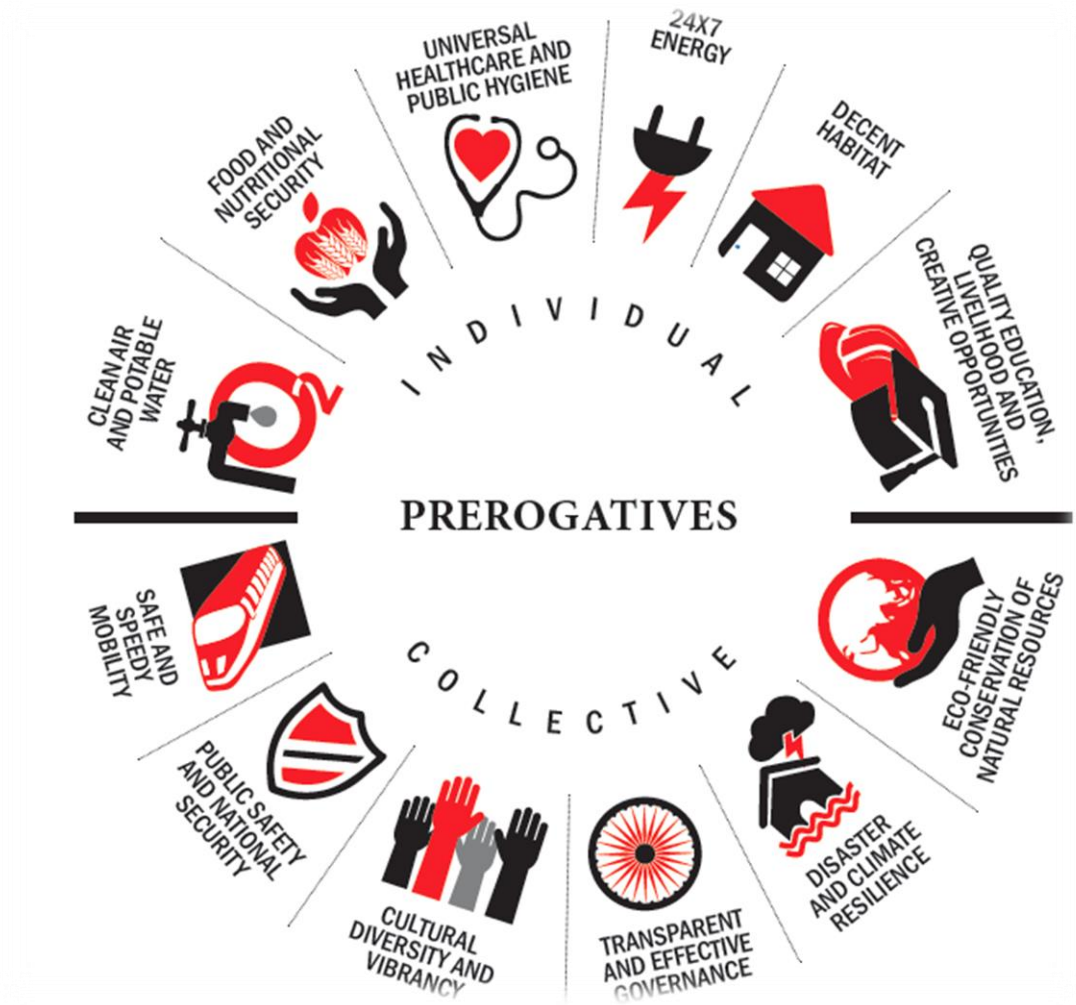
Inputs on Research from Industries & Other Stakeholders

University of Kerala



Internal Quality Assurance Cell (IQAC)

University of Kerala

2016

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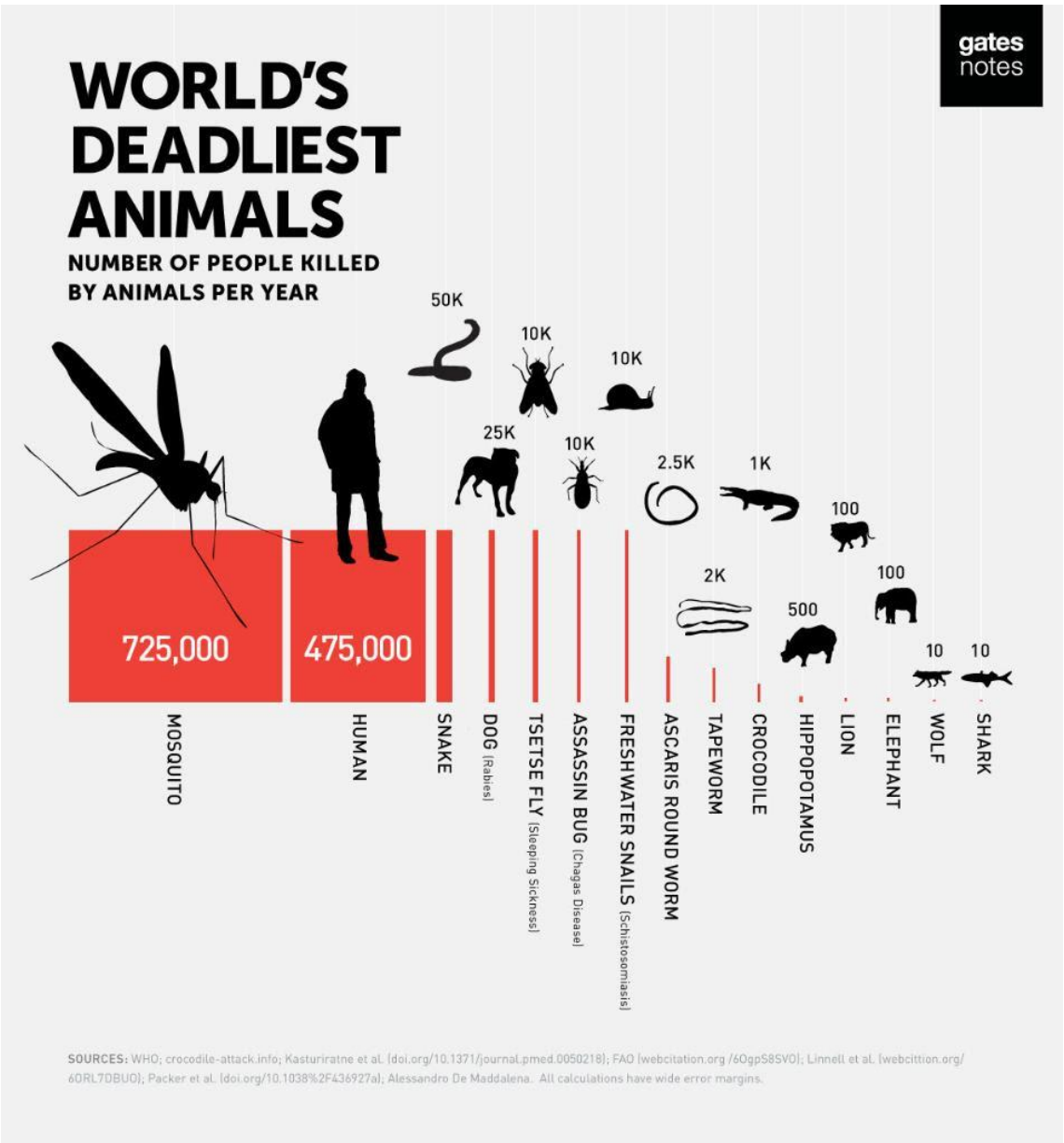

Editor: Dr. Achuthsankar S. Nair, Director, IQAC

IQAC has been collecting inputs from various stake holders on research and this compilation is meant to connect University's research to local realities and needs. IQAC acknowledges extracts from TIFAC Teachnology Vision 2035, and Gates Notes depicted above.

Internal Quality Assurance Cell (IQAC)
University of Kerala 2016

Preface

The University of Kerala has been accelerating its efforts to enhance quality in all spheres. This compilation is an important activity in that direction, aimed at connecting research to real-life problems. The Internal Quality Assurance Cell (IQAC) of the University has taken multiple steps to invite suggestions from all stake holders of the University, from general public, alumni, local and national Industries and organizations through direct communications, media releases and also using social media. Those have now been compiled and edited. It is now being published for the benefit of students & research scholars of our University. Many of the problems highlighted by the proposers are worth first consideration by researchers as their utility is automatic. Kerala Minerals and Metals has, for instance, pin-pointed their problem-that of developing means of using the two lakh metric ton of waste iron oxide and ETP (Effluent Treatment Plant) solid. The TCS Innovation Lab has proposed a collection of exciting technological problems. Many other organizations and individuals have made innovative suggestions regarding synthetic blood to attract mosquitos, coco-pistol to estimate tenderness of coconuts and so on.

I wish that the present compilation will go a long way in tempering the research in University of Kerala and taking it to a higher level.

Vice-Chancellor
Chairman, IQAC

Contents

Science & Technology Stream

DR. FEBI VARGHESE, MANAGING DIRECTOR, THE KERALA MINERALS AND METALS LTD.

Presently KMML is doing research works in the areas including management/utilization of solid waste generated. KMML would like to further pursue these research initiatives in tune with the objectives such as

1. Disposal and value addition of ETP solids,
2. Disposal and value addition of Iron Oxide,
3. Separation and Recovery of Cyclone solids,
4. Utilization Synthetic Rutile fines,
5. Development of new pigment/product development,
6. Plant scale production of nano Titanium Dioxide, Titanium Oxychloride,
7. Process improvements, cost reduction measures,
8. Finding end users of the above by products etc.

The disposal of ETP solid and Iron oxide is a serious issue and already we have above 2 lakhs MT of iron oxide and ETP solid in our secured ponds. Moreover, 50MT of ETP solid and iron oxide are generated per day. KMML is exploring ways and means for disposal of these solids.

For this, in addition to in house R&D research works, collaborative projects are undergoing at various reputed institutions. The major collaborative works are (i) Utilization of ETP solid and Iron oxide in Cement manufacturing: M/s National Council for Cement and Building Materials (ii) Utilization of iron oxide in Secondary steels: M/s National Institute of Secondary Steels Technology (iii) Utilization of iron oxide: M/s National Metallurgical Laboratory (iv) Utilization of ETP solid in concrete bricks: M/z Vellore Institute of Technology (v) Utilization of ETP solid in building materials: M/s T.K. M. College of Engineering.

ROBIN TOMMY, INNOVATION HEAD, TCS INNOVATION CENTRE

Here are some Problem Statements for consideration of Kerala University Researchers:

1. **Understanding the Brain**: What is the normal brain activity of a healthy human being for various situations? The situations are simulations for actual activity and mapping the brain signals for understanding the EEG. These EEG signals are learned for similar situational behavior and finding out the uniqueness using machine learning. The situation needs to cover normal emotional spectrum of human though meter. The thought meter needs to be plotted later and understood for the scenario. The study can be used for understanding criminal behavior, correct action behavior research, etc...: Technology Stream: Neurosensor, Artificial Intelligence and Bigdata.

2. **Crop Growth**: Observing the plant growth and checking the health of a plant is a very important activity today. Research is required to automate and understand the health of a plant by continuous observation of a plant (farm extensively) and finding out the manifestation of plant life.

Problem Statements

Issues found in the plant during its growth including the diseases and insect attack.
(http://www.thegardenhelper.com/troubleshooting.html)

Observe the leaves and predicting the harvest time based on the growth.
Flowering period analysis.
Technology: Image processing, IoT, AI and Bigdata.

3. **Ergonomics Chair Initiative**. Creating a self-assembling chair for taking care of the back posture of humans. The chair should be supporting the lumbar. The chair should be smart enough to inform the user if the posture is not proper and provide the right suggestions. The lumbar support of the chair should be auto adjusted. The system also should have sedentary analysis embedded. **Technology:** Product Design, Embedded Systems, IoT.

4. **Understanding the emotions:** The airline industry would like to understand the emotions of its customers while the flight is getting delayed. The authorities needs to understand change in emotions and provide suggestions to improvise suggestions.

5. Water bed identification-Geography: Identify the ground water reservoir availability in a specific region. The water availability should be predicted for making sure enough amount of water is made available during the dry summer season. There should be mechanisms to predict the usage of water from a geography perspective and predict the total amount of water to made availability on an yearly basis.

6. Electricity consumption: Understand the total electricity consumption and also predict the average consumption required for a particular geographical region. Also the wastage of electricity needs to be understood based on the leakage analysis.

CocoPistol[1]: Tender coconut stalls often have no idea of the tenderness of the coconuts until they cut open and until the buyer tastes, sometimes we get totally un-sweet water, sometimes the tenderness is not there, it is almost mature coconut. Maybe even when they pluck, they are not very clever at identifying the lot which is just ready (or is it that they cheat once in a while). Coco Pistol would be a small hand-held pistol which could be held on the husk and shot, wherein radar like operation in it will find out the ripeness in months and display it as a digit somewhere on the pistol. This could be used before plucking the coconuts, or be provided by the sellers to the customers to choose the nut they want.

DR. M. P. ESWARA SARMA, PRINCIPAL, VAIDYAARATNAM P.S. AYURVEDA COLLEGE, KOTTAKKAL

<u>Improving Research & Innovation through University-Industry Linkage-Suggestions</u>

1. I, Welcome your initiative in this regard and consider this as a matter of extreme importance and value to the society
2. Ayurveda sector has been flourishing in our nation in the educational area since long time. The last century had witnessed similar flourishment in the industrial sector too. Needs and priorities of day-to-day Ayurveda have been re-defined since then. The current trends in

[1] Courtesy: *Compilation of Socially Useful S& T Projects by KSSP, authored by Deepak P and Achuthsankar S Nair, 2008*

the Ayurveda industrial sector needs to be studied in depth and a KAP analysis of major parties involved in the educational sector can be done to identify the gaps in the knowledge.

3. Bio-technology has grown in large in the modern medical sector. But, sadly, the growth of bio-technology has not been incorporated into Ayurveda sector much. This also can be considered as an area of interest.
4. Ethnic groups having long tradition in Ayurveda are in the verge of extinct. WHO had proposed ethnographic designs in researches in this field. University can take up this challenge and conduct and conduct documentation of ethnic practices and aid the traditional sector.
5. Students learning Ayurveda and young practitioners of Ayurveda need to be supported via different orientation programs so as to enable them to take up challenges in managerial, health provider, communicator and researcher roles. University can provide them opportunity By starting short-term courses in the same.
6. Different classes in the employment sector of Ayurveda Industry are in most cases not well-sensitized regarding the basis of Ayurveda and this need not addressed.
7. Tourism industry has been milking different aspects of Ayurveda, but till now a standard operative procedure on Ayurveda practices in tourism has not been developed. Kerala should show the path in this regard by framing proper guidelines.

Understanding and Predicting "Chakara"[2]: Chakara, the unique phenomenon of fishes coming close to the coastline in Kerala has not been well-studied. Currently ocean researchers depend on costly buoys to monitor ocean parameters. Satellite data is available for certain extent, however not suitable for micro level analysis. Often the costly instruments and metal parts are stolen from buoys placed in the ocean. Another way of data collection is through cruises, whose costs are very high and require human presence in the ocean. The unique challenge would be to utilize a neural network or related mechanisms to take these incomplete data and use it to predict Chakara.

DR. P. G. LATHA, DIRECTOR, JAWAHARLAL NEHRU TROPICAL BOTANIC GARDEN AND RESEARCH INSTITUTE

Jawaharlal Nehru Tropical Botanic Garden (JNTBGRI) and Kerala Forest and Research Institute (KFRI) are the two premium research institutes functioning under the Kerala State Council for Science, Technology and Environment (KSCSTE). Both these institutes are mainly engaged in conserving our rich biodiversity and its sustainable utilization in terms of developing new process, products, technology transfer, etc.

The major R&D programmes currently operating in these institutions are

a. Systematic documentation of Traditional Knowledge associated with biodiversity especially plants used for food and medicine.
b. Process/Product development based on conducting preclinical and clinical trials.
c. Patenting, technology transfer, commercialization and benefit sharing.
d. Bioprospecting of plant genetic resources
e. Chemical prospecting of potential plant species

[2] Courtesy: *Compilation of Socially Useful S& T Projects by KSSP, authored by Deepak P and Achuthsankar S Nair, 2008*

f. Biotechnology based R&D programmes
g. Development of bioinformatics and database packages
h. Studies of population structure and gene flow system of endemic plants, reproductive Biology of RET species
i. Forestry science by standardization of propagation techniques, evolving bio-control of pests and pathogens, productivity improvement, plantation technology etc.
j. Species recovery programmes
k. Bamboo and Rattan research
l. Forestry science by standardization of propagation techniques, evolving bio-control of pests and pathogens, productivity improvement, plantation technology etc.
m. Phylogenetic, evolutionary and bio geographic studies including molecular aspects of microbes, mushrooms and flowering plants.
n. Studies related to conservation biology
o. Research on Orchid biology
p. Tissue culture and mass multiplication techniques

It also suggested that University may conduct a workshop involving the representatives from various research organizations/ industries with a view to develop a road map on the subject to work out the future action plan.

D. MANMOHAN SHENOY, GENERAL SECRETARY, KMPA, KERALA MASTER PRINTERS ASSOCIATION

Kerala Master Printers Association(KMPA) is an affiliate of All India Federation of Master Printers(AIFMP)- an official body of Print businesses in India from 1953 onwards. KMPA has been working for the welfare of printers in the state and the development of printing industry in Kerala since its formation 46 years ago.

Printing as a trade started as an art, progressed significantly by applying science and technology to it and now became a confluence of creativity, technology and science. Science and technology play a major role in successful printing, without proper understanding and efficient use of the scientific methods, print cannot be any better. As you might be aware, the basic premise of offset printing is a simple scientific principle that 'Oil and water will not mix together'. Starting from this, science is applied all along the print process and as an association of printers KMPA strongly believe that contribution from scientific community is essential for us to deliver consistent and improved print quality.

In the light of above facts and understanding, KMPA would like to know if Kerala University with its abundant source of scientific resources can help resolve some of the challenges we face. We are willing to collaborate and work actively with Kerala University in identifying, developing and implementing revolutionary solutions which can be path breaking in the industry point of view and can help to raise the standard of print industry as a whole. We can take active effort in piloting such

innovations through the vast network of our member printers, many of them have invested in leading technology solutions.

K.G. SREEKUMAR, CHIEF EXECUTIVE OFFICER, STATE MEDICAL PLANTS BOARD, KERALA

Before I put forth my suggestions, I wish to inform that I totally agree with the point that the University research programmes are by and large a process of research training. Degrees are produced for degree sake with little social relevance, over duplication and spoon feeding. How many these that are produced with original thinking and innovative ideas? Less than 10%. Hence I Suggest the following points for improving the research scenario particularly on the subject mentioned above.

1. 6 months research training for PhD candidates before initiation of work. During this period the basic facts of research and Objectives of the work to be made clear. Along with this training in project preparations, Scientific administration, mock presentations etc to to strengthen the capacity of the candidates.
2. Relevant topics required by the society in the Regional, National and International levels to be selected for research work.
3. As part of University-Industry interaction, topics of interest to be selected, funded by industries which may be short term or long term.
4. Incentives to researchers if the Projects executed are a success.
5. As done in IT industries, as part of human resource development enrollment of right research candidates in industry to be looked into after making and MOU with concerned industries. This will definitely boost the morale of young researchers which is presently the main lacuna in the research field where dynamic interesting researchers quit the research field in need of proper positions.
6. Initiation of team work among researchers for successful handling of mega projects.

I hope that these suggestions if implemented will definitely make a revolutionary change in the area of research particularly in University- Industry linkage. The State Medicinal Plants Board, Kerala is already working in this line in the implementation of its various projects.

THE DIRECTOR, KERALA STATE SCIENCE AND TECHNOLOGY MUSEUM & PRIYADARSINI PLANETARIUM

KSSTM is happy to give suggestion regarding the improvement of research and innovation through University. In this regard some technical problems/suggestions are furnished as below for including the same in the research topics of the research scholars and P.G. students of University. The concerned Research Scholars, PG Students or Professors are welcome to our institutions for further discussing in the above regard.

1. A simple software/ mechanism for projection on spherical screens.
2. Perfect merging of projection of images from multiple projectors simultaneously without over brightness & with perfect edge blending
3. Paint/chemicals which exhibit phosphorescence on coating over a surface.
4. Developing polarized screen for viewing 3D images using polarization techniques.

MADAN THANGAVELU (ALUMNUS OF UOK), UNIVERSITY OF CAMBRIDGE, UK

University of Kerala: Consolidating Seven Decades of Research & Enhancing, Diversifying and Charting the Future: Greetings from Cambridge and from Bell, Eifel, Germany, home of the European Ayurveda Association (www.euroayurveda.eu/)**.** Very happy to be reconnecting and also to be asked to share thoughts and views on research directions for scholars at the University of Kerala. The searchable compilation of PhDs awarded (http://research.keralauniversity.ac.in /viewphd Awardees.php) also I found invaluable. I have particularly enjoyed using the Research Portal and reviewing details of Ph.D. awarded by the Faculties of Applied Sciences & Technology (Biotechnology, Environmental Sciences), Medicine (Medicine, Nursing, and Pharmaceutical Sciences), Applied Sciences & Technology (Biotechnology, Computational Biology & Bioinformatics, Environmental Sciences, and Microbiology), and Science (Aquatic Biology & Fisheries, Biochemistry, Botany, Zoology and other subjects).

Despite the many constrains on how to enable world-class research with limited budgets and resources, I feel one can still engage and generate world class research results. Perhaps the first question to enable this would surely be "How to encourage both students and staff / research guides to identify with, add to and refine the seven decades of history of research, to develop critical skills and also identify areas that link the ancient with the modern / future and areas that are particular relevant locally." As an example, starting with one of the early PhD thesis, "Studies on Indigenous Drugs." (submitted 22/06/1954) one finds easily a path to the much needed issue of developing research questions.

The highest priority in this direction should be find ways to explore further the theme of "Developing a Research Style that resonates and leverages the local opportunities, needs and strengths but with a Global Vision". In terms of local problems, for instance, how to enable cross-disciplinary and transdisciplinary interests - for instance a continuation of the work "Rhizosphere Microflora of Coconut Palms with Special Reference to Root (Wilt) Disease." (V. Padmanabhan Potty 16/05/1978) and linking this with contemporary research on rhizosphere microbiome. The Microbiome is a fantastically rich area of study, as you well appreciate, and touches bioinformatics and skills which are also relevant for human and animal health and also health of the environment. Innumerable aspects, perhaps even general principles could be appreciated by studying local opportunities. The virgin lands of the Western Ghats offer excellent resource for exploring this area.

The One Health Agenda, in which such questions come to play, is starting to be appreciated more and more (*www.**onehealth**initiative.com/, https://en.wikipedia.org/wiki/**One_Health***). Food, Exercise-Fitness and Health are all the interlinked major themes - pointing also to the important and related concepts of *ama,* described well in Ayurevda, and the gut-brain axis in etiology and pathology of chronic non-communicable diseases as described in Ayurveda and the modern and very fast growing area of microbial metagenomics. Communication styles and systems we could not image even five years ago are already reshaping the world with each passing day. The speed and rapidity of such change will only increase. For instance, Lee Hartwell, Nobel Laureate Addresses the Convocation Gathering at Amrita University

https://www.amrita.edu/news/nobel-laureate-addresses-convocation-gathering/

Lee Hartwell 2009 Amrita University Convocation Speech, part 1
https://www.youtube.com/watch?v=4g-Usmkn1ns
Lee Hartwell 2009 Amrita University Convocation Speech, part 2
https://www.youtube.com/watch?v=5q40bUcF5S8
Lee presents well the links between environment and health.

"Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity" One of Kerala's unique strengths is its high population density. Trivandrum District, for instance has a density of almost 1,500 per square kilometer. Such local opportunities give rise to local needs and in turn excellent research directions, for instance in human health. One theme could well be: **"Molecular and Cellular Measurements of Health and Disease"** - alluded to by Lee.

Hartwell in his address (part 1 at 6:43 and onwards). Information that can be generated here will be of use to many research projects in India and around the world. Skills available in locations like RGCB and other institutes can be easily drawn to helps large programmes of work. To capitalize on Kerala's strength and tradition of Ayurveda, for instance, how might one connect with rich concepts like the ones described in the Samhitas and played out in applications like the one for treatment of hyperlipidemia as in this document?
Snigdha and *Ruksa Guna* with special reference to *Rasa-raktagata Sneha* (hyperlipidemia)
http://www.ayujournal.org/article.asp?issn=0974-8520;year=2011;volume=32;issue=2;spage=200;epage=206;aulast=Mishra

*T*he abstract of one of the presentations later this year at the Ayurveda Congress in Koblenz offers even more possibilities: *Traditional Knowledge Innovation-Kerala (TKI-K) & Ayurveda for Diabetes: Standardising the preparation, toxicity studies and efficacy of an ancient 22-ingredient kashayam formulation detailed in Keraleeya Oushadha Vijnana.* The **Traditional Knowledge Innovation-Kerala (TKI-K)** alluded to here points one to Kerala University's rich manuscript collection awaits deeper and fuller study and also how to maintain and grow locally the Sanskrit skills and strengths.

Manuscripts like the ones from Pandalam Palace, alluded to in the abstract, makes one ask how to capitalize on Trivandrum Sanskrit Series_(TSS) by Trivandrum University Manuscripts Library (https://archive.org/details/Trivandrum_Sanskrit_Series_TSS) and its strengths and to connect with other Kerala initiatives like or connecting with Kerala Innovation Initiative. Or the Vedic Knowledge with links to the four Madhom's in Vadakkunnathan Temple , Thrissur Vadake Madhhom in Thrissur. These kinds of strengths offers opportunities for forging academic links with other universities in India - particularly ones like Jamnagar (Gujarat Ayurveda University) and Banaras Hindu University in areas like Sanskrit and Samhitas and contemporization of ancient knowledge.

The opportunities are many, and if there is one state in India that can enable all this then it surely must be Kerala and in Kerala the University of Kerala has a special role. There are innumerable other such possibilities that can be visualized that will not only turn into exciting projects of immediate relevance but also reinstall in scholars a sense of pride for the local traditions and also in turn the energy and enthusiasm to kindle such a passion in the students that will teach. Kerala has much to offer not just India but all of Mankind across the World.

I am delighted to be asked to do this exercise. I am happy to continue this dialogue and to details possible projects and opportunities for connecting with universities across India and around the Globe.

G. SREENIVASAN, KSEB, THIRUVANANTHAPURAM

Earthing: 1.Enhancing earthing properties of substation premises in KSEB using locally available materials. The earth resistance of substation should be as low as possible, preferably 0.5-1 ohm. Due to lack of sufficient land and geological peculiarity [filled land and poor conductivity], this value is seldom achieved paving way for multiple issues viz. safety, equipment failure etc.

Generation: 2. A case study with respect to the sudden damage of Arial Bunched Cable [ABC] installed at Chimney SHEP in Thrissur District. The Arial Bunched Cable in Kerala System is not capable of withstanding Short Circuit Current. The present design [eccentricity of core, size of messenger wire] causes frequent burning of carrier/messenger etc.. This has resulted into huge loss to exchequer-.

3. Evaluation of commercial worthiness of SHP in Kerala. SHPs do not follow merit order depatch system where the costly machine has to be switched off when cheap power is available. If SHP is awarded to Independent Power Producer [IPP], the commercial impact on KSEB would be high. A solution is yet to arrive.

4. Mitigation of challenges in Renewable Energy [RE] integration-A model to finalize the requirement of spinning reserve. The implementation of Solar Power is gaining momentum and moving in uncontrollable way. Govt. of India has envisaged addition of 175GW by 2022.Also, various regulations have come up compelling utilities to incorporate 8% of their consumption from RE as Renewable Power Obligation[RPO]. Technical issues of RE integration is a challenge for utility as no reactive power is supplied to grid- Engineering solution is very much required with respect to requirement of spinning reserve.

5. Electricity generation from municipal waste- Development of appropriate model for Kerala Scenario. Electricity from waste has not been developed adequately in Kerala due to high Humidity and unsegregated waste., thereby efficiency of process becoming less. Segregation of waste and processing has been flourishing in Europe – Many models adopted here have become a failure. Development of appropriate model for Kerala Scenario in the context of high volume of food waste among South Indians.

POWER THEFT: 6.A solution to power theft caused by Electrostatic Devices [ESD]
The energy meters are designed based on IS and CBIP Standards. One of the high- tech power thefts is by applying electrostatic voltages to meter, making it temporarily/ permanently out of order and leaving no physical evidence. Researchers have come out with Sensors having high immunity to ESD and communicate to data centre on which utility can act upon later. But R&D should develop to design meters which can act as deterrent to ESD itself. A Solution is yet to be developed globally.

This is very important as 1% of GDP in India is lost by way of power theft.

7. Correlation of over reacting high responsive community in Kerala and Power theft – Establishing a relationship. It has been observed that high responsive communities indulge more in committing crimes.

8. Power Theft- Establishing relationship between the undue benefit enjoyed by industrialist [Ice Manufactures of Kerala] and Power Theft, through unfair industrial competition and its Social impact. Electricity is the main "Raw Material" for Ice plants. They resort to power theft to get competitive prize for Product. The effort of Govt. of Kerala and KSEB for DSM activities has failed since only 5 % companies followed Energy Conservation & DSM activity, though payback period is just 1month. There were 1400 ice manufacturers in Kerala, now reduced to 500, remain competitive in field mainly through their flair to circumvent any action by authorities against this silent crime.

9. Power Theft- Social Stigma of Consumers trapped by organized Power Theft Performers-A study

Power Theft is a criminal activity invites up to 5 years imprisonment. Organized criminals professionally undertake power theft causing lifelong Social Stigma to consumers who are otherwise honest and unaware of the severity of the issue. The law is very strict as theft need not be caught red handed and performer escapes and consumer got punished as benefit of doubt is towards prosecution in this case.

10. Power Theft -A Study on the detection Vs Conviction of Power Theft cases – Issues associated in the prosecution problems in Kerala.

11. Power Theft -Media avoidance of Power theft related stories of corporate business establishments. A study to expose the unholy nexus between two corporate.

12. Techno-economical impact of domestic inverters in Kerala. A continuous load of 50-150 watts per inverter is thrust on the system –It is estimated that 10 Lakh inverters are functioning in Kerala, of which majority are unbranded causing threat to power quality and commercial viability-A cost effective model is required.

13.A study on mitigation measures for the harmonic pollution by solar inverters

Solar Inverters are sources of both Harmonic Voltages and Harmonic current creating severe impact in System. This is absent in foreign countries where solar integration is in HT and usually would be with two grid, based on priority. A study and mitigation measures for the harmonic pollution by solar inverters would be beneficial as more and more solar schemes are in the offing.,

14. LED Lights and Cornea Damage – Is there any relationship? KSEB is on the process of distributing 1.5 Crores LED bulbs throughout Kerala as a part of domestic efficient lighting program [DELP] of Govt. of India. Also, retrofitting of street lights with energy efficient LED lights are in progress at few area on trial basis. Answer to '*LED Lights and Cornea Damage – Is there any relationship*?' will help a lot for the manufacturers also to alter design parameters and to society at large.

15. Harmonic injection of LED in Kerala system –An impact study and mitigation measures. LED is

considered as a panacea for all lighting problems now a days. LED Driving Circuit, Retrofitted LED etc are having heavy harmonic injection -On Long Run it will affect Distribution Transformer, core heating, neutral current to increase etc. –An effective solution is required

Safety: 16. Is Extreme trade union activism the major contributing factor that causes accidents in KSEB Ltd.? The **fatal** electricity accident rate of KSEB Ltd **per month** is as follows. Staff-1, Contract workers -2, Public - from KSEB installations-3. A preliminary study on this for 18 month statistics shows that carelessness, over confidence, confidence of being protected etc are the reasons behind this. Usually the enquiry of accidents will take years together to complete and often the guilty comes out with minimum punishment.

17 A nature friendly disposing model for 1.5 crores CFL in Kerala. KSEB has distributed 1.5 Crores [not the exact number] CFL in domestic sector about 6-8 years back. This program has been rated as one of the best in demand side management [DSM] in India. A survey recently conducted by this office revealed CFL density of 6 numbers per house. How to dispose is a challenge for utilities and state.

SABARINATH, MIT (Alumni of University of Kerala)

I wish to bring to the note of researchers in University of Kerala the MIT Initiative – Innovating for Billions: This is a phenomenal program started by a Media Lab professor Ramesh Raskar. I really love his quote, "The World is our Lab". The idea is to bring collaborative teams from around the world to innovate and define solutions that would help Billions of people. Naturally, they have multiple collaborators in India. The program is called Emerging Worlds, you can read more about it here. http://www.redx.io/emerging- worlds-1/ #emerging-worlds Please review two attached documents. Through this program, I met this Kid, a 10th grader from Nasik, who taught himself Hadoop and other programming languages, and came up with a solution for crowd counting, controlling and managing using existing cellphone infrastructure. This was piloted during last Kumb Mela I was quiet impressed by this kid. I am sure, in 10 years we will hear about him a lot.

I strongly believe, if our research scholars and faculty truly understand this philosophy, we can identify problems in our society that needs solutions affecting large number of lives. Many a times, success of research or innovation lies in collaboration and not working in a silo. Identify and forge right partnerships, its actually easier than we think. When we talk about research, it does not have to be inventing something new, does not have to be hard core scientific. It could be a solution using the tools that is available.

One of my pet peeves about our city and state is that none of the modernizations are done based on any planning or after analyzing data at hand. May be I am totally wrong. One of the examples is traffic control in the city. Do we have any mechanism to capture and analyze traffic data from different roads in the city. If we collect data, number of vehicles using a particular street at different times during the day, weekday weekends etc, couldn't we develop some smart algorithms to control traffic flow? Maybe make certain streets one-way during certain times of the day, increase number of lines in one direction during certain times etc. Anytime these types of

discussion comes up we are quick to point out that this will happen only in places like US where you have wide highways and great roads. Actually not true, doing such research will at least provide us with enough data to corroborate our arguments, one way or another.

I would like to propose a social research on why we as Indians have trouble being a model citizens in our own land but would be a perfect citizen in any other land. Is this due to lack of instilling values in early childhood, what can be done? At least identify the problem. I am talking about seemingly simple issues like, standing in line, being courteous to the person next to you. Simply smiling at a stranger when you make eye contact. I am not talking about rules or punishments, in other countries rules and punishments are needed only for a very small minority, majority of its citizens grow up to be descent humans, both within their families and as citizens at large. Sabarinath, MIT

DR. P.C. DIWAKAR, SCIENTIFIC SECRETARY, INDIAN SPACE RESEARCH ORGANIZATION, BANGALORE

ISRO has closer interactions with the academic institutions including your esteemed University in many ways, in pursuing research areas of mutual interests as well towards indigenous capacity building in the country. I would like to highlight a few of them below.

(i) ISRO has an ongoing programme of sponsoring research in academics in India, namely RESPOND. The main objective of RESPOND is to encourage quality research in the areas of relevance to the Indian Space programme. Many Universities, including your University, have joined hands with ISRO in this Programme which is of mutual benefit. You may like to visit the URL for further details of the Programme and type of ongoing cooperation with the academia: www.isro.gov.in/sponsored-research-respond

Particularly to get an idea of areas or research proposals of interest to ISRO, you may like to see the Sponsored Areas of Research wherein a consolidated list of more than 500 projects undertaken from 2000 to 2016 are listed (www.isro.gov.in/sponsored- research- respond/ supported-areas-of-research). It should provide the wide variety of areas of interests pursued by ISRO.

(ii) ISRO/DOS has also a programme of supporting Planetary Sciences and Exploration Programme (PLANEX) administered through Physical Research Laboratory, Ahmedabad. The PLANEX programme has evinced keen interests from among the student community about research and development in Planetary Sciences and allied areas, including development of payloads for future space missions. PLANEX has also established a National Facility at PRL for analysis of astromaterials and research, which are open to the interested students. You may like to see further details in the URL below: https://www.pri.res.in You may like to see particularly the periodic Newsletters brought out by PLANEX to get an idea about latest: research and technological activities undertaken in Planetary Sciences to motivate the researchers.
http://www.prl.res.in/~rajiv/planexnews/index.php

I am sure, the information provided in the above websites will provide you an idea of various ongoing and the planned research activities, that are of interest to ISRO, and enable your esteemed University to take up some of the topics for research and innovation.

DR. KAMALAKSHAN KOKKAL, KSCTSE

University Research scholars should see the children science congress projects. These projects are having societal applications. Univ. Research scholars should take up such projects with greater dimension on science and technology involvement on societal needs and progress. Sent from my ASUS.

DR. T. K. ALEX, HON DISTINGUISHED PROFESSOR, ISRO , BANGALORE
(Former Student from TKM College of Engineering, Kerala University : 1964-69)

As far as ISRO is concerned, there is a need for Academic Interaction to achieve the National goals. ISRO has published its areas of interest in different fields like Launch vehicle technology, Satellite Technology and Application of Space for Societal applications. ISRO has brought out these requirements in a document, which can be obtained from the office of Scientific Secretary, DOS, Bengalore 560231. All research work need not be for immediate application. Some of them could be for understanding the fundamentals of any subject (science or engineering). It may have application, may be in the future. Wishing you all the best for this effort of interaction with all stake holders.

MAHESH KUMAR .R, VAYALARIKOM, ATTINGAL
കേരളത്തിൽ ഇന്ന് കോഴി മാലിന്യങ്ങൾ കൊ□ ് പൊതുനിരത്തുകളിൽപോലും സഞ്ചരിക്കാൻ കഴിയാത്ത അവസ്ഥയാണ്. പൗൾട്രി ഫാമുകൾക്ക് ലൈസൻസ് കൊടുക്കാൻ ആരോഗ്യ വകുപ്പിൻ കീഴിലോ മലിനീകരണനിയന്ത്രണ ബോർഡിലോ ഒരു എഴുതപ്പെട്ട നിയമ വ്യവസ്ഥകളും ഇല്ല. കക്ഷികളുമായുള്ള സ്വാർത്ഥതാത്പര്യങ്ങൾക്ക് വിധേയമായും പ്രലോഭനങ്ങളും സാമ്പത്തികലാഭങ്ങളും മാത്രം മാനദണ്ഡമാക്കിയുമാണ് ഈ പ്രക്രീയ നടക്കുന്നത്. ഈ വിവരങ്ങൾ ഇവിടെ ആരുടേയും ശ്രദ്ധയിൽപ്പെടതെ കാലങ്ങളായി നടന്നുവരികയാണ്. ഈ വിഷയം പഠനവിധേയമാക്കണമെന്നും സർക്കാരിന് ഇതിന്റെ തീവ്രത ബോദ്ധ്യപ്പെടുത്തണമെന്നും ആവശ്യപ്പെടുന്നു. വ്യകതമായ ദൂരപരിധി, ജനവാസമേഖലയിൽ പാലിക്കപ്പെടേ□ മാനദണ്ഡങ്ങൾ ഈ വിഷയങ്ങളിലുള്ള വ്യക്തമായ രൂപരേഖക്ക് ഈ വിഷയം പഠനവിധേയമാക്കണമെന്ന് അപേക്ഷിക്കുന്നു.

DR. BABOO M. NAIR, PROFESSOR EMERITUS, APPLIED NUTRITION, FOOD HEALTH SCIENCE CENTRE, LUND UNIVERSITY, SWEDEN

Most important advice I can give to the researchers of Kerala is to do research on the utilisation of organic and inorganic raw materials of Kerala to produce highly value added finished products for the global market. Not simple products and not for the domestic market!

A. SHAJAHAN IAS, EXECUTIVE DIRECTOR, KUDUMBASREE

Kudumbasree Mission is a Government of Kerala Initiate launched in 1998 to wipe out absolute poverty from the state through concerted community action under the leadership of Local Self Governments. Kudumbasree is today one of the largest women-empowering projects in the country and has been instrumental in assisting many women owned micro enterprise units as part of its livelihood interventions. We extend our thanks and appreciation to you for showing interest in our organization.

Kudumbasree is promoting microenterprises for livelihood of poor women. Wide variety of microenterprises are promoted by Kudumbasree right from canteen and catering, IT, Taxi service,

Infant supplementary feed, Apparel Sector, Agri and Animal Husbandry related enterprises many being upgraded to Producer Companies for economic empowerment of Women. But still we have identified some gaps in Marketing, Quality aspects, Technology updation aspects, HR Development aspects, Legal aspects etc. in Enterprises. Profitability and sustainability of the Enterprises is still a gap which affects our enterprises. We think that the Faculty of Legal and Management studies can assist us in certain areas. Also the Department of Home Science, Food and Nutrition can assist in developing the quality and shelf life of the products manufactured by Kudubasree Enterprises. Similarly the University can assist us in developing v arious projects related to women empowerment especially gender studies. Also we have certain programs/projects like Ashraya)Destitute Identification and Rehabilitation Project), BUDS, Tribal and Coastal etc. for social empowerment and assistance of the poor and downtrodden. Students can do project studies in our Organization. Also Research scholars can study specific topics in any of our initiatives. Hence we would like to have a discussion with University of Kerala to workout strategies for Mutual collaboration and Partnership in various Projects including the scope of consultancy services. Kindly make it convenient to have a discussion on all the above possibilities on a mutually convenient date and place.

EXTRACTS FROM 10 BREAKTHROUGH TECHNOLOGIES 2016 by JESSICA SVENDSEN

- Same Areas to explore
  - Genetically engineered immune cells for treat cancer
  - Human powered house hold devices (light, fan etc.)
  - Bio sensors

MISCALLANEOUS

Building Material (Via Social Media): Can we embed sealed plastic/aluminium cases filled with water in buildings? Can that make the rooms cooler during summer? Can waste plastic bottles be used for the purpose?

Frugal Innovation (Via Social Media): University needs to think of simple and common-sensical solutions to problems rather than highly complicated and technological solutions. Researcher should not get corrupted by technology.

Toy Microscopes: Can we recycle used web-cams or mobile cameras in reverse to build toy microscopes for schools (Dr. R. Dileep Kumar, Post Doc Fellow, University of Kerala).

Humanities, Arts & Social Science Stream

EXECUTIVE DIRECTOR, KERALA INSTITUTE OF LABOUR AND EMPLOYMENT(KILE)

KILE is an autonomous body, constituted by the Govt. of Kerala in 1978 for the purpose of training and research on labour, employment and allied subjects. Our emphasis is more on applied-Problem –solving type of studies with diagnostic perspectives and not on the academic type of studies guided by hypotheses and sophisticated statistical techniques. Our focus is on discovering the cause-effect relationships of the chronic problems in managing labour. Industrial relations, labour laws, labour welfare, adjudication, trade union movements- both in the industrial and the agrarian sectors, work-related problems of labour in the unorganized sector, migrant workers and the like. The other focus of the studies is the employment – unemployment sector, problems and prospects of self-employment in the Kerala context and the impact of various schemes for promoting employment. A list of major studies undertaken by us is attached here with. Some of the earlier studies have become out of date. There is need for projects on these subjects for updating the earlier findings, conclusions and solutions.

KILE has just completed a study on the "Current Status of the Coir Industry in Kerala". It was a diagnostic type of study mainly to understand the under-currents responsible for the decline of the industry. Similar studies could be undertaken on the traditional industries of Kerala such as cashew, handloom, handicrafts, plantations, bricks and tiles, match industry etc. The state governments and the State Planning Boards seek such diagnostic studies for developing schemes.
For promoting and supervising research-type of studies, KILE has set up a Core Committee consisting of experts on research methodology and have adequate budget allocations. Only Ph.D holders are eligible to submit proposals.

University Departments can take up inter-disciplinary type of studies related to various aspects of industry such as:

1. The persisting problem of industrial sickness in public sector undertakings in Kerala.
2. An assessment of work culture and work ethics among Kerala labour in terms of labour productivity.
3. The nagging problem of loading and unloading/nokku coolie in Kerala and its impact on industrial development.
4. Persistent opposition against productivity-linked wage agreements (and not time-based wage agreements which is the practice today in industries)
5. An assessment of the status of "ease of doing business" in Kerala

DR. K. AMBADY, MANAGING DIRECTOR, KERALA STATE COASTAL AREA DEVELOPMENT CORPORATION LIMITED

KSCADC is a fully owned Sate government Company for integrating the developmental activities of coastal areas. KSCADC is presently undertaken projects in coastal infrastructure developments, fisheries infrastructure development, Technology acquisition, Commercial Operation and Consultancy. With reference to the above letter, I am forwarding following suggestions which will help to create a better university industry linkage.

1. SWOT studies on fisher folk on social side.

2. Department of Aquatic Science and Fisheries can undertake realistic studies to augment the production of aquatic vegetation as well as animals.
3. Studies on market research, market analysis and marketing strategies for promotion of innovative fish and fishery products.
4. Conduct studies on types of fish aggregating devices that are most suitable along the Kerala coastal waters. Also studies on pre and post installation fishery resources available and the linked economic scenario.
5. Conduct studies on problems/factors affecting school drop outs of fishermen children and propose remedial measures to minimise such drop out and to handhold them back to mainstream education.
6. Conduct studies to minimise the cost of fishing and thus to improve catch per unit effort.

DR. RAJASHREE AJITH, DIRECTOR, KERALA INSTITUTE OF TOURISM & TRAVEL STUDIES

I suggest following research topics in tourism:

1. Product development in tourism giving focus to social and environmental settings of Kerala.
2. Developing value added products to core tourism products such as beaches, backwaters, hill stations Ayurveda giving focus to local specificity
3. Exploring niche products and niche markets in tourism
4. Facilitating accessible tourism in museums and heritage sites
5. Developing strategies for enhancing occupancy ration in accommodation sector
6. Developing Crisis Management System for properties in tourism destination
7. Developing customized software for property management system in Tourism
8. Use of IT in facilitating tour guiding
9. IT as a facilitator for interpreting museums, heritage monuments and historical sites
10. Economic linkages of Tourism in Kerala
11. Branding ethnic products for ensuring quality
12. Developing destination specific souvenirs

DR. SYED IBRAHIM, DIRECTOR, GOETHE CENTRUM, TRIVANDRUM

1. The history of Chala Bazaar and its socio-economic role today.
2. The architectural and social relevance of Agraharams in Trivandrum
3. IT Revolution and the Emergence of Technology Parks in Kerala. With a Special Reference to the socio-cultural Impacts
4. A Study of the Political Landscape on Kerala and exploring the causes of political violence in certain areas

E. R. JAYADEEP P.K, LEAD QMS AUDITOR, IRCA

Need Based Educational System of Social Significance: During my professional days as a sales engineer in early seventies, I have been travelling far and wide in India and abroad. I had opportunities to closely interact with people of various strata from porter and tea boy to managing

directors and chairmen of large scale public and private establishments. In fact, I was more impressed by the common sense and skill of people at lower stratum in comparison with the rest.

I have many classic examples on this and a few are enumerated. A tea boy in an Iranian restaurant in Pune, who was from Assam, had all the knowledge on the types of teas available all over the world and their tastes, which was comparable with the knowledge of any expert tea taster. After many years I found him still in the same restaurant. He got stuck where he is! Once I suffered from a severe and unbearable stomach ache late night while staying in a hotel in Allahabad. I called up for help from room boy to take me to any nearby clinic. He asked me, what I ate for dinner and I mentioned that I had taken fresh water fish fry. He told me to wait for a few minutes and he went to his house nearby and brought some fresh leaves which he told me to chew, which I did hesitantly. To my surprise, the pain had totally vanished in a few moments. loved to eat mangoes cultivated by Adivasis in a plantation of five thousand acres of forest land in Karim Nagar district of Andhra Pradesh. It was an unnamed variety and never again in my life had tasted such delicious mangoes. This was a project initiated by Nizam of Hyderabad that was abandoned. The concept of hidden talents of slum dwellers was projected by the author Vikas Swarup which was the theme for the famous Oscar Award winning movie "Slum dog millionaire".
Like a diamond can be cut from ordinary carbon, potential to perform is there all over. What defines is to identify, package and transform.

The "3 M's" product of stickers that stick but do not stick well is an applied knowledge on a spark of an innovative IDEA. We need to open our minds to see such a potential to build and name it to Global Standards. Start-Up is a phenomenon arising of the concept. Some of the world's best performers today are not through conventional educational system. But their stories provide abundance of scope, to tap such talent and knowledge. Sourcing from scrap is where the seed grows.

CHALLENGES:
Challenges involved in addressing this social issue are:
1. Focus on identification and training
2. Reforms in educational system to accommodate deprived members of Society
3. Tailor made rather than custom built but based on research and development
4. A Global Approach without colour, creed, language or economical status but for those with potential to grow
5. To sustain the approach build infrastructure and processes with trained psychologists and systems
6. Governing from an angle of achievable targets

Study on Suicide and its lessor incidence in certain communities: I have a hunch that there is lesser suicide among Catholic Community in Kerala. After verifying this, if found trues, can we learn anything from their upbringing that other communities can adapt?: **Anonymous**

Civic Sense: Investigate effective ways of instilling civic sense at school level may be researched into: Anonymous Citizen.

SABARINATH, MIT (Alumni of University of Kerala)
I would like to propose a social research on why we as Indians have trouble being a model citizens in our own land but would be a perfect citizen in any other land. Is this due to lack of instilling values in early childhood, what can be done? At least identify the problem. I am talking about seemingly simple issues like, standing in line, being courteous to the person next to you. Simply smiling at a stranger when you make eye contact. I am not talking about rules or punishments, in other countries rules and punishments are needed only for a very small minority, majority of its citizens grow up to be descent humans, both within their families and as citizens at large. Sabarinath, MIT

DR. SABU PADMADAS, Southampton University (Alumni of University of Kerala)

Research for sustainable societies: The following notes highlight some of the critical research challenges that our societies face. This list is by no means exhaustive but offers some ideas for undertaking research for promoting sustainable societies and human wellbeing, potentially applicable in Kerala and elsewhere.

1. Gender equality and equity in social and economic development
2. Fostering innovation for affordable technology and resilient infrastructure
3. Potential for a diversified economy for sustainable growth
4. Population and social impact of regional and sub-regional flows of migration and concentration of economic migrants in cities
5. Delivering affordable preventive and curative health care to marginalised and vulnerable populations
6. Improving the quality of higher education and human capital
7. Behavioural and psychological disorders and risk factors at family, work and community
8. Innovative technology for tackling crime and civil unrest
9. Public security and safety against terrorism and communal violence
10. Low-cost and clean energy for sustainable environment
11. Public health solutions for tackling emerging and re-emerging infections and antimicrobial resistance
12. Political accountability for safer and sustainable societies
13. Early interventions for long-term and sustainable health
14. Social reintegration and economic wellbeing of return migrants
15. Social integration of short- and long-term skilled and unskilled migrants
16. Catastrophic health expenditure and economic impact of non-communicable diseases
17. Eco-friendly housing and sustainable development in high dense areas
18. Multiple adaption strategies to mitigate climate change risks and changes in physical environment
19. Measuring happiness and wellbeing across individual life course
20. Quality of life and economic wellbeing in post-retirement life
21. Effective use of social media for emergency and non-emergency health care

22. Urban planning for reducing traffic congestion and air pollution
23. Rain water conservation and access to safe drinking water
24. Family cohesion and intergenerational transmission of social values
25. Monitoring social change and human development using innovative research tools

എസ്. രമാഉണ്ണിത്താൻ, സീനിയർസിറ്റിസൺ ഫ്ര് ്വെൽഫെയർ അസോസിയേഷൻ ജില്ലാകൺവീണർ, സംസ്ഥാനകമ്മിറ്റിയംഗം.

ഇന്ന് നമ്മുടെ സമൂഹത്തിൽ പ്രശ്നങ്ങൾ ഏറെയു□ ങ്കിലും വലിയൊരുപ്രശ്നം വയോജനങ്ങളുടെ സംരക്ഷണമാണ്. അവരുടെ സംരക്ഷണം, ആരോഗ്യം, പാർപ്പിടം ഈവക കാര്യങ്ങളെക്കുറിച്ച് ഗഹനമായ ഗവേഷണം നടത്തേ□ കാലം അധിക്രമിച്ചിരിക്കുന്നു. ഒയ്റ്റക്കുതാമസിക്കുന്ന സ്ത്രീയ്ക്കും പുരുഷനും യാതൊരുവിധ സംരക്ഷണവും ലഭിക്കുന്നില്ല എന്നതാണ്സത്യം. എന്തുകെ□ വർ ഒറ്റപ്പെടുന്നു? സാമ്പത്തികശേഷിയുള്ളവരും വിദ്യാസമ്പന്നരുമായ ആൾക്കാരുടെ കഴിവുകളെ സമൂഹം എന്തുകൊ□ ു പ്രയോജനപ്പെടുത്തുന്നില്ല? ഏതുവിധത്തിൽ ഇവരുടെ ഒറ്റപ്പെടൽ പരിഹരിക്കാം വയോജനങ്ങളെ കർമ്മനിരതരാക്കാൻ സർക്കാർതലത്തിൽ എന്തെങ്കിലും പരിഹാരം ക□ ത്തിയാൽ ഒരതിരുവരെ ഒറ്റപ്പെടൽ കുറയുമെന്നുതോന്നുന്നു.

A. SHAJAHAN IAS, EXECUTIVE DIRECTOR, KUDUMBASREE

Kudumbasree Mission is a Government of Kerala Initiate launched in 1998 to wipe out absolute poverty from the state through concerted community action under the leadership of Local Self Governments. Kudumbasree is today one of the largest women-empowering projects in the country and has been instrumental in assisting many women owned micro enterprise units as part of its livelihood interventions. We extend our thanks and appreciation to you for showing interest in our organization.

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CARNATIC MUSIC CURRICULUM:

The curriculum for Carnatic music education remains static for over many centuries. New technologies have come up and modern theories of instruction have emerged. A new look at this curriculum is required. A research to evolve this will be welcome Dr. A. Sukumaran Nair, former Pro-Vice-Chancellor.

LANGUAGES AND LINGUISTICS

Scientific revision of type scripts in Malayalam for improving typing and type setting with special focus on retaining conventional pronunciation of the language.

Developing a complete set of revised scientific conventions for citing bibliography and allied reference for reporting Malayalam research studies to confirm with international conventions.

Developing a pronunciation dictionary of English language for Kerala scholars, using Malayalam scripts supported by additional symbols for representing for phonemes not covered by Malayalam language.

Developing a graded series of English text books for teaching English as a second language in Kerala schools with supporting notes in Malayalam for making basic English vocabulary and sentence structures in the English.

MISCALLANEOUS

1. Incidence and prevention of child labour in Kerala in the right the child labour act of 1986.

2. The impact of the latest retrenchment policies adopted by the Gulf countries with special reference to Kerala economy.

3. Socio-political factors which have contributed to the steep increase in the incidence of gender – based criminality towards women in India with a special reference to framing of legislative corrections.

4. Critical re-examination/a retrospective study of the RTE Acts of 2009 for assessing positive and negative impacts of the legislation, to be used in developing a revised legislation.

5. Developing a scientific policy for reemployment and redeployment of Gulf returnees in Kerala following the large scale retrenchment of Indian citizens of gulf countries.

6. A study of the impact of the flow of cheap labour from North Indian states to Kerala.

7. Designing strategies for containing the movements of wild elephants into human habitat in Kerala (by planting deterrent plant spices?)

8. A survey of important garbage treatment technologies for deciding their suitability for use in Kerala's garbage clearance.

General Inputs & Remarks on Research

ROBIN TOMMY, INNOVATION HEAD, TCS INNOVATION CENTRE

Some general remarks aimed at improving Research

The current system of professionals focuses more on the mental capability of mugging up and writing the exam in a detailed manner, with more words and less content. The thinking capacity is turning out to be a scarcity. The problem-solution pattern is never overviewed nor focused in the current curriculum. Focus is more on studies rather than the application of what is being learnt. Research is also just a talk rather than becoming a practice. The system is lacking a process where the students are immersed to the problem scenario and push their thought process to come out with a novel, yet efficient solution from both a theoretical and practical perspective. Mostly in the current process, examinations drive the learning. The student learns for a degree rather than for a living. The education should focus on problems, make the students learn over it and creatively push them for a change. The mindset approach and evolution pattern needs to be studied over time and changes needs to be made available in the education system. As of today, research is nowhere a focus point in the system and which needs a lot of importance for solution oriented and problem solving approach-habit creation.

Proposed Solution.

1. Research should be a focus area in the bachelors program.
2. Work on real time problems. Travel around and find problems. Creating a problem statement and evaluating the ROI should be learnt, to make things simpler.
3. PhD graduates should strictly have a discussion with the industry to get the business use cases and bring the literature survey based on the reality of the problem statements.
4. Learning should be based on the problem-think-brainstorm-MVP (Minimum Viable Product)-Final Product-Use.
5. The PhD curriculum should support design thinking, creativity enhancement, innovation and idea inculcation.
6. The students should understand the current environment and try to enhance the boundary of the solution management based on advances in the industry.
7. Follow the industry and research areas and always have a hands-on on the recent advances. The advancements should be instilled quickly and the research scholar's knowledge should be measured on the inculcation and knowledge curve fitting exercise.
8. Relevant research papers should be churned out and patents should be filed with collaboration with the industry.
9. The knowledge acquired during the PhD phase should also be shared with industry and the solution pattern can be a use case for the next PhD aspirant.
10. Whitepapers will help the industry to compare the research topics and what needs to be selected for a particular use case.
11. Industries will always be interested in ROI (Return on Investment). Any solution should have a focus on this area.
12. Thinking exercises, creativity patterns, design stance and idea brainstorming should be the bread and butter of a PhD Scholar.

Conclusion: According to me a PhD scholar should have a problem focus rather than solution focus. Solutioning is something very easy if we understand the problem promptly and solely. Requirement understanding and current solution pattern understanding is also very important. Try the design thinking course for the PhD scholars which would add their ability to look into a problem scenario. Literature survey can focus on white papers along with research papers too. Application of the solution in a scenario can help us in validating the outputs which would be the criteria to award the PhD.

P. HARIKUMAR, TRAVANCORE ANALYTICS, TECHNOPARK, TRIVANDRUM

My opinions can be seen as that of a person not directly connected with academic research. The world owes much to those who have done serious study and research. I write the note below for those studies that have not been done seriously. My Observations on the Current Scenerio:

1. Though statistics is not a good way of evaluating result of research programmes, it is good to subjectively introspect on the research conducted and published so far. As the volume is very huge, please take a 3 month period last year (say April- Jun 2015) and evaluate them based on i) Was that a genuine problem to be solved ?ii) Was there a solution already. If not, Could the person really solve it ?iii) If you really solved it, did you attempt to implement /commercialize /or offer it free as a solution to someone - Is there a taker ? Even a free taker is a testimony of the solution. iv) Most importantly, is there any relevance for this problem to the society - academic, industrial, common people? Pls address this with special relevance to Kerala or India. Those who have completed research can be asked again now - they need not fear of the consequences :)

2. I have seen that VSSC used to give research problems to IIT/Madras. May be to some other institutes too. Some of the problems I know were related to mechanical and production engineering. Has VSSC given any problems to KU ? Have we returned a value?

3. There are very many research programmes running because it has become a mandate for teacher's career development. Obviously the end result of such research does not matter much to the researcher. This has lowered the bar seriously.

4. Evaluation of the problem is poor. Evaluation of the result is also poor. I am not sure what happens in foreign universities. The situation could be better, but would not be very different. It will be a useful exercise to look at self- funded universities - Indian and outside.

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Some Suggestions:

1. Set Expectations right: Research programmes, especially PhD, should have strict entry barriers on quality of the problem and its relevance. Should give priority and funding to problems that bring about a constructive change in the life of people.

2. Problem Vs Idea: Research should be aimed to solve a problem, rather than just to implement an idea (idea is not a problem).

3. Time is of Essence: We should be able to distinguish between researches that yield results in bounded time and those that are open ended with contentious results. Personal career aspirations

should be separated from meaningful research. Meaningful research should be funded well, others should be personally funded.
4. Incentivize Research: Cash awards or incentives for research outputs that add value to society, when they are put in to real practice. Proportional incentives for industrial research.
5. Involve the Industry. Provide avenues for industry staff to work in University, and University staff to work in Industry. Time based to Result based transition.
May be more. You should locate at least one good research that has been practised for making the life really better. Highlight and reward it. Finally it will point to a single solution. Bold Academic Leadership.

SANJAY VIJAYAKUMAR, CEO, STARTUP VILLAGE

Education systems always follow industry. So first came the mechanical wonders and then came the mechanical and electrical engineers training system. It was never that a lot of people were trained in something and they invented it. The invention first happened, at the industry.

Thus, in my opinion,
1. A University should do active research on what is happening in industry
2. Fix the timing of how Futuristic research should be (now, 2yr into future, 5-10 years into future and 10 years+ into future)

To do research, we need
1. The people who can deeply study and think and do quality research
2. The research environment (labs, infrastructure, policies, resources etc).

India as a country needs 1million new jobs a month, every month, for next 20 years to employ all its youth. This is possible only if we create many new companies in many new areas. Our new state govt. also has promised 25lakh jobs. This is not an easy task. Thus, from a research being socially useful point of view, Universities need to be in sync with what society needs. I believe that aiming to be a world class entrepreneurship research university would bring KU to a global stage, create global partners from academia, industry, government and support from general society at large. Within entrepreneurship, there are a 1000 research areas from how to create better pedagogical systems in our teaching to how to create advanced technology jobs to how automation and robotics will reduce jobs and what should we do if we face a jobless society.

DR. MURALEE THUMMARUKUDY, UN EXPERT ON DISASTER MANAGEEMENT

I honestly have more suggestions to research supervisors in Kerala than researchers. Not sure if that will help in formulating research problems under them. I will need to make the reply to be generic than specific. So only few principles can be given which are universal and can be tailored to every domain.

1. Make the research students feel proud of their work. It is important that our researchers feel proud of their work, feel themselves striving towards pushing boundaries of science and engineering than just trying to earn a degree or worse get a scholarship. We need motivational orientation programmes for researchers in every university at least once a year.

2. Set strong foundation on research - We need to have a strong foundation on fundamentals of research which include research methodology, ethics, professionalism, language skills, publication and promotion etc. Somebody should design an excellent course in this and introduce in every university in Kerala + invite guest faculty of successful researchers.

3. Promote networking - researchers should be networked between themselves as well as with rest of the world. There should be an annual meeting for all researchers in Kerala only for networking where they discuss not their technical domain but practical aspects of research, career opportunities etc.

4. A newsletter for researchers - there should be a newsletter for all researchers in the state introducing them to new opportunities, promoting their achievements, pdf opportunities.
5. Promote our researchers - give them generous recognition even when they publish a paper, give awards for papers, give awards for best PhDs and so on. Money is not important. I know many parts of these are already happening but bringing them together and institutionalising them will be nice.
Now in terms of PhD topics.

1. Relevance - select a topic which is relevant globally. I am not one who will say take a local topic. The topic could have relevance locally but that is not the focus. We should set our eyes on the world and then if we bring it down to our state, then best. For example we can do world class climate modeling, but focusing on Kerala.

2. Continuity - faculty members should take a bigger problem and slice into few discrete chunks to be done by multiple students across the year.

3. Interdisciplinarity - faculty should come together, at least from two faculties to define problems which are then followed by students from both faculties. There is big market for it.

DR. PRAHLAD VADAKKEPAT, ROBOTICS EXPERT, NATIONAL UNIVERSITY OF SINGAPORE

What I perceive is that, from the point of view of relevance to life, lately, companies are resorting more to understanding the needs of people (known, unknown, latent, explicit). Ethnography and human ecology are becoming very much part of the research and development of products and services alike. From another angle, the current generation can be excited with a purpose in life in a logical manner.

From such an angle, if we can ground the scholars to expose them to societal issues and potentially useful (purposeful) approach to problem solving or solution building, they will get excited to go for a deep dive. The scientific approach to understanding a problem in depth is crucial and which is being pushed around / compromised due to the eagerness to publish. For instance, in a history department, we can explore interesting studies along community development, community movement and several aspects related to human ecology. I am mentoring 3 students (in India) who are trying to understand human trafficking in India. They are from Jharkhand, Jaipur and Kerala. One of them is a law student (LLB) and the other two are from Engineering (Manipal Institute of Technology). It is amazing to learn about various aspects of the issue. I have learned about the "culture of silence" that is prevalent in our society and there are books written on it. What I conveyed to them (three students) is not to think of a solution now. The aim should be to understand the problem in depth and as broad as possible. The discussion is going on for the last

10 months. They are in their 2nd year of study. Last month, I have another person who was in Singapore, who will join IIT Gandhinagar for PhD, helping them. Her PhD area is within "post-humanism." When I shared about the three students' project, the PhD scholar was able to clearly connect to several topics related to her research. For her, such real life problems are most suitable and relevant.

In the above project, it is possible to have other disciplines involved as well. The final aim of the research is to come up with a solution that will be suitable to tackle the menace of human trafficking. Here, social science, history, community development, engineering and other disciplines converge. Such convergence of disciplines can be exciting.

I feel that the bigger picture is always not understood by scholars and mentors alike. Or, the bigger picture is not given enough importance. Quick solutions might be driving research aimed purely at publications / degrees. Need to come out of that vicious circle and there should be problem specific brainstorming to happen. We use brainstorming rules [https://en.wikipedia.org/ wiki/ Brainstorming] for ideas in the "Innovation & Enterprise" module where New Product Development is elaborated. I feel that such rules can be utilized. We also use mind-mapping software [www.xmind.net] to get a bigger picture from literature review.

I love ethnography approach to understanding problems. We take our students to a remote rural village in Maharastra every December and live there for weeks. It helps the students to ground to the problem and to perceive the contextual constraints well. By doing that we can feel them able to understand them-self better allowing their empathy to manifest.

We need to take the scholars to reality and show them the purpose of their research useful to humanity in certain setting. That will help them to appreciate the problems better and to go for a deep dive. We play the following video in the first lecture of the module "Innovation & Enterprise." https://www.youtube.com/watch?v=2Dtrkrz0yoU. I think that such relevant videos from the web helps scholars to get a bigger picture and to connect several dots better. It also help them to see how others approach problems.

Another aspect which is important is to visit other Universities. The Japanese and Koreans are good at that. They take their students across the globe to expose them to other cultures. That helps them to know their own culture better in relation to others.

CYRIAC DAVIES, MANAGING DIRECTOR, KITCO LTD.

Commercialization of Research/Lab Technologies: Universities are rich with numerous advance research and development studies on emerging technologies spread across various fields of applications. Making all the research and development thesis/publications publically available for the young entrepreneurs/Startups, will enable further development resulting into useful products and services. This can be attempted by compiling all the past research papers and presenting potential research papers through series of seminars/conferences. Students with entrepreneurial zeal will seize this as an opportunity to develop useful commercial product/service.

Adoption of industries especially PSUs by a group of colleges:

It has noticed that many of the emerging startups require design tools, manufacturing facilities, testing facilities etc. for developing the prototypes. The existing industries, can act a facilitator for such startups by opening up the existing equipment and systems for the use of startups. Providing access to the industry premise to startups and students will help the industries to get familiarization with modern practices and technology infusion enabling them to develop new products and services needed by the present day market. Create a formal platform for industry to interact with campus based startups towards developing high end products. The same can be initiated by encouraging leading industries to set up their R&D centre at selected campuses. Presence of such centres will bring new synergy to the students and lead research based on industry needs. Establishing a strong industry linkage as mentioned above will provide requisite development and testing facilities at affordable cost to student startups.

Research in Emerging and Future Technologies: Encourage research on advance and emerging technologies in sectors like electronics, material science etc. Such researches can be initially undertaken through set of students with each individual college taking a particular sector as focus areas from lighting devices, smart electronics devices, defence technologies, health care devices etc.

Training on Business skills and Business functions: The industrial and entrepreneurial environment is continuously evolving and the market force are no more local. Student startups working on research based products/lab technologies will require guidance and training on developing viable business plans. Also, such startups will require training to build business orientation and for acquiring business skills. Industry experts, successful entrepreneurs and agencies like KITCO can contribute immensely in this endeavor as an enabler. Presence of such a guided environment will enhance the success rate of student/campus startups considerably.

We take this opportunity to extend all support in University's endeavor to create a new learning culture integrated with useful outcome.

CLIF KUSSMAUL, FORMER FULBRIGHT VISITING PROFESSOR IN UNIVERSITY OF KERALA (FROM USA)

As often happens, a seemingly simple request leads to deeper reflection and insight. Researchers don't need better ideas, they need better processes & collaborations. Venture capitalists prefer an 1st level team with a 2nd level idea over a 2nd level team with a 1st level idea – a great team will succeed, but a lesser team won't. So my advice to researchers (faculty & students) is as follows: Choose projects that excite and motivate you. This seems obvious, but doesn't always happen. Research values novelty, but just because an idea is new doesn't mean that it is useful or exciting. I see this in conferences – there are always a flood of papers using the latest buzzwords, just because they're new. Instead of creating a novel solution and then looking for a problem, choose a real problem and find a good solution. Choose projects that excite good collaborators, since collaborating is much easier than working alone, especially if you like and respect each other. Collaborators bring different skills and perspectives, so you will find and solve problems in better ways. Collaborators provide encouragement and support – when one person is busy or stuck, another can help move forward. My best (and happiest) collaborations have been in such settings,

where we had a group of great people with diverse backgrounds who liked working (and playing) together. I've also been in settings where individuals were just as capable, but without the sense of collaboration and community. A top university can have experts in everything. Other places need to choose and focus on a few areas of specialty – this is sometimes called a T model, where there is broad (but shallow) experience in many areas (the horizontal part of the T), and narrow but deep expertise in a few (the vertical part of the T).

Choose projects that matter to other people. Good projects also benefit from external stakeholders – advisors, clients, customers, governments, investors, publishers, target markets, etc. They provide important advice, feedback, emotional support, resources, etc. Focus on projects that will directly help your institution, local companies, governments, and not-for-profits, and your broader community.

I made several key mistakes with my PhD thesis – I came up with something novel, but not very useful, and not something I was particularly excited about. I didn't have collaborators – my committee was helpful, but my topic was outside of their expertise. However, my POGIL work has gone very well – I am excited about improving education, the POGIL community in general and my CS collaborators in particular are wonderful, knowledgeable, and fun to work with. Our work is making a difference – we've gotten a sequence of grants and publications, have helped many faculty rethink their classes (which helps all of their future students), and our work is changing education in CS and other disciplines. I now have a motto – always have at least 3 reasons to start a project, so it is still useful even if 1 o r2 reasons don't work out. Thus, I suggest that universities in Kerala create more (interdisciplinary) research centers. Make the selection process competitive and as open and transparent as possible, to encourage and reward researchers who talk to each other and want to take on new challenges. Some of the centers might include several academic organizations, and some might include non-academics – e.g. Technopark, VSSC. Centers might get priority for new or renovated space, special facilities, and new faculty positions. My personal preference would be a Center for Teaching and Learning to emphasize and expand the use of evidence-based learning practices and the "scholarship of teaching and learning". Less lecture and rote memorization of facts, more active learning with guided inquiry learning, problem-based learning, project-based learning, etc. to help students develop critical thinking, problem solving, communication, and other essential skills. These ways of learning and thinking will help students in their in their careers, will helps their companies and improves the reputation of their universities, which helps them recruit more and better students, who can do more and better work, which helps them recruit more and better faculty – a virtuous cycle. Here are two institutions I'm familiar with that do this: - Olin College (USA), -Ashesi University (Ghana). Do universities in Kerala have coop programs, where students work for local companies? This seems like another good way to help students develop relevant skills, build ties with local businesses and other organizations, etc.

PROF. GOPALAKRISHNAN, CHAIRMAN (FACULTY), AMRITA CIVIL SERVICE ACADEMY

I have always felt that it is what has been done that directs what is to be done. Research is no exception. After all, research is to re-search. Research in universities is done, often, as an academic compulsion. Increments, promotion, the never-dwindling fascination for the prefix are some of the reasons for this kind of pursuit. So, if research were not made obligatory for promotion, it would be taken up, I think, only by scholars for furtherance of academic interests, not

for material benefits. This in itself could improve quality. There are, at least in the humanities, four reasons for taking up a particular topic for research: guide's interest in the domain, availability of search material, time available for completion and ease of operation. Central questions like how do I make an original contribution, how can I make my thesis unique, how best can I pursue it to make it socially relevant and how can I bring in utmost rigour in my work … are questions that are seldom posed, let alone answered.

Critiqued from this perspective, research should gesture itself thus:

a. The ultimate beneficiary of all research should be either the student or the community
b. It should be made mandatory for the teacher who proceeds on paid leave to submit how his salaried absence would be amply compensated for.
c. Periodic progress assessment is imperative for timely completion
d. Open Defence should not be a platform for civilities and refreshment alone but an opportunity for enlightening interaction as well.

At a time when information is in abundance, scarcity of relevance should not occur. There has to be regular interaction among college and university teachers wherein the former can table teaching issues and the latter, research prospects. This academic symbiosis (Shall we call it 'inclusive inquiry'?) can make research more meaningful.

I am holding an office which is under public gate and is constantly under controversies. I am afraid if someone has planted secret cameras or recorders in my office. Also, I am afraid that some visitors carry secret cameras on them. Can the technology researchers device an instrument which if I keep in my room, it will beep if any such device is present?: **Anonymous**

Can we have a simple low cost device which will produce a beep sound in the house (i) when the overhead water tank over flows (ii) when the overhead water tank has only 10% water left. Such a device, if very low cost, has a potential to be sold in every house in Kerala: **Anonymous**

A gun which will produce ultra/supersonic sound which will scare dogs away: **Anonymous**

Reins from plants like Vatta (which was used as gum) and that of Murinja etc. need to be researched: **Anonymous**

PROF. K. SUDHAKAR, PROF, IIT, BOMBAY

Primary stakeholders in a PhD programme are those who hold a direct interest in research outcome of PhD research. Stakeholders must also include those who are interested in human resource coming out of PhD programme to execute cutting edge research (ie. Interested in research scholar him/herself).

I would say there are 3 things to consider in putting in place a good PhD programme;

1. How to pick a research problem from out there
2. How to solve the problem
3. How to reach solution to out there.

Step -2 here is as important as the first and the third. Irrespective of the goodness of the research problem a research scholar must learn the process of taming it through a structured approach to create new world-class knowledge and show case that new knowledge; and do all that with high level integrity and ethical behavior. This approach to problem solving is what will shape him/her as a valued human resource to contribute to the world after (s) he steps out of the University.

An outcome orientation to PhD programme (where we define what we wish to see in a research scholar who becomes eligible to receive his/her PhD degree) can be useful. As indicated at item (A) one has to focus on many other aspects of grooming a scholar no matter what is the research problem. A baseline thought in this direction can be a bullet list of attributes (http://www.nsf.gov/).

1. World-class knowledge in a relevant specialty
2. Ability to develop work-class knowledge in related areas
3. Understanding of how specialized knowledge aligns with the larger context of knowing and understanding
4. The ability to understand and be understood by those in other disciplines and other cultures
5. Awareness of all effects of globalization and technology-and the price they exact on society
6. Leadership, as reflected in breadth of knowledge and ability to articulate ideas, confidence, poise and focus
7. Ability to define and solve problems
8. Ability to deal with predicaments as well as problems
9. Ability to both a thinker and a strategist.

DR. SABU PADMADAS, Southampton University (Alumni)

Advancing Interdisciplinary Research for Sustainable Societies

The following notes provide some pointers and suggestions towards improving the uptake and quality of interdisciplinary research. University of Kerala has immense potential and scope to nurture and sustain research leadership, for which inclusive planning, investment and implementation strategies are needed.

Improving the uptake and quality of research

1. A research oriented postgraduate programme is definitely a good start where students can be offered credit-based research skills (design, analysis, writing and communication) training with a practical orientation. These are presumably already existing but can be strengthened to enable students to think 'out of the box' (beyond discipline boundaries) reflecting on current social, economic and technological challenges. The training should reflect on harnessing professional and transferable skills and should be offered to all those entering postgraduate doctoral programmes at the university level.

2. The University could consider establishing a central hub for promoting high quality research skills training and offer short training specialised and generic courses (e.g. 1 week) addressing the research requirements of different disciplines.

3. Our students, especially doctoral and post-doctoral researchers, need to develop confidence and independent skills to design, implement and manage research. They need to be exposed to both national and international research opportunities and engaged to existing research projects providing opportunities for them to interact with experienced researchers.

4. The organisation of doctoral research programmes could be improved by (a) conducting annual internal formal review of thesis progress and an intermediate examination for transfer from MPhil level to PhD; (b) introducing compulsory seminar presentation at least one each year during the course of programme; (c) engaging researchers (10-15% of their time) for teaching Masters level students; (d) encouraging and providing support for PhD researchers to attend national and international conferences and (e) more importantly, coordinating the examination process ensuring that the research outputs are either published or of publishable quality in peer-reviewed national/ international journals.

5. A central research information systems can be established to inform, encourage and assist academic staff and researchers to write competing peer-reviewed research proposals for state, national and international funding. This system can also function as a nodal point to promote international research collaboration.

6. We can set milestones, internationally competent thresholds, evaluate the quality of research outputs, conduct annual research formal appraisal and provide incentives (research awards, promotion, financial rewards) for academic staff.

7. Identify departments, centres, institutes which are already performing well at national and international standards, provide basic infrastructure and human resources. In addition, identify those units which demonstrate evidence of potential for research growth.

8. The University could consider coordinating distinguished lecture series on emerging and re-emerging critical issues (e.g. related to sustainable development, population dynamics, societies, technology, environmental and climate change). A calendar of events (for a year) could be circulated ahead of the lectures. The lecture could take place on the last Friday of every month at the main campus.

DR. KUNCHERIA ISSAC, VC, Kerala Technical University

We should try to select problems the community is likely to face 5 years/10years from now so that by the time you complete the work, it will have high application. The engineers shall look into the grand challenges prepared by NAE, USA and the Technology vision 2035 of TIFAC to find out the problems for research rather than searching the literature alone for finding the problem. Of course state of the art by searching the literature is essential. The problem we face is that we try to

marginally improve a system or process which has very little application by the time you come out with the outcome of your research.

DR. BABOO M. NAIR, PROFESSOR EMERITUS, APPLIED NUTRITION, FOOD HEALTH SCIENCE CENTRE, LUND UNIVERSITY, SWEDEN

During my visits to University of Kerala, I had opportunities to have discussions with many students and teachers of the university. What comes to my mind is that the students themselves did not understand (not conscious or not troubled over) the fact that the University of Kerala is trying hard to improve the quality of its output by way of research and education. I felt that the students were clever and were satisfied in doing the minimum. In general it is my observation that they did not express much ambition to do a great job. Some dreams in that direction were there and perceivable but not that they will die for reaching that goal. I felt the same attitude among the teachers too. Somehow achieve the minimum to publish a paper, finish the thesis and get out with a degree etc. were clearer than the thirst/urge/desire for knowledge and strong devotion to research as the mission. The university campus did not appear to be a place where tomorrows intellectuals were in discussion about big questions of tomorrow except for the presence of red flags all over in large numbers. I felt that the flags has been placed there in large numbers to mask the lack of interest in real matters like quality of the performance of the university in advanced research and higher education.

I am sure that you know very well that the quality as well as quantity of the performance of an institution depend upon many factors and many people. It is the manifestation of the total performance of every category of employees, teachers, administrators, students, leadership and supporting staff at every level. What I find it as a weakness at Kerala University and almost all institutions of India I came into contact with is the bad behaviour of out sourcing. Everyone will keep asking somebody else to do the work they could do, they are supposed to do or expected to do.

I can illustrate this by relating a story which I hope you will enjoy. Let us say that you are visiting a director of an establishment. While speaking to you the director may ask" Do you like to have a cup of coffee Dr. Nair?" And you answer "yes please a cup tea thank you". Then the director will invariably call his assistant to ask him to bring a cup of tea for the guest. Then the assistant will go in turn to his own assistant and ask him to bring a cup of tea to the office of the director. The assistant of the assistant will then ask the clerk of the office and the clerk will ask the peon and the peon will at last ask the teashop near the office to send a cup of tea to the office. It will naturally take some time and an innocent soul in the form of a poor boy come to the office with a cup of tea and the boy with the tea will stand there wondering what to do with the tea as everyone in the ordering chain especially the peon who wanted the boy to bring the tea has become least interested and therefore invisible as far as anyone can see. Then it is left to the imagination of the poor boy to find a solution as it is his remuneration which is at stake. In this scenario, the boy is the helpless one as it is he who has to deliver the tea and bring back the money to the tea shop if he is not to be beaten up by the owner. Soon many people will become engaged and start running here and there for some time, asking who ordered a cup of tea, until at last the tea reaches the director's office. The director asked you for a cup of tea as a matter of routine/courtesy. He may not even care very much if his mission is achieved or not. The turbulence of the situation often will absorb

all the mistakes and miss happenings as well as deliver reasons for excuses and just turbulence is everywhere as a blessing to every one ! Now the tea can be substituted with anything else too with full compliance. Making/asking other people do things is a normal/common thing in India in every sector and in every state. This behaviour undermines the quality of the result in every walk of life. Even very simple assignments are out sourced not only in offices but also in homes. Somehow most people feel that they are great if somebody else keep doing their job. Of course, I am the first to agree that there are exceptions to this and to some extend there is also need to request others for help in executing your duties. But to ask somebody else to do the work which is destined to you is very common to India. It is so common that it works negatively when it comes to keeping the standard of quality. Because you outsource the work but not the quality criteria.

Now, I would say that it is the duty of the university itself to produce the critical mass of ideas for its own input in advanced research and higher education. It is the activation and motivation of the employees which is necessary/required. If a university is poor in ideas, it is very bad. No industry or outsider can contribute to compensate the lack of ideas. Because, you need some receptor/receptivity to absorb ideas relevant to the purpose even from an industry. Once you have an active research going on in your department, it will be easy for you to take in an industry project. At the same time an industry project cannot be taken in if there is no own research in the field is going on at the department.

It is the nature and characteristics of the inner activity of the university which has to be improved for improving the quality of its performance out wards. I think, it is the leadership which has to express its vision mission and strategy in the activity/management of the university with utmost clarity. Improvement of quality cannot be outsourced. It has to be carried out by the university itself. It should be recognized and acknowledged that it is the duty of each and every employee to be fully involved in improving the quality of the day to day performance as well as its long term performance.

My suggestion is that the leadership has to take it as a mission to define the quality and quantity of the performance of the university as clearly as possible to its employees students media and the society. This should be done with the cooperation and active participation of all the personal categories. Quality assurance is a continuous day to day process at every point of delivery. The duty of the leadership (vice chancellor and the deans) is to make the employees aware of this fact and make them integrate it as a part of their duty/job and this this will not function well if the leadership is not subscribing to its own principles.

How to do that: If I were to be the vice chancellor, I would start a process/series of meetings. The first meeting with the deans of all faculties. The second meeting with all the head of the departments. The third meeting to address all the employees and post graduate students of all the departments. The fourth meeting to talk to the representatives of all the trade unions connected to the university. The fifth and final meeting in this series will be a meeting of the pro-vice chancellor, vice chancellor pro-chancellor and chancellor to inform each other and to collect advice and political and financial support for forming a strategic plan for the improvement of the quality of research and education of the university and its implementation.

The next is to develop the actual strategic plan for the university for five years and suggestions on how it will be implemented. Each department should be invited to contribute a plan for their department. Each faculty/dean should be invited to contribute its plan and also a plan from each trade union representative. The final strategic plan should be a synthesis of all the contributions and it should be placed in front of the syndicate and senate for their information and approval.

The next step is to discuss and create a continuous digitalised monitoring system/ procedure to see to what extend each department follows its own rules of the game and the rules of the game set forth by the university. In monitoring as well as in everything mentioned above digital administration procedure may be applied. Digitalization of performance in relation to goals on one hand and rewards and /or punishments on the other hand may be effective.

The university could/should think of developing a performance portal. Anyone could be allowed to take advantage of the information presented in that portal with utmost possible transparency. Courses, course handouts, laboratory notes, instructions, study questions, report of the seminars, results of the workshops etc. can be made available to the public and also to the interested industries.

The university may also consider a few things. (Which are applied in our university)

1, Allow maximum possible freedom of activity to the researcher in planning and execution of their own research and education.

2, Allow maximum possible freedom of activity to the researcher to own the IPR of his/her research activity with him/her as his/her property.

3, Allow maximum possible freedom of activity to the researcher to take initiative in bringing ideas to the university for consideration and implementation

4, Allow maximum possible freedom of activity to the researcher to have collaborative projects with industries and nongovernmental agencies.

Then it is also up to the leadership of the university to see that the researchers are motivated, inspired and put/expose them into such circumstances which will promote exercising above freedom in practice

Every product we export should have the highest amount of new knowledge in them. We must not concentrate on exporting things/material. We must on the other hand concentrate on exporting new knowledge to gain revenue. Even if we do not succeed in obtaining any break through at once, it will in a long run, raise the standard of the quality of research and education in Kerala. Failure by working with difficult problems will improve your knowledge level more than success by working with simpler problems. What we must teach the researchers is to define the problem well in such away that anyone can understand it and try to solve it even if/when you have become unsuccessful.

Every researcher should follow the principles of research and carry out the work following the

rules of the game when it comes to formation of a hypothesis, design of experiments, collection of observations, making tables, drawing figures, doing statistical analysis of the results, and making conclusion based on the observations. To avoid generalisations and drastic conclusions based on a few observations are important measures in keeping the quality of the research intact. These can be taught in a class room or learned by reading a suitable course book.

A. SHAJAHAN IAS, EXECUTIVE DIRECTOR, KUDUMBASREE

Kudumbasree Mission is a Government of Kerala Initiate launched in 1998 to wipe out absolute poverty from the state through concerted community action under the leadership of Local Self Governments. Kudumbasree is today one of the largest women-empowering projects in the country and has been instrumental in assisting many women owned micro enterprise units as part of its livelihood interventions. We extend our thanks and appreciation to you for showing interest in our organization.

Kudumbasree is promoting microenterprises for livelihood of poor women. Wide variety of microenterprises are promoted by Kudumbasree right from canteen and catering, IT, Taxi service, Infant supplementary feed, Apparel Sector, Agri and Animal Husbandry related enterprises many being upgraded to Producer Companies for economic empowerment of Women. But still we have identified some gaps in Marketing, Quality aspects, Technology updation aspects, HR Development aspects, Legal aspects etc. in Enterprises. Profitability and sustainability of the Enterprises is still a gap which affects our enterprises. We think that the Faculty of Legal and Management studies can assist us in certain areas. Also the Department of Home Science, Food and Nutrition can assist in developing the quality and shelf life of the products manufactured by Kudubasree Enterprises. Similarly the University can assist us in developing v arious projects related to women empowerment especially gender studies. Also we have certain programs/projects like Ashraya)Destitute Identification and Rehabilitation Project), BUDS, Tribal and Coastal etc. for social empowerment and assistance of the poor and downtrodden. Students can do project studies in our Organization. Also Research scholars can study specific topics in any of our initiatives. Hence we would like to have a discussion with University of Kerala to workout strategies for Mutual collaboration and Partnership in various Projects including the scope of consultancy services. Kindly make it convenient to have a discussion on all the above possibilities on a mutually convenient date and place.

PROF GOPALAKRISHNAN, CHAIRMAN (FACULTY), AMRITA CIVIL SERVICE ACADEMY

I have always felt that it is what has been done that directs what is to be done. Research is no exception. After all, research is to re-search.

Research in universities is done, often, as an academic compulsion. Increments, promotion, the never-dwindling fascination for the prefix are some of the reasons for this kind of pursuit. So, if research were not made obligatory for promotion, it would be taken up, I think, only by scholars for furtherance of academic interests, not for material benefits. This in itself could improve quality.

There are, at least in the humanities, four reasons for taking up a particular topic for research: guide's interest in the domain, availability of search material, time available for completion and ease of operation. Central questions like how do I make an original contribution, how can I make

my thesis unique, how best can I pursue it to make it socially relevant and how can I bring in utmost rigour in my work … are questions that are seldom posed, let alone answered.

Critiqued from this perspective, research should gesture itself thus:

a. The ultimate beneficiary of all research should be either the student or the community

b. It should be made mandatory for the teacher who proceeds on paid leave to submit how his salaried absence would be amply compensated for.

c. Periodic progress assessment is imperative for timely completion

d. Open Defence should not be a platform for civilities and refreshment alone but an opportunity for enlightening interaction as well.

At a time when information is in abundance, scarcity of relevance should not occur. There has to be regular interaction among college and university teachers wherein the former can table teaching issues and the latter, research prospects. This academic symbiosis (Shall we call it 'inclusive inquiry'?) can make research more meaningful.

SADASIVAN KP, CONSULTANT (LIBRARY), IIITMK, TECHNOPARK, TRIVANDRUM

01.Research: Shallow vs Deep: There is a general opinion among the peers, especially those from abroad, that the scope and treatment of the research topics are by and large more shallow in nature than deep into a specific problem.

02. Topics with Societal Relevance: UK HEC Model: The trend among the leading Universities the world over is towards choosing research topics with Societal Relevance. The UK Higher Education Council has even gone to the extend of rejecting proposals for doing PhD, if the topic chosen happens to have no societal relevance.

In our country/ State, there is no dearth of socially relevant topics necessitating a solution by applying the appropriate Science/ Technology base. It needs to be analyzed based on the, say, last 5-10 years of chosen research topics in Kerala University before finalizing the strategy for future.

03. Industry-Academic Interaction:

(a) For identifying and resolving issues aimed at mutual benefit, it needs to be examined critically. The existing misconceptions/ mistrusts need to be de-mystified. The University can even create a framework of the possibilities existing in the industrial sector of the region (and elsewhere too) vis-à-vis the research strengths of different disciplines/ departments of the University so that the prospective research scholars can be given a sort of Guidelines on the choice of their topics.

(b) Many of the academically excellent pieces of PhD works carried out earlier end up in closed shelves eternally. The potential application of such works are seldom understood and applied in real life situations. For instance, a Computational Modeling and Simulation work of a Chemical Engineering Process would have been carried out from the Computer Science Software/Programming Perspective. With appropriate refinement, it can perhaps be used in a real life factory environment to optimize a dynamic Chemical Engineering Process, cost effectively. There can be several such examples transgressing different disciplines. Biochemistry/Biotechnology applications for Health Sciences problems of specific regional or national significance is another such case. Fusion of Computer Science/Information Technology and Agriculture is yet another example.

(c) A cohesive approach with the thrust areas given in the Policy Planning Documents of the national and regional organizations like ICAR, ICMR, DBT, Department of Health Sciences Kerala, Department of Agriculture Kerala, Centre for Development Studies, Sector-wise Perspective Plan Documents of State Planning Board, etc. are necessary ingredients/ inputs for the quality improvement exercise in our University Education System.

(d) A Major Scheme of Internship Programmes in the industrial sector for the Post Graduate Students of the University has to be worked out as a sustainable prelude to research-oriented higher education.

04. Effective interaction with R&D establishments: Equally important as at Para 03 above, is the creation/ strengthening of an effective interactive mechanism with the R&D establishments of the State. It will catalyze the process of discovering new ideas, strengthening expertise and sharing knowledge, instrumentation and other infrastructure facilities. Improvement in the rate and quality of Publications and Patents are also possible.

05. Peers+ PDF Scholars Cushioning Package: An intellectually elite ambience is an integral part of quality research– from the stage of its conceptualization to its ultimate delivery. Intermediary stages are equally important, particularly with a shareable ecosystem to build confidence and meaningful mid-course corrections.

Lectures, Workshops, Seminars – both internal and external – with the participation of Peers is certainly an added advantage and are in practice too, in many departments. But beyond that, one proposes a different/novel mechanism for consideration for implementation. Large number of young Post-Doctoral Fellows in different disciplines and basically hailing from Kerala are scattered in different leading institutions across the world. Creating a 'Virtual Pool' of such Scholars selectively and engaging them for short/ very short term programmes in the departments

concerned will certainly be a value addition to the works of the young PhD Scholars. This may be tried on an experimental basis.

06. Good Bye to Conventional Research: Our conventional research practices including (i) Selection of Topic (ii) Literature Survey & Review (iii) Research Methodology followed (iv) Experiments carried out (v) Data Analysis (vi) ICT Applications (vii) Results, Inferences and their Impact Study (viii) Publishing Patterns and the Criteria thereof ….All these need total re-structuring in the context of the fast changing eco system of Higher Education in the global scenario.

07. Careerism vs Professionalism: The predominant factor prevailing at present among the young researchers is to get a doctoral degree as the 'Passport' for fetching a job. The concept of careerism has engulfed the merit of 'Professionalism'. Well, our prevailing socio-economic conditions may be a contributory factor for this state of affairs. Naturally, erosion of quality of research will be the consequential damage to our education system. So the Government and the University System have to carefully think, plan and decide as to how the quality assurance is not diluted in the higher education domain.

08. Academic Administrative Managers vs Political Managers: The Vice Chancellor and the other top officials of the University should be well reputed academicians with knowledge, wisdom, vision, diplomacy and administrative capabilities. Political interference in choosing mediocre personnel will only spoil the quality and standard of the University and its products. De-politicization of the academic sector is essential for ensuring quality education.

09. Role of Professional Societies in Promoting Research Culture: Professional Societies have a significant role to play in creating the right ambience for imparting quality education and ensuring its sustenance. The well planned programmes of professional societies can make the academic environment more vibrant and focused. Moreover, the Research Students, as its bona fide members, will develop a sense of identity as members of an academically elite group, which, in turn will imbibe the spirit of doing quality research.

Well, many of the professional societies should wake up from their deep slumber and rejuvenate their own activities for accomplishing this target. The University, in turn, may examine whether membership in such well reputed Societies could be made mandatory.

10. Promoting Interdisciplinary Research Programmes: Most of the departments in the University do confine PhD research programmes within the 'boundaries' of their own respective disciplines. But it is being widely accepted that inter-disciplinary research programmes are fast emerging as a more innovative and productive mode of research. There is need for initiating some thoughts on these lines.

11. Promoting Publishing & Patenting: A universally accepted Metrication System to Measure the Quality of Scholarly Publications needs to be introduced in the Kerala University System, in tune with the stipulations of mandatory agencies like UGC, AICTE, etc. Suitable benchmarking shall be prescribed for compliance by the Research Scholars too, before their final Open Defence.

(a) The status of filing of Patents uptill now by Kerala University is lamentably poor. Some of the recommendations proposed in this document, especially vide Para 03, 04, 10 & 17, if implemented, are sure to put the University in the Map of Universities regularly filing Patents.

The impact of this change is expected to reflect in the PhD Scholars' works too.

12. Augmenting & Modernizing Infrastructure Facilities: Be it the Library System or the Instrumentation facility, the University needs both augmentation of the existing facilities and modernization with new Resources, Facilities and Services. These changes together with the recommendations made vide Para 03, 04, 14, 16, 17 & 19 are expected to achieve quality improvement in academic research.

13. Introducing New Avenues of Learning Processes: The ICT-enabled Learning System Facilities are the hall marks of Higher Education globally. But they are yet to make an entry/impact in the domain of education in Kerala University. If implemented with careful planning and judicious spending, the resources and services will be unlimited. The young Research Scholars are sure to quickly migrate to the new paradigm and the results will certainly have a cascading effect in terms of quality and efficiency.

14. Creating/ Strengthening Research-Planning & Development Cell of the University: If such a system already exists in the University, it will, in all probability, be functioning as an Administrative mechanism.

What is now proposed is a kind of Academic-cum-Research Apex Body with the responsibility of :

a) Planning, Developing, Implementing and Monitoring the Programmes of various departments,

b) Performance Appraisal based on Output/ Outcome/Accomplishments of Assigned Tasks,

c) Performance Auditing

d) Identification and implementation of Collaborative Programmes with regional, national and overseas agencies and institutions including Exchange Programmes for PhD Scholars to strengthen their research work and

e) Fixing of Long Term & Short Term Development Plans & Targets ensuring better visibility, acceptance and ranking of Kerala University.

15. Promoting Inter-Institutional Research Programmes with Regional, National and International Institutions: This is partly covered in Para 15 above. But that apart, major collaborative research programmes with other leading institutions will have scope to accommodate PhD Scholars to carry out part of such Projects as the topic/area of their academic research work.

Support from the Alumni of Kerala University holding key positions in major institutions – Private or Public - all over the world can also be explored and made use of.

16. Promoting to Undertake Externally Funded R&D Projects: University should encourage and promote undertaking of major R&D Projects funded by various Ministries, Organizations and Departments of Government of India. At present, only isolated cases apparently exist. This needs to be introduced more extensively among all possible departments having some stake/ expertise in the area concerned. Several Universities in other States are much ahead of us in utilizing such possibilities.

Apart from improving the financial condition of Kerala University, it will have direct impact in quality improvement of its academic research programmes too, as partly indicated in Para 15 & 16 above.

17. Consciously Attempting to Shift from the 'Era of Awareness Programmes' to the 'Era of Research Programmes per se': A closer examination of scores of PhD Theses transgressing different departments reveal that they are all mediocre works and do not contain an element of innovation ; they do not propose new ideas or new processes or techniques or devices to enhance the existing knowledgebase; they do not even help trigger the thought process in a different direction. These so called 'Scholarly Works' can perhaps be equated with 'Awareness Programmes' rather than serious 'Research Programmes per se'.

This needs to be addressed. Stricter academic –cum- aptitude screening of the aspiring researchers at the time of registration and rationalized criteria for the selection of the topic for research, can partly help filter out incompetency.

18. Knowledge Resource Consortia Initiative: The abundance of literature and information resources available and accessible in the public domain either priced or free of cost is a blessing for the academic and research community of modern age. The variety of modes, techniques and devices for getting such resources (mostly, e-Resources) at variant forms add tremendous value to the speedy success of the research programmes undertaken by the scholars. Consortia approach plays a major cost-effective method in facilitating use of such resources. Kerala University can perhaps take the lead in initiating such resource mobilization schemes in association with other Universities in the State to ultimately benefit the scholars.

19. Creating a 'Think Tank' for Quality Assurance in Higher Education in Kerala/ Kerala University: Creating a 'Think Tank' at the State Planning Board OR Higher Education Council level OR even at the University level as described in Para 15 above, preferably with the inclusion of external experts too, on **Quality Assurance in Higher Education in Kerala**, with constant metrication, monitoring and forecasting mechanism is an option worth considering.

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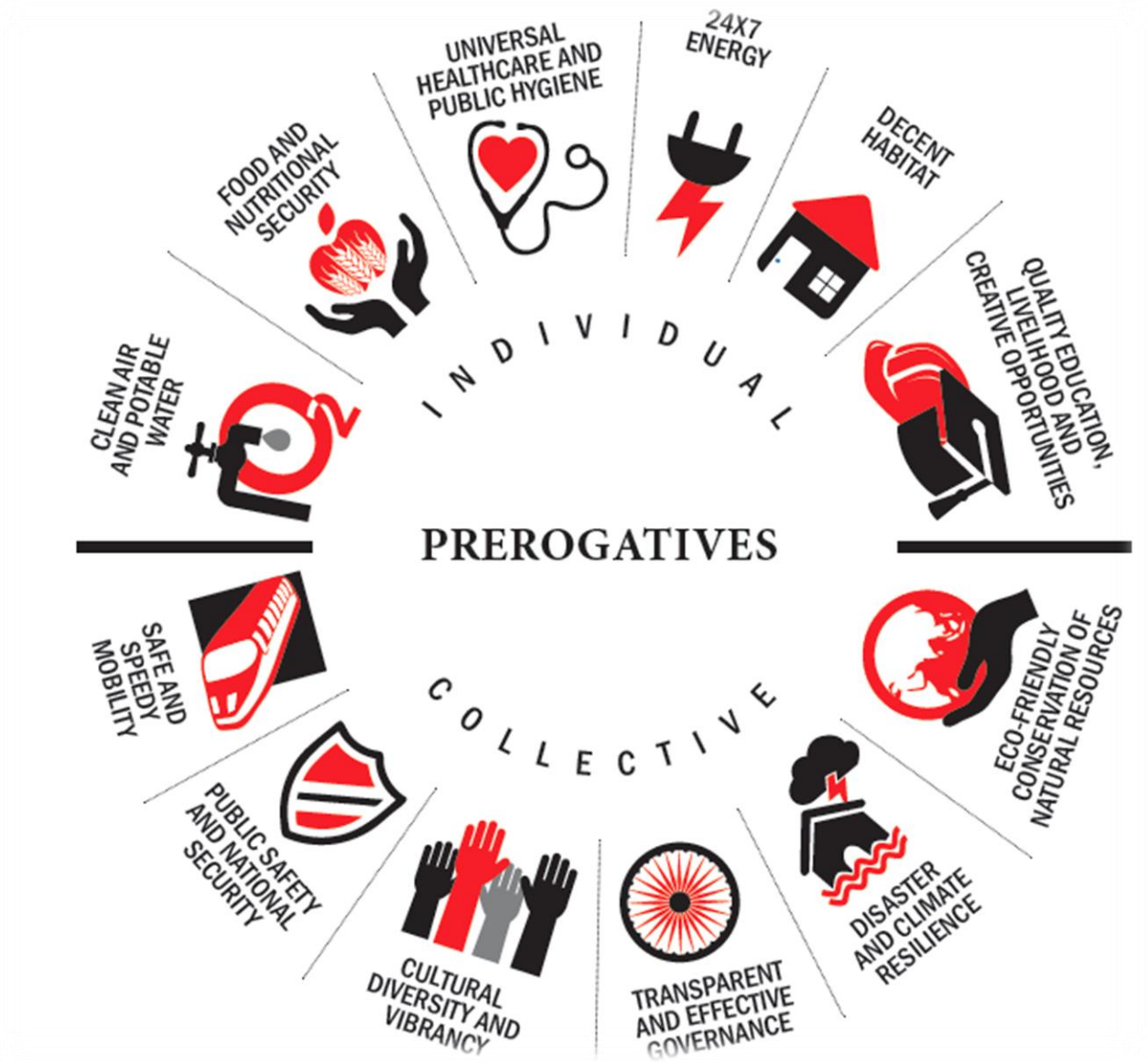
Extracts from "TIFAC Technology Vision 2035" Courtesy: TIFAC, New Delhi



CLEAN AIR AND POTABLE WATER

ADVANCED CLEAN COAL TECHNOLOGIES		●	●	
ALTERNATE FUEL BASED TRANSPORTATION	●	●	●	
NOVEL PROPULSION TECHNOLOGIES		●	●	
GREEN MANUFACTURING	●			
INTELLIGENT TRANSPORTATION SYSTEM	●			
LOW DUST CONSTRUCTION TECHNOLOGIES	●	●		
REAL TIME DENSE SPATIAL AIR QUALITY MONITORING		●	●	
REAL TIME AQUIFER MONITORING INCLUDING SALINITY INGRESS		●	●	
INSTANT PORTABLE WATER QUALITY TESTING	●	●	●	
AFFORDABLE DESALINATION TECHNOLOGY		●	●	
MEMBRANE BASED WASTE WATER TREATMENT	●			
AFFORDABLE DE-SILTING OF WATER BODIES		●	●	
TECHNOLOGY FOR RUN-OFF CONTROL	●	●	●	
SCALABLE POINT-OF-USE WATER TREATMENT TECHNOLOGY		●	●	
DEW HARVESTING		●	●	
IN-SITU WATER PURIFICATION IN PIPELINE			●	
SELF HEALING PIPELINES			●	●

Technologies, concepts and approaches relating to clean air and potable water that—

- are readily deployable
- needs to be moved from Lab to Field
- require targeted research
- are still in the imagination

FOOD AND NUTRITIONAL SECURITY

VERTICAL FARMING	●	●		
DEVELOPMENT OF PERENNIAL CEREAL CROPS			●	
CONVERSION OF NON-EDIBLE PLANTS INCLUDING SEA FLORA INTO FOOD			●	
BIO-FORTIFICATION (BOTH CONVENTIONAL AND GENETIC)	●	●	●	
GENOMICS AND PHENOMICS	●	●	●	
TRANSGENIC CROP PLANTS AND ANIMALS	●	●	●	
RAPID DIAGNOSTIC TOOLS FOR DETECTION OF ZOONOTIC DISEASES		●	●	
TECHNOLOGIES FOR INCREASING SHELF-LIFE OF PERISHABLE FOODS		●	●	
ELECTRON BEAM FOOD IRRADIATION	●			
OIL TO POWDER TECHNOLOGIES FOR FOOD		●	●	
HIGH VALUE NUTRACEUTICALS AND PHARMACEUTICAL PRODUCTS FROM AQUATIC ORGANISMS AND ALGAE	●	●	●	
REAL-TIME MONITORING OF QUALITY AND BIO-TRACEABILITY RELATED TECHNOLOGIES		●	●	
CLIMATE-SMART AGRICULTURE	●	●	●	
CONVERSION OF C3 PLANTS TO C4 PLANTS.			●	
NANO FORMULATIONS OF PESTICIDES AND FERTILIZERS		●	●	
INTERACTIVE FOODS				●
SMART FOODS				●
3D PRINTING OF FOOD			●	
EXPLOITING MICROGRAVITY AND SEA FOR CULTIVATION OF CROP PLANTS				●

Technologies, concepts and approaches relating to clean air and potable water that—

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UNIVERSAL HEAKTHCARE AND PUBLIC HYGIENE

NEW VACCINES FOR MULTI DRUG RESISTANT AND NEWLY EMERGING DISEASES			●	
m-HEALTH	●	●	●	
BODY FLUID MARKERS FOR EARLY WARNING OF LIFESTYLE DISEASES		●	●	
INTEGRATION OF INDIAN SYSTEM OF MEDICINE (ISM) WITH MODERN SCIENCE	●	●	●	
PERSONALIZED MEDICINE		●	●	
REGENERATIVE THERAPIES				●
SYNTHETIC BIOLOGY		●		
3D PRINTING (ORGANS AND PROSTHETICS)		●	●	
NOVEL AND COMPOSITE MATERIALS FOR DEVELOPMENT OF PROSTHETICS AND BODY PARTS			●	
BRAIN-COMPUTER INTERFACE FOR DEVELOPING ADVANCED ASSISTIVE DEVICES	●	●	●	
IMPLANTED SENSOR BASED DRUG DELIVERY			●	●
NANO-ROBOTS			●	●
TELEMEDICINE AND TELE-SURGERY	●			
OPTOGENETICS			●	
WEARABLE DEVICES	●	●	●	
MEDICAL TEXTILES	●	●	●	
AUTOMATED ALERTING SYSTEMS FOR MEDICAL EMERGENCIES		●	●	
AFFORDABLE DRY SANITATION TOILETS	●			
SELF STERILISING HOUSEHOLD FITTINGS	●			

Technologies, concepts and approaches relating to clean air and potable water that—

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24x7 ENERGY

SOLAR PV	●	●		
ALGAL ENERGY			●	
NUCLEAR FUSION			●	
FUSION FISSION HYBRID REACTOR			●	
FAST BREEDER REACTORS FOR THORIUM			●	
SUPERCRITICAL COAL	●			
ADVANCED COAL CYCLES			●	
ADVANCED FOSSIL FUELS EXTRACTION TECHNOLOGIES				●
SHALE GAS	●	●		
TIGHT GAS		●	●	
GAS HYDRATE			●	
HYDROGEN ENERGY			●	
BIOREFINERIES			●	
HYBRID STORAGE		●		
FUEL CELL		●	●	
MICROBIAL FUEL CELL				●
DC GRIDS		●		
SMART GRIDS	●			
ICT BASED SMART MONITORING SYSTEMS	●			
WIRELESS POWER TRANSMISSION			●	
GREEN AND NET ZERO ENERGY BUILDINGS	●	●	●	
SMART WINDOWS		●		
ZERO ENERGY ARTIFICIAL LIGHTING (e.g. BIOLUMINESCENCE)			●	●
MICRO-GASIFIER COOKSTOVE		●		
BRUSHLESS DC (BLDC) MOTORS	●			

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DECENT HABITAT

4D CAD FOR OPTIMIZING CONSTRUCTION	●			
SENSORS BASED DESIGN, CONSTRUCTION AND INTELLIGENT OPERATION OF BUILDINGS	●	●	●	
CALAMITY AND FIRE RESISTANT STRUCTURES	●	●	●	
UNDERWATER BUILDING CONSTRUCTION THROUGH MINERAL ACCRETION			●	●
LOW COST DESALINATION TECHNOLOGIES FOR CONSTRUCTION			●	
3D PRINTING OF HOUSES	●	●	●	
BIO-MIMETIC CONSTRUCTION				●
ANTI-GRAVITY DEVICES FOR CONSTRUCTION				●
FILLER SLAB ROOFING WITH VARIOUS ECO-FRIENDLY FILLER MATERIAL	●	●		
CEMENT FREE/WATER FREE CONCRETE			●	
NOVEL CONCRETE SUCH AS FLEXIBLE, TRANSPARENT, BIO-CONCRETE AND SELF-HEALING		●	●	●
NOVEL STRUCTURAL MATERIALS SUCH AS LIQUID GRANITE, TRANSPARENT ALUMINA AND SUPER ALLOYS	●	●		
LOCAL AND RECYCLABLE MATERIALS FOR CONSTRUCTION	●	●		
NANOTECHNOLOGY FOR PAINTS AND SURFACE COATINGS; DURABILITY OF MATERIALS	●	●	●	
GREEN AND NET-ZERO ENERGY BUILDINGS	●	●	●	
ARTIFICIAL LIGHTING BY USING ABSORBED ENERGY			●	●
TOUCH PANEL WALLS AND SMART WINDOWS	●	●	●	

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QUALUTY EDUCATION, LIVELIHOOD AND CREATIVE OPPORTUNITIES

MASSIVELY ONLINE OPEN COURSEWARE (MOOCS)	●	●		
GAMING/GAMIFICATION	●			
INTERACTIVE REMOTELY CONTROLLED LABORATORIES	●			
PERSONALISED VIRTUAL TEACHERS			●	
4G AND 5G COMMUNICATION	●	●		
IMMERSIVE VIRTUAL REALITY	●	●	●	
BRAIN COMPUTER INTERFACE AND MACHINE AUGMENTED COGNITION	●	●	●	●
WEARABLE DEVICES	●	●	●	
DIGITAL IDENTITY AND LEARNING ANALYTICS	●			
AUTOMATED EVALUATION AND ASSESSMENT SYSTEMS	●	●		
DIGITAL HOLOGRAPHY, 3D IMAGING AND VOLUMETRIC/3D DISPLAY	●	●		
3D PRINTING	●	●		
REAL TIME TRANSLATION FOR INDIAN LANGUAGES	●	●	●	

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SAFE AND SPEEDY MOBILITY

INTELLIGENT TRANSPORTATION SYSTEM	●	●	●	
ALTERNATE FUEL BASED TRANSPORTATION	●	●	●	
ADVANCED POWERTRAIN TECHNOLOGIES		●	●	
AFFORDABLE ENERGY STORAGE AND INFRASTRUCTURE FOR FAST CHARGING		●	●	
ACTIVE AERODYNAMICS		●		
HEAT RECOVERY SYSTEMS		●	●	
INTELLIGENT ROADS		●	●	
LONG LIFE, LOW MAINTENANCE ROADS AND STRUCTURES		●	●	
SELF HEALING ROADS				●
FOG VISION SYSTEM FOR ROAD AND RAIL	●	●		
ACTIVE AND PASSIVE SAFETY TECHNOLOGY	●	●	●	
MAGNETIC LEVITATION TECHNOLOGY		●	●	
TILTING TRAIN TECHNOLOGY			●	
AUTONOMOUS VEHICLES		●	●	
NOVEL MODES OF TRANSPORT (e.g.EVACUATED TUBE TRANSPORT, HYPERLOOP)			●	
AMPHIBIAN AND FLYING VEHICLES	●	●	●	
BIOMIMETICS DESIGN FOR SHIP			●	

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PUBLIC SAFETY AND NATIONAL SECURITY

DEVELOPMENT OF INDIGENOUS SECURITY LAYERS PROTECTING COMPUTING AND COMMUNICATION PLATFORMS		●	●	
NATIONAL CYBERSPACE BORDER SURVEILLANCE, PRIVACY PRESERVING SURVEILLANCE AND DEEP PACKET INSPECTION (DPI) TECHNOLOGIES	●	●	●	
INDIGENOUS, SECURE NETWORK BACKBONE AND STORAGE DEVICES		●	●	
EQUIPMENT CONTROL SECURITY TECHNOLOGIES	●	●		
INDIGENOUS DEVELOPMENT OF BEHAVIOURAL, PHYSIOLOGICAL, BIOMETRIC AND CYBER FORENSIC TECHNOLOGY	●	●	●	
TECHNOLOGIES TO SECURE BODY IMPLANTS			●	●
TECHNOLOGIES TO PROTECT AGAINST REMOTE MIND CONTROL SYSTEMS			●	●
ADVANCED SYSTEMS FOR ENSURING PEDESTRIAN SAFETY	●	●	●	
RAPID SENSING MECHANISM TO DETECT CHEMICALS TO PREVENT DRUGGING CRIME	●	●	●	
SENSORS FOR PROTECTION AND SECURITY OF ELDERLY & PERSONS WITH DISABILITY	●	●	●	
FRUGAL FIRE DETECTION AND FIRE FIGHTING DEVICES	●	●		
ADVANCED FIRE AND SMOKE DETECTION AND RETARDATION IN TRAINS		●		
SENSORS AND PROTECTIVE DEVICES TO PREVENT SPREAD OF PANDEMICS AND EPIDEMICS			●	●
BIOLUMINESCENT/ZERO ENERGY STREET AND PATHWAY LIGHTING			●	●
DETECTION AND PROTECTION SYSTEM AGAINST CHEMICAL, BIOLOGICAL, RADIATION AND NUCLEAR (CBRN) ATTACKS	●	●	●	
EFFICIENT CROWD MANAGEMENT AND COMMUNICATION SYSTEMS		●	●	

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CULTURAL DIVERSITY AND VIBRANCY

ADVANCED COMPUTATIONAL PHOTOGRAPHIC TECHNIQUES			●	●
DIGITAL DOCUMENTATION ON OPEN SOURCE PLATFORMS			●	
3D IMAGING	●	●		
HOLOGRAPHY	●	●		
VOLUMETRIC DISPLAY DEVICES		●	●	
IMMERSIVE VIRTUAL REALITY	●	●	●	
GIS APPLICATIONS FOR ARCHAEOLOGY	●			
ADVANCED CHEMICAL TREATMENT AND PRESERVATION OF TANGIBLE HERITAGE	●			
GROUND PENETRATION RADARS FOR INVESTIGATING HEALTH OF MONUMENTS	●			
AFFORDABLE LASER CLEANING OF METALLIC SURFACES OF MONUMENTS	●	●		
AFFORDABLE PORTABLE INTERPRETATION DEVICES			●	
NATURAL LANGUAGE INTERPRETATION		●	●	
DIGITISATION AND REAL TIME TRANSLATION OF ORAL AND WRITTEN MATERIAL	●	●	●	
SYNCHROTRON RADIATION TECHNOLOGY	●	●		

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TRANSPARENT AND EFFECTIVE GOVERNANCE

SAFE, SECURE AND AUTHENTIC NATIONAL DATABASE VAULTS	●	●	●	
DIGITISATION AND STORAGE OF PERSONAL AND PUBLIC RECORDS IN OPEN STANDARD STORAGE FORMAT	●	●	●	
INTEGRATED EMERGENCY RESPONSE AND ASSISTANCE	●	●	●	
LOCATION AND ABILITY INDEPENDENT VOTING FACILITY	●	●		
NETWORKING OF ALL LEGAL DOCUMENTS	●	●		
ADVANCED FORENSICS	●	●	●	
WEARABLE DEVICES FOR MONITORING AND INTERROGATION UNDER DUE PROCESS OF LAW	●	●	●	
DIGITAL HOLOGRAPHY & 3D IMAGING (VIRTUAL LAWYERS)	●			
REAL TIME TRANSLATION	●	●		
ADVANCED BIOMETRICS FOR DIGITAL IDENTITY	●			
HUMAN INDEPENDENT DECISION SUPPORT SYSTEMS			●	●

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DISASTER AND CLIMATE RESILIENCE

EARLY WARNING FOR NATURAL AND MANMADE DISASTERS		●	●	
EARTHQUAKE PREDICTION		●	●	
CALAMITY RESISTANT STRUCTURES	●	●		
SENSOR NETWORK BASED RESCUE, RECOVERY AND REHABILITATION		●	●	
ALL-TERRAIN INTEGRATED RESCUE EQUIPMENT AND VEHICLES	●	●		
ACCURATE WEATHER FORECAST AT MICRO LEVEL	●	●	●	
CLIMATE SMART AGRICULTURE	●	●	●	
ARTIFICIAL PHOTOSYNTHESIS			●	●
ENERGY EFFICIENT ELECTRICAL EQUIPMENT	●	●	●	
ALTERNATE FUEL VEHICLES	●	●	●	
TECHNOLOGY FOR LANDFILL GAS RECOVERY	●	●	●	
HOMEOSTATIC DIAMOND TREES / ARTIFICIAL TREES				●
WEATHER MODIFICATION TECHNOLOGIES	●	●	●	

Technologies, concepts and approaches relating to clean air and potable water that—

- are readily deployable
- needs to be moved from Lab to Field
- require targeted research
- are still in the imagination

ECO-FRIENDLY CONSERVATION OF NATURAL RESOURCES

HIGH CELLULOSE CONTENT AND STRESS TOLERANT FOREST TREE SPECIES		●	●	
USE OF MICROBIAL CONSORTIA FOR ENHANCING BIOMASS PRODUCTION	●	●		
SENSOR-BASED FOREST FIRE MITIGATION		●	●	
IDENTIFICATION OF FORESTRY SPECIES FOR RECLAMATION OF DEGRADED SOIL, WATER LOGGING, OR BIO-DRAINAGE	●	●		
MODELING TREE WATER RELATION HYDROLOGY			●	
NATIONAL LAND MORPHOLOGY MAPPING		●	●	
REGENERATION OF EXTINCT SPECIES FOR REASONS OF BIODIVERSITY		●	●	
IDENTIFYING, CONTROLLING AND ELIMINATING INVASIVE SPECIES			●	
SATELLITE TELEMETRY TO GAIN INFORMATION ABOUT THE SPECIES MOVEMENT, MIGRATION AND DISTRIBUTION	●	●		
SPECIES DISTRIBUTION KNOWLEDGE AND MODELING			●	
STUDY OF POPULATION DYNAMICS OF SPECIES AND THRESHOLD LEVEL	●	●		
TECHNOLOGICAL MEASURES TO MITIGATE MAN-ANIMAL CONFLICT	●	●	●	
USING INDIGENOUS KNOWLEDGE FOR ECOSYSTEM PROTECTION	●	●		
GREEN MINING		●	●	
MICROBIAL ENHANCED OIL RECOVERY	●	●	●	

Technologies, concepts and approaches relating to clean air and potable water that—

- are readily deployable
- needs to be moved from Lab to Field
- require targeted research
- are still in the imagination

TIFAC GRAND CHALLENGES
(Courtesy: TIFAC Technology Vision 2035)

1. GUARANTEEING NUTRITIONAL SECURITY AND ELIMINATING FEMALE AND CHILD ANAEMIA: Nutritional security for all Indians should be our first Grand Challenge, with elimination of anaemia in women and children as our specific target. Unlike other markers of women's health, which have registered significant improvements over the India are showing a worsening trend. Currently over half of all Indian women of reproductive age are chronically anaemic. The price that individuals, families and the nation pay for the high incidence of female anaemia is enormous. Only a combination of targeted public health and nutrition initiatives, involving government, civil society and research institutions, will reverse this morbid trend.

2. ENSURING QUANTITY AND QUALITY OF WATER IN ALL RIVERS AND AQUATIC BODIES: Cleaning our rivers would be an integral part of our second Grand Challenge. The quantity and quality of water in our rivers, inland waterways, water bodes and aquifers has an enormous impact upon the health and quality of life of all Indians. We will need to conceive of our river basins from source to sink as integrated biotic systems, and plan our hydraulic engineering schemes accordingly. Desalination technologies, which would reduce the pressure on our freshwater systems, would reduce the pressure on our freshwater systems, would be a crucial part of this Grand Challenge, as would the provision of 100% sanitation and sewage to all households.

3. SECURING CRITICAL RESOURCES COMMENSURATE WITH THE SIZE OF OUR COUNTRY: Critically of resources in the national context would depend on factors like potential constraints on supply, non-availability on Indian landmass and potential for performance enhancement. Economic and dependent on assured access to critical resources. With depleting earth resources, their uneven distribution and increasing global demand, this could eventually become a challenge of unprecedented dimensions. Assured access to required resource thus needs well targeted exploration efforts as well as sustaining diverse supply chains through concerted diplomatic and commercial linkage. The latter has go be a

dynamic process alive to the evolving geopolitics. A key strategy in resource security management would be to maximize domestic value addition. This is also important for the economic growth of the country. While accessing critical resources should remain a matter of priority action, we also need to strength our technological capabilities to develop alternative that need less raw material resources or substitute them with more abundantly available alternatives. This calls for a dedicated long term program that encompasses relevant R&D and its translation to commercialization. Development of fusion energy, fluid hydrocarbon substitutes, functional materials, low cost high technology products that deliver desired objectives more effectively and with minimum use of materials, are some examples of thrust areas that need to be pursued in a concerted manner. A standing framework that monitors and responds to resource security vulnerabilities that could emerge and implements a long term program to make the country self-reliant in terms of critical resources should be established.

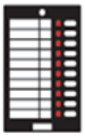
4. PROVIDING LEARNER CENTRIC, LANGUAGE NEUTRAL AND HOLISTIC EDUCATION TO ALL: Our fourth Grand Challenge relates to the provision of educational opportunities to all Indians. Technology makes it possible for us to move beyond the bane of predetermined, one-size-fits-all content; we can now provide individualized curriculum that is relevant to the needs, interests and talents of each individual learner. Assimilation of material deemed essential for all learners can be accomplished at different paces and sequences. Language need no longer be a barrier to learning. Education and skilling would then be liberating and empowe4ring, imparting the values to make complete human and social beings while being relevant in terms of life and livelihood possibilities.

5. UNDERSTANDING NATIONAL CLIMATE PATTERNS AND ADAPTING TO THEM: Notwithstanding impressive strides taken as a result of Green Revolution, our agriculture is still principally dependent on the monsoon rains. Even slight alternation in its course or time table and the agricultural output along with its contribution to the GDP suffers badly. Granting that monsoon is a variable phenomenon making it difficult to chart its progress, we cannot afford to be at the mercy of fickle weather. The problem has been compounded further in recent years with worldwide-climate change having disturbed the weather routine to which we have become accustomed for decades. This cannot be allowed to continue as it can harm our development plans disastrously-All efforts would have to be made, therefore, to understand the national weather pattern along with global atmospheric conditions impacting on it, so as to be able to provide reliable forecasts at the micro level.

This would require not only modernizing our weather forecast machinery but also designing newer models of prediction. |We will have to take simultaneous steps to impress on all stakeholders the necessity of adapting to the changed patterns. Grand as this challenge is, it is well within the potential of technological and human resources we have at our disposal.

6. MAKING INDIA NON-FOSSIL FUEL BASED: Presently, energy use at a level commensurate with high Human Development Index poses the twin challenge of energy resource sustainability and threat of climate change. Coal is the mainstay of our electricity supply and may come under severe stress in a few decades. Most of our hydrocarbon needs are presently met through imports. In the business as usual mode, our energy import bill which is already very high is likely to become unmanageable. The Grand Challenge then is to be free from such heavy dependence on fossil energy. Luckily, our energy resource endowment in thorium, renewable energy (primarily solar) and as yet untapped hydro potential is quite favorable to this objective. Since there are a number of India specific challenges that are unlikely to be of priority interest to most other countries, we need focused indigenous efforts to develop and deploy these technologies. Technologies for production of electricity as well as fluid hydrocarbon substitutes would need to be developed. A comprehensive implementation structure to deal with policies, technology development and rapid large scale deployment of non-fossil energy in the country would have to be put in place.

7. TAKING THE RAILWAY TO LEH AND TAWANG: If the difficult Katra-Banihal stretch is completed by 2017, we would finally have a rail link to the Kashmir valley in our 70th year of independence. Our seventh Grand Challenge would be to push onwards toward Kargiland Leh, tunneling through the Great Himalayas. On the eastern flank of the Himalayas, we would also need to take the railway line across the Brahmaputra and all the way to Tawang. This Grand Challenge would be an order of magnitude more difficult than tunneling under the Pir Panjal range to Kashmir. Nevertheless, is strategic terms, these is no Grand Challenge more urgent than building a rail link connecting the rest of India to these important national peripheries.



8. ENSURING LOCATION AND ABILITY INDEPENDENT ELECTORAL AND FINANCIAL EMPOWERMENT: Our eighth Grand Challenge would be to leverage technology to empower all Indians politically and financially irrespective of their location and ability. Holding free and fair election is a mammoth logistical task in our country, requiring massive and sustained contributions from our administrative and security personnel. Un fortunately, millions are not able to exercise their franchise as they are unable to reach a specific location either due to disability or other reasons. Many do not possess even the physical ability to press button or cast votes through paper ballots or other means. Technology can overcome these barriers and would empower each citizen politically and financially in real sense.

9. DEVELOPING COMMERCIALLY VIABLE DECENTRALISED AND DISTRIBUTED ENERGY FOR ALL: To ensure universal availability of quality power to all households and establishments, we will need innovative solutions for generation, transmission and distribution. While the present approach of establishing centralized and large scale power generation facilities is a basic necessity for quickly addressing the energy availability short fall at the macro level, we will always be in catch up more for ensuring techno-commercial viability in urban pockets, rural and remote areas. To address this issue, we will require the development and integration of technologies that enable synchronous utilization of renewable energy sources, micro-generation facilities, smart grids, and extra energy efficient equipment. The Grande challenge will be execution of the above in a manner that is commercially sustainable, environmentally benign, weather and resource independent, and for all time to come

10. ENSURING UNIVERSAL ECO-FRIENDLY WSTE MANAGEMENT: Of the several important initiatives that would be integral to our last Grand Challenge, perhaps the most important would be to provide modern sanitation facilities to 100% of our households. By 2035, automotive components and electronic devices would be ubiquitous, so ensuring their 100% recycling would be essential. All biodegradable wastes would be decomposed and converted into energy, thereby eliminating large landfills on the edges of cities. Manufacturing processes would produce minimal waste, which would be inputs into other production cycles. India would be well on the path to becoming a zero waste economy.

Appendix

Letter from VC to Industries/Organisations

Greetings from University of Kerala. I write this in connection with improving research and innovation in University of Kerala. The University is now in a process of upgrading its quality. This letter is not for seeking funds, but for something more valuable to the University: *ideas for our researchers and students to take up as challenge.*

The University of Kerala's research programs are by and large a process of research training. Though it does produce new and useful knowledge, there is no effort to translate the research results to field. One of the reasons identified is that the research problem is chosen without concern for the field application. Therefore, the University is making an attempt to contact R & D organizations, Govt. Departments as well as Industries and compile a set of problems that they are interested in. This may involve a new process, product or material. Such a compilation would be a starting point to orient University's research to industry/business needs, which I am sure, you agree, is a key point in innovation.

I therefore request you to kindly propose problems of interest to your organization that can be taken up by students and researchers from our University. Scientists, technologists and managerial experts of your organisation may be asked to suggest this. Both minor and major problems can be suggested, without concern for facilities and funds, at this point of time. The compilation will be published by the University so as to trigger interest among research and post-graduate students of the University.

I request you to animate scientists, technologists, managerial experts and other professionals of your organization to cooperate with this socially useful attempt to create University- Industry Linkage. I look forward to your kind and valuable response.

With warm Regards,
Sincerely

Prof. P.K. Radhakrishnan

The links mentioned below are pointers to University's research and innovation profile.

1. Summaries of PhD research from the University in 2015
   http://www.iqac.keralauniversity.ac.in/docs/PhD_Summaries_V4-Final.pdf
2. Consultancy brochure of the University.
   http://www.iqac.keralauniversity.ac.in/docs/Consultancy_Brochure_Ver_16.pdf
3. Innovation in University of Kerala:
   http://www.iqac.keralauniversity.ac.in/docs/eBook_on_Uok_INNOVATION.pdf

Ideas Obtained through Social Media

Comments & suggestions obtained

Director, IQAC invited suggestions through Facebook with a message as follows: Dear Friends, based on your professional and personal experiences, please spare some time to suggest what our Universities and Colleges should do as research. There are about 5000 PhD level researchers, 50,000 engineers and about 3 Lakh arts and science students doing projects at any point of time. If 1% can be useful to the society, that would mean 3500 useful things for the society. It could be something like "An effective way to stop overhead tanks from overflowing" OR "A way to improve the life of mosquito bats" OR "An efficient way to stack books in a small library" OR "Design a chair for people with back aches" OR "A way to reorganise exam paper marking to make it more time-efficient" OR "reusing pencil shavings as packing material" .... There could be mega suggestions or micro suggestions. You don't need to be an expert, and don't worry about workability of your suggestions. It can also be any subject area. This will be comped as citizen inputs...

Those working in industries/business can perhaps look at it like this: If someone is ready to do something free that will make your business better, what would u wish?

Biji Tharakan Thomas (Via Social Media): I have my 'idea diary' with lot of projects/ products. Some I want to keep to convert "for profit" businesses. How about a "Fruits/Veggies" washer? Just like a mini desktop washing machine which will wash fruits and vegetable and leaves without damage but remove all dirt pesticides wax etc.

Jayan Chandrasekharan (Via Social Media): A series of workshop for university guides to spread "Wisconsin Idea" may be worth a try. https://en.wikipedia.org/wiki/Wisconsin_Idea

Clif Kussmaul (Via Social Media): On improved educational methods to help more people, more quickly and efficiently, learn to think, solve problems, etc.

Prince Prasad (Via Social Media): Good research is all about improving society. But since our knowledge is very limited, we feel most of them are irrelevant. When Newton was doing research on gravitation, there were people who thought, his work is useless. Years after when you realize that an apple falling and a satellite orbiting obey Newton's law of gravitation, you realize the value of research. I think plenty of useful research is going on and I feel, our stress must be on how to facilitate quality research rather than choosing some topics.

Mahesh Thampy (Via Social Media): How young criminals and anti-socials are born, what to do to tap those wasted potentials.. the research would bring in wonders to the society.

Bhagyalekshmy Saraswathy (Via Social Media): Bringing up of modern children and society in a useful manner to both family and nation can be made a topic for research.

Dinesh Kumar .A (Via Social Media): I think we are not getting even 0.1% fruitful products or ideas from these researchers. If one can find out a chemical (already in our blood)which can attract mosquitoes, then we could easily kill them without the danger of allethren in mosquito repellent. (Comment: it is a killer idea - synthetic blood just to catch mosquitoes).

PeEm Ji (Via Social Media): UGC/AICTE sponsored research is a waste of time in India... What they find out is unfortunately useful only for some salary hike! Again the losers are students as their teachers won't get enough time to teach them! This research activity leads to academic decline only! All research has to done in research institutions, otherwise our educational institutions will become places of no use for students! (Comment: Teaching and Research are inseparable. We must try to make research useful to society. One of the ways is to take up problems that the society suggests, that create artificial problems and solve them. Pls suggest your wish projects)

Dr. Thrivikramji Kyth: (Via Social Media): Bring back the PhD adjudication process that existed in the early nineties or prior to that. Eliminating the foreign examiner from the adjudication panel was a watershed decision. Then started the quid pro quo in phD thesis adjudication. I recall a friends comment about adjudication. If you want to reject the thesis then you got to read it. Or else… With all Indian examiners now even the language is gone awry, leave alone the cut pate thing… So don't wait for other universities to emulate. Let this university in Trivandrum undo the damage done by the reform.

Dr. Thrivikramji Kyth: (Via Social Media): Ours is a nation with lots of street children growing up into adulthood. I wish somebody did take the initiative of building parallel bars and ring clusters distributed in different parts of the town but avoiding the lock key and gated system type of

B. Ramachandran Nair: (Via Social Media): Before launching a training program on large/massive scale, we normally go for a training for trainers. Similarly we should develop a cadre of guides. It is a herculean task.

Premsankar Chakkingal: (Via Social Media): Technology should applied to various sectors for social change .. for example , Put GIS in all KSTRC bus so general public can track them easily ... Small Electronic devices for daily needs of farmers and rural workers . We should focus on electronic manufacturing - The fab labs in my college and other 21 fab labs planning to implement in Kerala will boost the rural electronic innovation ....

Jibin Thomas: (Via Social Media): There is lot of plastic waste getting generated every day. If we can develop a method/machine which can help recycle say plastic bottles (power, mould them in to something useful…eg. Interlocking bricks), I believe it will be a solution for a major social problem. If an affordable system is created which can be operated by a few people in a standalone model, then multiple units like this can create employment for many across different parts of state/country. Reduce plastic waste…and Create Employment locally!!!

Large number are people are migrating inside and outside the country for different reasons…some are voluntary…some are forced. Solutions that lower communication barriers can go a long way in reducing the problems due to migration. I will be more than willing to collaborate as we are working on certain mobile based software for translation, interpreting etc. based on social collaboration. Creating something that reduce barriers of inter-language communications can go a long way in enhancing understanding of other cultures and will surely help in the overall progress.

Jibin Thomas: (Via Social Media): a) A method for ranking the translators for correctness based on their contributions from a given period of time. b) A method for analyzing/identifying key patterns of what people are requesting translation c) ways of aiding language learning by means of such a platform. ..Can give more specifics if required.

Suja Nair: (Via Social Media): A very simple case - When a project is prepared to clean the drains, it stops with clearing the waste in the drains and keeping it just on the sides of the drain/road. And in the next day rain , the entire thing just falls into the drain again . Don't we need to add this component into this project - to take away the removed waste being left on roadsides ? Somebody can study why this pattern is being followed and what can be done to avoid such situations - not much intellectual research needed, but it will be useful to the society as a whole.

Kevin Mathew Sunny: (Via Social Media): It would be a great thing if research can be fuelled into the social `Sciences`. Axioms of developing the society has to be fine-tuned, but the research towards this has been neglected both at the pre and post stages.

Anoop P. Ambika: (Via Social Media): Here is a list of wish projects 1. Quality Check Sticks for food products. A litmus paper/pregnancy detector kind needle which will change colour/scale if

there is huge amount of heavy metals is a certain food products. 2. Vacuum controlled waste disposer. Train waste bins are often spilling over with cups by the time we reach Cochin from TVM. If there is a waste bin which will compress these plastics and papers using some vacuum pumping a small bin could hold a lot more waste 3. Wearable device to predict a fall. Before someone falls down because of a vertigo there are certain vitals that gets changed. If we can have a wearable device which could predict these, it will be a great help for the old age 4. Virtual reality teaching. If I have something like Ocular Rift for my math studies, why do I need a school.

Gopikrishan Gopalakrishnan: (Via Social Media): Bio gas plants in every 1 or 2 kms to collect and convert waste to bio gas and use it in say small tea stalls etc. or provide at subsidized rate to hotels which are ready to participate. Plant trees also on road side which can be fertilized from the slush. Automated cleaning robot for small canals and drainage pipes. Glass doubling up as solar panels which can extract energy form facades of buildings at least to light up the common areas. Cost effective automated parking solutions to de congest.

Chandran Parameswaran: (Via Social Media): If you look around through a designer's eye, one can see hundreds of things which need improvement. For example, there can be a standard design for signal posts. The present designs never stand straight, there will be many cables hanging on it. I don't think hardly any study has been done regarding the visibility of drivers, chances of errors in reading the lights etc.

Ahmed Thajudin: (Via Social Media): An important step in stopping "paid projects". Please try to put in a portal so that it is helpful for the faculty and students of engineering colleges and polytechnics. Out research centres (Kerala has research centres for every food grain, spice and vegetable) can also follow this.

Eldho Joy: (Via Social Media): Why not think about projects on "animal intelligence". For instance how ants follow a straight line path and carry twice its own wweight< Also, road accidents and the drugs and'drinking'?

Akhil S. Nair: (Via Social Media): There are a lot of projects and innovative ideas have been depicted on each State Science Exhibitions and at the district level. But these are not given much exploration at a practical zone.

Jacob Bijo: (Via Social Media): What about perfecting small scale domestic water purification systems that run on alte3rnate energy??? Many places in and around Kochi and Kuttanadu will require lots of them (not very sure of the southern parts) Several attempts are reported from our neighboring state in this field – based on nanotechnology.

Achuthsankar S. Nair: Can we have a low cost sensor developed to detect pesticides? Here is a use-case: You buy tomatoes. Take it home and put ½ a kg in ½ litre of water for 10 minutes. Now dip the sensor in the water, it should indicate the pesticide presence of the most prevalent type and indicate quantity also.

-A machine to extract the edible part of jack fruit (Chakka Polikkunna Yanthram).

UNIVERSITY OF KERALA

PUBLIC RELATIONS WING

PRESS CUTTING

Name of Paper : മാതൃഭൂമി ദിനപത്രം

Date of Issue : 29/7/2016 29/7/2016

Caption of News Item :

29/7/16

PUBLIC RELATIONS OFFICER

QUALITY IMPROVEMENT

KU receives innovative research ideas

EXPRESS NEWS SERVICE @ T'Puram

THE University of Kerala has received numerous innovative ideas on research from the industry and the academia as part of the institution's attempts to improve its quality.

The University had invited suggestions for research from organisations and general public. This was in line with a recommendation from the National Assessment and Accreditation Council (NAAC) that Universities should seek inputs from stakeholders on its activities.

Kerala Metals & Minerals Limited (KMML) Chavara has asked the University to take up the issue of handling over two lakh metric tonne of iron oxide and solid from Effluent Treatment Plant located in their premises.

The University also contacted alumni holding key positions across the world via e-mail. Dr Madan Thangavelu of University of Cambridge urged the University of Kerala to focus on multi-disciplinary research involving the biodiversity of the state.

Combining aspects of chemistry, botany, biotechnology, computing and Ayurveda was cited as an example of multi-disciplinary research.

Developing a mini desktop fruits/vegetables washer, low-cost sensor for detecting heavy metal in food,

low-cost sensors to detect food adulterants and low-cost domestic water purification were among the research suggestions the University received from social media.

The University has now asked the general public, organisations and movements for ideas on research. The suggestions can be sent to Director, Internal Quality Assurance Cell (IQAC), University Campus, Palayam, Thiruvananthapuram - 695034. Email ID: team.iqac@gmail.com.

29/7/16