the future, this method could also be used to split water into hydrogen and oxygen. The researchers explored the possibility of combination of photovoltaics and electrochemical storage. The feasibility of such a system depends crucially on whether it is able to work at high temperatures. "This would allow us to concentrate sunlight with mirrors and build large-scale plants with a high rate of efficiency," says the researcher. Common photovoltaic cells, however, only work well up to 100°C. In a solar concentrator plant, much higher temperatures would be reached. The key to success was an unusual choice of materials. Instead of the ordinary silicon based photovoltaics, special metal oxides -- so-called perovskites -- were used. By combining several different metal oxides, the researchers managed to assemble a cell which combines photovoltaics and electrochemistry. The cell consists of two different parts - a photoelectric part on top and an electrochemical part below. In the upper layer, ultraviolet light creates free charge carriers, just like in a standard solar cell. The electrons in this layer are immediately removed and travel to the bottom layer of the electrochemical cell. Once there, these electrons are used to ionize oxygen to negative oxygen ions, which can then travel through a membrane in the electrochemical part of the cell. "This is the crucial photoelectrochemical step, which we hope will lead to the possibility of splitting water and producing hydrogen," say researchers. In its first evolution step, the cell works as a UV-light driven oxygen pump. It yields an open-current voltage of up to 920 millivolts at a temperature of 400°C. If the electrical power can be increased a slightly, the cell will be able to split water into oxygen and hydrogen. The concept is not only useful for the production of hydrogen, as it could also split carbon dioxide into carbon monoxide. The produced energy carried in the form of hydrogen and carbon monoxide can be used to synthesize fuels.

Source https://www.sciencedaily.com/releases/2016/02/160222091011.htm

10. Converting Atmospheric Carbon Dioxide into Batteries



The Solar Thermal Electrochemical Process (STEP) converts atmospheric carbon dioxide into carbon nanotubes that can be used in advanced batteries.

An interdisciplinary team of scientists has worked out a way to make electric vehicles that are not only carbon neutral, but carbon negative, capable of actually reducing the amount of atmospheric carbon dioxide as they operate. They have done so by demonstrating how the graphite electrodes used in the lithium-ion batteries that power electric automobiles can be replaced with carbon material recovered from the atmosphere. The unusual pairing of carbon dioxide conversion and advanced battery technology is the result of a collaboration between the laboratory of Assistant Professor of Mechanical Engineering Cary Pint at Vanderbilt University and Professor of Chemistry Stuart Licht at George Washington University. The team adapted a solar-powered process that converts carbon dioxide into carbon so that it produces carbon nanotubes and demonstrated that the nanotubes can be incorporated into both lithium-ion batteries like those used in electric vehicles and electronic devices and low-cost sodium-ion batteries under development for large-scale applications, such as the electric grid. "This approach not only produces better batteries but it also establishes a value for carbon dioxide recovered from the atmosphere that is associated with the end-user battery cost unlike most efforts to reuse CO_2 that are aimed at low-valued fuels, like methanol, that cannot justify the cost required to produce them," said the researchers. The project builds upon a solar thermal electrochemical process (STEP) that can create carbon nanofibers from ambient carbon dioxide developed by the group. STEP uses solar energy to provide both the electrical and thermal energy necessary to break down carbon dioxide into carbon and oxygen and to produce carbon nanotubes that are stable, flexible, conductive and stronger than steel. "Our climate change solution is twofold: (1) to transform the greenhouse gas carbon dioxide into valuable products and (2) to provide greenhouse gas emission-free alternatives to today's industrial and transportation fossil fuel processes," said the researchers. "In addition to better batteries other applications for the carbon nanotubes include carbon composites for strong, lightweight construction materials, sports equipment and car, truck and airplane bodies." The researchers showed that the multi-walled carbon nanotubes produced by the process can serve as the positive electrode in both lithium-ion and sodium-ion batteries. In lithium-ion batteries, the nanotubes replace the carbon anode used in commercial batteries. The team demonstrated that the carbon nanotubes gave a small boost to the performance, which was amplified when the battery was charged quickly. In sodium-ion batteries, the researchers found that small defects in the carbon, which can be tuned using STEP, can unlock stable storage performance over 3.5 times above that of sodium-ion batteries with graphite electrodes. Most importantly, both carbon-nanotube batteries were exposed to about 2.5 months of continuous charging and discharging and showed no sign of fatigue. Depending on the specifications, making one of the two electrodes out of carbon nanotubes means that up to 40 percent of a battery could be made out of recycled CO_2, the researchers estimated. Combining batteries with solar cells provides renewable power with zero greenhouse emissions, which is needed to put an end to the current carbon cycle that threatens future global sustainability.

Source https://www.sciencedaily.com/releases/2016/03/160302094000.htm

Engineering Innovation in India

Gandhi Young Technological Innovation (GYTI) 2016 Awards

The Gandhi Young Technological Innovation (GYTI) 2016 Awards were conferred on 13th March 2016 at Rashtrapati Bhavan. Brief details of two award winning projects are given below.

- **X-niff: Microcantilever Based Electronic-nose Platform for Airborne Chemical Vapor Sensing Applications**

Innovator: Gaurav Gupta. **Guide:** Prof. V Ramgopal Rao,
College: Indian Institute of Technology –Bombay

The invention pertains to an electronic nose system for explosive sensing using polymer piezoresistive microcantilever sensors. The engineered system can detect explosive material in the ambient conditions in both swipe based as well as vapour collection technique and can differentiate with non-explosives. Highly sensitive stacked based multi-channel analog instrumentation readout circuit for interfacing sensors is used. Collected responses from the sensor are given to tablet or PC for data processing and pattern recognition. A novel hybrid pattern recognition algorithm is proposed for a better accuracy in explosive sensing and reduced rate of false positives. This invention relates to the multichannel electronic nose system for trace explosive sensing. It relates to a trace detection of explosive material like TNT, PETN, RDX and other derivatives of explosive in presence of external interferents using microcantilever based sensing platform. It also relates to use of pattern recognition algorithms to selectively indentify explosives from non-explosive material.

- **Energy Efficient Combined Process of Microbial Fuel Cell (MFC) And Membrane Bioreactor (MBR) For High Efficiency And Reliable Treatment of Organic Wastewater**

Innovator : Sreemoyee Ghosh Ray, **Guide :** Prof. M. M. Ghangrekar
College : Indian Institute of Technology, Kharagpur

The invention pertains to a combined approach of treating domestic wastewater using Microbial Fuel Cells (MFC) and Membrane Bioreactor (MBR) Technologies as an Energy-efficient, novel and promising process of reliable wastewater treatment. Wastewater Treatment in Single Stage MFC has a limitation to achieve the required treatment efficiency for inland surface water disposal or to utilize the effluent for irrigation without further treatment. Therefore, a two-stage continuous process was developed combining MFC and submerged MBR, with intermittent suction of high quality effluent through ultrafiltration membrane, which could be used for treatment of sewage as well as medium strength industrial wastewater. Submerged hollow-fibre ultrafiltration unit was attached inside the aeration tank and effluent extraction was carried out under constant membrane flux at a regular interval of 10 h with vacuum pressure adjusted at 0.1 bar. Both total and soluble COD removal from aeration tank after the stipulated time period was around 85%. Very high permeate flux was maintained to extract effluent from the aerobic tank through hollow-fibre ultra-filtration membrane followed by frequent membrane back-flushing. Furthermore, the required electrical energy for this combined treatment process at all stages of operation was much lesser than the electrical energy generated in MFC. The study revealed an energy efficient and two-stage process of MFC–submerged MBR technology minimizing the organic matter load in final effluent by more than 98% with complete removal of suspended solids and consequently generating high – quality effluent and bio-electricity in this process.

Source http://gyti.techpedia.in/