

Nation Building and Happiness¹

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Good afternoon ladies and gentlemen,

Thank you Mr. Upadhyay for the introduction. I am delighted and honored to be here. After all when does a villager from rural India get a chance to address and interact with the future leaders of Indian Railways – an organization which employees close to 1.5 million people, has a huge and separate budget and is the backbone of mobility in India? So when Prof. Kalyani Sethuraman invited me to this talk I jumped at the opportunity.

As told to you by Mr. Upadhyaya, I am a mechanical engineer and became one because of railways! I have always been fascinated by trains and when I was small the event to look forward to was a visit to Lucknow railway station to either receive or see off somebody. These visits invariably led me to spend most of my time standing in front of a steam engine. The power of steam, noise and wheels spinning on the rails when the train started used to fill me with awe and kindled in me the desire to become an engineer. Initially I wanted to be an engine driver because I felt that he was the most powerful and knowledgeable person regarding the steam engine but when I saw the helper oiling the pistons I thought that was a better job !

The reason why I am telling you all this is that generations of young minds were greatly influenced by these powerful machines whose innards and working was easily visible and showed the power of steam. I have therefore always felt that no or limited access to such technologies and exposure only to computers, mobiles, video games etc. somehow is subliminally influencing the young minds to opt for software and computer engineering. The romance of big machines, etc. is lost to most of the young children and we see fewer and fewer people going for hardware engineering and more and more students going in management and other software programs. A society that focuses mostly on software systems is doomed in the long run since I feel the wealth of the country is created by hardware both in manufacturing and in agriculture. That is the essence of nation building.

Hence my talk today will be about how to use high technology to improve the quality of life of rural poor and bring them into mainstream development and how in doing so will create happiness all around.

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What is Nation Building?

All life forms want a comfortable and happy life. All our endeavors are based on maximizing our happiness. In case of human beings it is a sum of two things, personal happiness and better environment.

Personal happiness can be obtained in a variety of ways. Basically one becomes happy when one is contented or at peace with oneself. This happiness comes because of internal security. We will talk about how to achieve this later in my talk.

Environmental happiness or making our environment better is what I call nation building. It is the enabling environment which makes you feel happy to live in, to work in and just be a part of it. This environmental happiness also gives us a sense of belonging, makes us feel proud of our surroundings and gives us a sense of ownership. If each one of us creates a happy environment for our work and living then we will make India a great place to live. Each one of us should therefore work towards improving our immediate environment both at work and the place we live so that it becomes nice and cheerful. Then we will be genuinely proud to be a part of it.

For environmental happiness and nation building we need excellent young technologists and managers like you.

How can you help in Nation Building?

First accept that whatever we are today is because of the country and the society. Hence we should give something back to the society. Gratitude is the essence of being human.

I believe that the whole purpose of our existence is to increase personal and societal infrastructure. Personal infrastructure includes personal health, happiness and general well being. By improving our personal "infrastructure" we become better human beings and it helps in our emotional growth and evolution. By giving back to the society so that its "infrastructure" increases we help in mankind's evolution. Both these activities when carried out simultaneously can give us a great joy and satisfaction.

Most of us work towards fulfilling our basic needs. But once our basic needs are satisfied, all of us long for some meaningful existence. Even very rich are looking for some meaningful actions and purpose in their life. Happiness cannot be obtained by money alone. It only comes when there is some meaning to life. That meaning, I feel comes from helping other less fortunate people and by giving something back to the society.

Since you are all going to be part of Government of India's elite services, just doing your job properly and in an excellent manner is your contribution to society. Be an agent of change. The challenge should be to make Indian Railways the most efficient and cost-effective mobility service which will provide a very pleasant experience to the passengers. I have traveled in some of the great trains of Europe and it is really a very

pleasurable and exciting experience right from entering the station till the journey is completed. The same cannot be said about the Indian trains and Railway system. That is the biggest challenge for all of you and if you make a difference it will be your great contribution to the society and in improving the environment. Later on in my talk I have listed some technological challenges for you to think about.

I am sure you will come across stumbling blocks put forward by bureaucracy and politicians. Removing them for efficient working of railways is also a great challenge and your contribution to the society.

For some of you who will feel overwhelmed by the bureaucracy and slow pace of change in Railways, you can do the society work by trying to change and improve your immediate environment, whether it is near your home or your community.

Nevertheless in all these things be very active and this activity will give you a positive frame of mind. Develop a "can do" approach. Everything is possible with a strong will and a good attitude. At young age the mind is very active and hence you should be bubbling with ideas. Best ideas are the maximum ideas. The more ideas you have the higher is the chance of producing a great idea.

Be positive in your approach. Rise above the negative things and make them irrelevant. This is how nature works. It evolves by branching out and only that branch, which interacts properly with the environment, survives and evolves. The other branch, which does not, withers away. Thus nature never suppresses the other branch – it becomes automatically irrelevant.

Hence never try to bring others down. Rise up over them and you will benefit by this strategy. This is a higher mode of development where the whole system is upgraded and lifted up. Learn to follow nature in everything you do specially in design. It has evolved through millions of years and hence has great design templates to copy and emulate. Thus the mantra of design should be biomimicry. We will talk about this when we discuss the technological challenges facing Railways.

Don't worry about the outcome. Positive things will happen if you are honest and conscientious in your work. You are doing the society work for your benefit namely discipline and discovery. Besides you will also feel tremendous satisfaction in helping others. Every work you do will help you learn new things and will help in increasing your "infrastructure". If you have this attitude then any work you do becomes enjoyable. Never say "what is in it for me". That is a negative attitude.

What are the issues in Nation Building?

Around 60% of our rural population lives in very primitive conditions. They have no electricity and their lives are in darkness. This is a sorry state of affairs even 64 years after independence. They use inefficient kerosene lanterns for light, primitive and ancient biomass cook stoves for cooking, and have no clean drinking water. Modern

technology somehow has not touched their lives. In cities we take all these things for granted. Thus at the flick of a switch we get light; turn on the gas for cooking and open the tap for drinking water. Yet for the majority of rural population this is luxury.

Besides the poor quality of end product the devices used by them create tremendous health problems. Thus there are estimates that around 300,000 deaths per year in rural areas of India are attributable to inhaling smoke from the inefficient and primitive biomass stoves. Similarly lack of clean drinking water kills about half a million children every year in rural areas.

Without these people getting into the mainstream development process, environment cannot be improved and India cannot become a super economic power. Around 54% of India's population is below the age of 25 years and most of them live in rural areas and are unemployed. This huge mass of energetic youth with increased aspirations because of mass media, is the engine of development. Creation of rural-based enterprises is the best way to generate employment, create wealth, improve their quality of life and bring these people into mainstream of development. Our leaders are talking about making India the third biggest economy by 2012. Unless the lives of rural population are improved this will not be possible.

So what are the technological challenges and strategies to solve these problems ?

High Technology for Rural Development

Around 65-70% of our population depends upon agriculture directly or indirectly. Not only it provides food for the country but also has a huge potential for producing energy. Hence agriculture can provide both food and energy security for India and can drastically improve the quality of life of rural population by creating wealth and employment.

However for this to happen there is a need to use high technology for rural applications. High technology allows the conversion of dilute locally available energy resources like biomass, solar, wind etc. into useful end-products and services. Our rural areas, as you all know, are blessed with enough resources of biomass, sun and wind.

Sophisticated technology allows the development of very efficient systems and this is what is needed in rural areas. In this process we need to follow nature and so the mantra of technology development should be biomimicry.

Natural systems have evolved into very efficient materials and energy converters. In this process, size of the system reduces and its efficiency and complexity increases. Some of our designs and technologies are following this strategy. For example, computer chips, cell phones, power plants, etc. are all becoming very efficient, small in size and complex. Technology developers should follow this strategy in developing rural technologies. In fact, much more sophisticated thought and "high" technology is required for solving rural problems since the materials and energy resources available are limited and often only

available in "dilute forms". Thus the strategy of high technology allows maximum energy and materials to be extracted for useful end products.

Farming for Energy

India produces close to 600-800 million tons/year of agricultural residues. Most of these residues are burnt in the fields to solve the waste disposal problem. Not only does this create tremendous air pollution but this burning is also a waste of an important energy source.

These agricultural residues can theoretically produce via lignocellulosic conversion about 150 billion liter/year of ethanol which can take care of about 50% of India's total oil demand. Similarly if we go via pyrolysis oil route then it can provide around 80% of India's diesel demand. Pyrolysis oil is produced by rapid heating of biomass to 600-700°C and quenching the smoke rapidly to produce oil. This oil with suitable modifications is very close to diesel in characteristics.

Alternatively if these residues are burnt in the biomass-based power plants then they can produce close to 80,000 MW of electricity or nearly 50% of India's total installed capacity. Biomass power plant technology is very well developed and there are close to 91 plants in India with installed capacity of about 500 MW.

Thus the use of residues for energy production can substantially ease India's present energy crisis and can be a Rs. 2 lakh crore/year industry. At the same time the use of biomass for energy production can also produce about 50 million jobs in rural areas. Hence farming for energy can not only create huge wealth in rural areas but can also solve India's energy problem.

However for this to happen two things are necessary. Firstly farmers need to be paid for the agricultural residues.

It is a peculiar aspect of farming that only 25-40% of its produce fetches money and the rest 60-75% are agricultural residues and have to be discarded. No industry can run on such norms where 3/4th of its produce is not sold and in fact discarded. Yet for farming we accept these norms.

When agricultural residues are capable of producing very high quality energy like liquid fuels and electricity, they should be given very good price. Our estimates show that with proper pricing of these residues a farmer can easily earn about Rs. 5000 to Rs. 7000/acre/season by selling them for energy production.

Any marginal farmer can produce agricultural residues even if the main crop fails. The income from these residues can give him benefits even in the case of distress sale of his crop and this is the best hedge against farmers' suicides. I also feel that unless and until the farmer gets remuneration from his entire produce, farming will never become

economically viable. This is an aspect of farming which should be understood by policy planners.

The second aspect of farming is the need for very high science and technology inputs in it.

Presently most of the agriculture in India and other developing countries still exists in stone ages. There is very little mechanization and ancient agronomic practices are used. The problem has also been compounded by the fact that because of land reforms in India the land holdings have reduced thereby restricting the use of existing big and heavy farm machines. In fact this farm size reduction could be a boon in disguise since it enables the use of precision agriculture which can reduce inputs and increase productivity and is becoming popular in western countries.

Thus very extensive R&D is required for developing efficient farm machinery for small farms. This requires inputs from very bright young scientists and engineers. Presently all the bright students opt for engineering, medicine, MBA, etc. and so agricultural sciences and engineering do not attract them.

One of the major problems of farming today is that it is becoming very non-remunerative and hence farmers' children do not want to get into it. There is a general refrain that farming is not a dignified profession any more and that the sons of farmers are not considered to be a "marriageable commodity" ! Besides being uneconomic, farming is also hard work. By developing high technology farming equipment like small combines, harvesters, baling machines etc., it is quite possible that farming can be made less labour-intensive and more attractive to younger generation and with production of energy and fertilizer from agriculture residues it can also become very remunerative. Once farming becomes remunerative it will also become glamorous !

Water Issues

However, for farming to increase so that it can bear the load of food and energy production, adequate water supply has to be ensured. To my mind supply of adequate water to rural areas and poor regions of the world is a much bigger challenge than even energy availability, and where you engineers and technologists can play an important role. I feel that rainwater harvesting technology, and management should be a compulsory minor in all educational Institutes like this.

With the coming of green revolution in India, there has been an extensive use of water, resulting in shortages in some parts of the country. Not only is there a water shortage, but lack of clean potable water results in millions of deaths every year due to diarrhea. This is despite the fact that there is enough rainfall. Every year India receives ~ 4000 billion cubic meters of rainfall, whereas the present yearly water consumption is only 650 billion cubic meters or 16% of the total rainfall. Thus theoretically we have enough clean water, but the rainfall is not evenly distributed over India and it comes in short spells, thereby pointing to the need for rainwater harvesting and storage programs.

However, the issues of rainwater harvesting and its supply to the community in rural areas raise a question of who will own the water bodies. This is a touchy issue and quite a few developing countries are grappling with it. I feel there is a need for the local governments to develop policies so that rural water utilities can be set up which can harvest the rainwater, store and clean it and then supply this water to a village throughout the year. These water utilities may also be able to buy water from the government through the existing canal system.

Presently, all the water utilities in India are owned by the government and this leads to corruption in supply of water and its very inefficient usage. In 2003, the Government of India passed a revolutionary electricity act allowing for the first time the private players to produce, sell and distribute electricity anywhere in the country. This act has allowed power producers to break free from the clutches of inefficient and corrupt government power utilities. I feel a similar water act will help in the efficient supply of water to rural and urban areas.

NARI's Contribution to Rural Development

I will now tell you a little bit about what our rural based science and technology NGO has done. All our work is listed [on our website](#). We work mainly in areas of agriculture, renewable energy, animal husbandry and sustainable development. We are a small Institute with a staff of about 35 and work on a shoestring budget.

However we are proud of our accomplishments. For example the saffola oil that some of you may be consuming comes from our safflower varieties. Similarly we pioneered the introduction of sweet sorghum as an alternative crop for ethanol production in India in early 1970s. Today because of our efforts there is a national program on the use of sweet sorghum as a crop for ethanol production and about 20 government and private institutes are involved in this program. The national program of biomass based power generation which is managed presently by MNRE was based on our work. NARI was the principal author of this national policy.

Similarly we introduced the FecB gene for twinning into local Deccani sheep so that shepherds income could be increased. For this we received CSIR's highest award for rural development in 2008.

In all these inventions we followed our basic philosophy of use of high technology for rural applications.

And now I will talk a little bit about our new invention of a device which provides simultaneously light and clean cooking energy for rural households. This invention got us the [Globe Forum Award](#) in Stockholm, Sweden couple of years back.

This invention called [Lanstove](#) which runs on kerosene provides simultaneously very bright light (equivalent to that from a 250-300 W incandescent bulb) and cooks a complete meal for a family of 5. Besides it also boils 10 liters of water to make it

potable. Thus one device provides cooking, lighting and clean drinking water. We have tested the lanstove in 35 huts which never had electricity and are expanding the program.

The lanstove is extremely efficient and is nearly 5 times more efficient than electric cooking and lighting. This is a prime example of how to utilize all the energies for end usage – something that nature does all the time.

Our work is a small example of what can be done in rural development even with limited resources. However I feel that with the resources that India has both in terms of money and its people, and with each one of us working conscientiously and diligently to give something back to the society, we can make India as the greatest country on this earth.

I will now briefly tell you something about what I perceive as challenges for the railways

- (1) Railways were the pioneers of steam power in the world and I feel that this technology should be revived, with the use of modern materials and technologies, to produce 100-500 kW power for villages. The energy source will be agricultural residues.
- (2) High speed trains running on liquid fuels should be developed. Running them on overhead wires is a retrograde step. In nature the life forms store energy and use it for movement. That is the basis of automobile revolution. Railways should follow it.
- (3) Use of new light weight materials for rails, locomotives and cars.
- (4) Set up a world class R&D Institute for Railways. The great strides in Spanish and Chinese railways have come because of tremendous R&D in these countries. The present RDSO in Lucknow has not been up to the mark in R&D and sponsored projects with IITs have not yielded very good results.

I am aware that all of you know much more about technological problems associated with Railways but it is a good idea to develop a modern approach in keeping up with the technological developments taking place in other areas of engineering.

Developing a modern, energy efficient and cost effective railways will be a great challenge and your contribution to nation building.

How helping others creates happiness?

However for an individual to work for the society it is necessary that he/she should be secure and happy. You can only give back to the society when your stomach is full and your “personal infrastructure” is adequate. And now I will discuss about how to be secure and achieve personal happiness.

Happiness is a state of mind. You start feeling happy when you become internally secure. Deep thought or Sanyam helps in creating internal calmness and security. When you become honest with yourself and try to understand yourself deeply you start becoming internally secure.

You are all young. At this age the brain is at its peak. Thus it continuously seeks inputs to process them and without a focus, results in jumping from one thought to another. This results in attention deficit disorder (ADD) that we often observe in youngsters. This ADD is good for reacting to crisis as most animals do but is not conducive to deep thinking which results in solutions and vision.

For achieving happiness it is necessary that mind be calmed. An ADD-prone mind is full of stress, anger and hence is unhappy. The mind can be calmed by the practice of Yoga. By focusing on a single thought for a long time the brain power is enhanced and mind becomes calm. A powerful brain can move mountains and becomes very innovative and sensitive to the surroundings and propels us to start changing our environment to make it better. This is the genesis of nation building.

At the same time this powerful brain or processor can analyze every situation very efficiently and gives us perspective in life by providing internal security. This in turn makes us less greedy for materials and resources and hence helps us become sustainable in our lifestyle. This is the genesis of corruption free society.

Every citizen of this earth aspires to a decent lifestyle. However with tremendous onslaught of mass media most aspire to have a lifestyle of western nations which is mostly unsustainable. For example, in U.S. the per capita energy consumption is 350 GJ/yr, whereas in India it is a low of 18 GJ/yr. If each citizen of India tries to live an American lifestyle then the whole world's energy resources will be needed only for India.

I believe an [emotionally satisfying lifestyle is possible](#) with much less energy than is consumed by an average U.S. citizen. Thus an energy consumption of 40-60 GJ/person/yr or one-seventh that of the US can provide a decent and emotionally satisfying lifestyle. This type of energy consumption will put much less pressure on earth's resources besides reducing substantially the environmental pollution. However it can be possible only if we become spiritual and follow the maxim of "simple living and high thinking".

With the reduction or removal of greed an individual becomes happy. A happy individual can then give back to society both knowledge and resources. This is the essence of environment improvement and nation building. Thus if we all work together for creating happiness in our personal lives and for nation building then India can teach the world a new way towards sustainable living.

I will end this talk by telling you a story, a tale from our ancient scriptures, the *Puranas*. It is a typical Indian story of a sage and his disciples.

The sage asks his disciples, "When does the night end?" And the disciples say, "At dawn, of course." The sage says, "I know that. But when does the night end and the dawn begin?"

The first disciple, who is from the tropical south of India replies: "When the first glimmer of light across the sky reveals the fronds of the coconut trees swaying in the breeze, that is when the night ends and the dawn begins". The sage says "no".

So the second disciple, who is from the cold north, ventures : "When the first streaks of sunshine make the snow gleam white on the mountaintops of the Himalayas, that is when the night ends and the dawn begins".

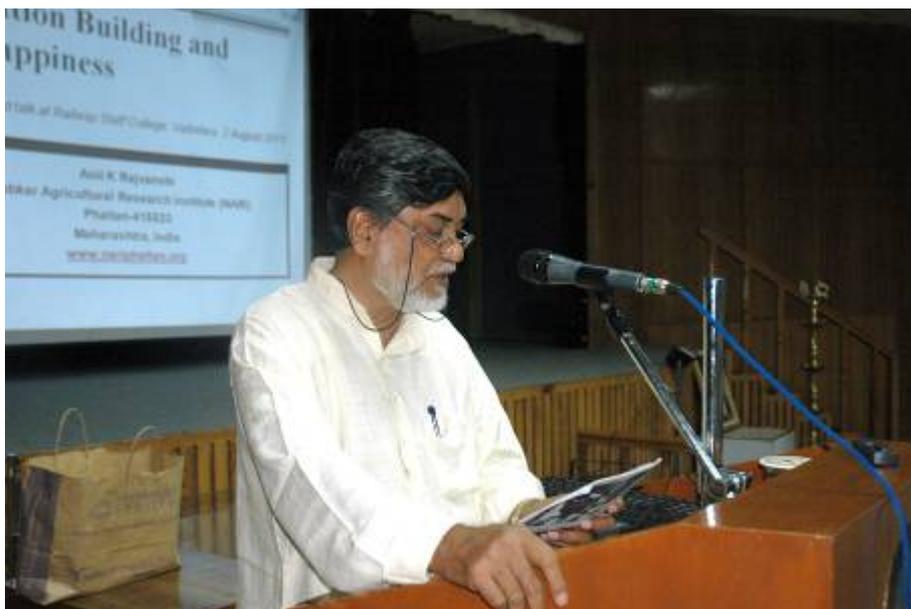
The sage says, "No, my sons, when two travelers from opposite ends of our land meet and embrace each other as brothers, and when they realize they sleep under the same sky, see the same stars and dream the same dreams – that is when the night ends and the dawn begins".

I feel that when bright young people like you who have ample opportunities to improve the quality of life of rural population through technology and resources, then it will bring in the dawn of a new and happy India. This is the essence of nation building.

Thank you.

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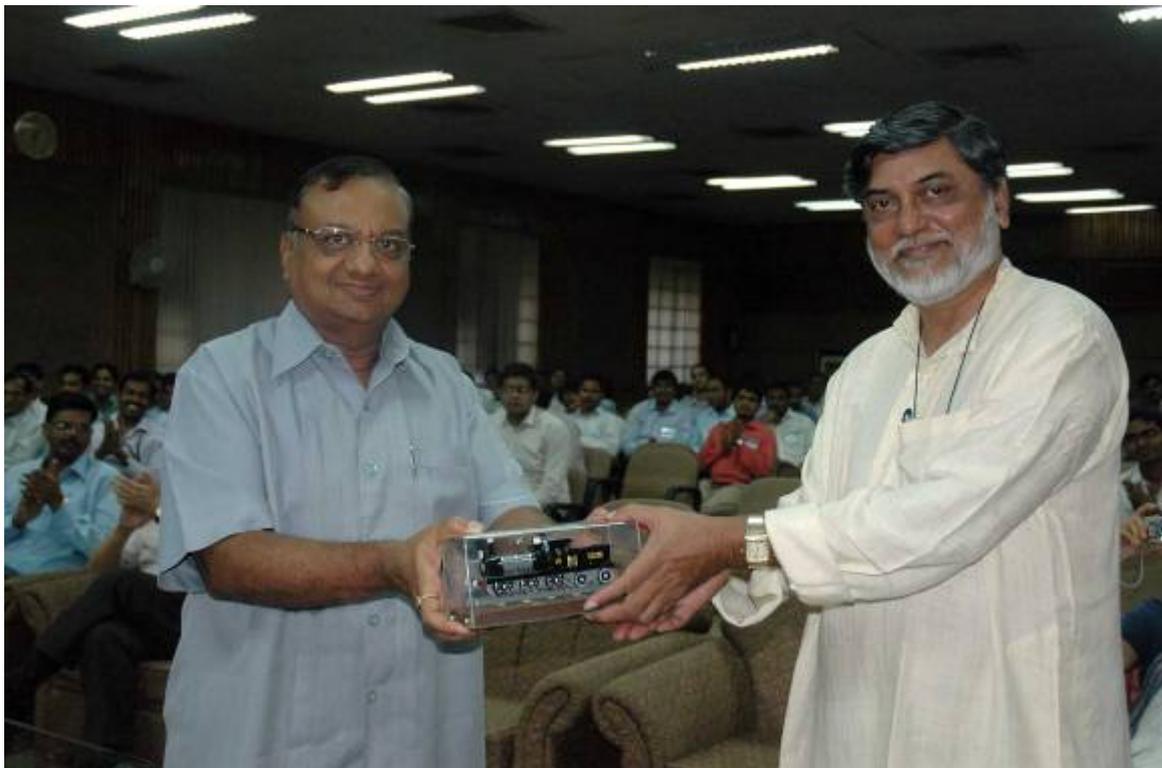
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AKR delivering the lecture



From R to L; Dr. Nandini Nimbkar; AKR; and Niraj Kumar, DG, Railway Staff College



DG Niraj Kumar giving a memento to AKR