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**CULTIVATING THE COURAGE TO CREATE: A FUNDAMENTAL REQUIREMENT TO
BUILD A DYNAMIC AND VIBRANT ECONOMY**

Partha S. Ghosh
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Since my graduation from IIT Kharagpur in 1971, I have debated different socio-economic issues related to India with various learned friends in India and around the world. In my own humble way, both as a student at MIT and Harvard, and as a consultant to large and medium size corporations around the world, I have tried to draw out a few lessons from more advanced economies which I think are applicable to India.

While I am sure my *learning* is by no means complete and hope it will continue for the rest of my life, I would like to build on those lessons today and share with you my views on the challenges ahead for India and the strategic role our future generations, particularly the scientists and technologists, must play in building a nation we can all be proud of. Specifically, I would like to address four major themes:

1. India's Current Crisis: A Question of Survival?
2. Hope Beyond the Crisis: Cultivating "Courage" and Re-energizing our "Will"
3. Role of Scientists and Technology Specialists: Seizing Opportunities to Create
4. Renewing India's Image on the World Stage

As I begin to elaborate on these four points, I would like to share with you excerpts from two speeches made by the great Indian spiritual leader Vivekananda about 100 years ago. Following his return from the World Congress of Religions in Chicago, Vivekananda addressed a group of Indian leaders in Calcutta on the theme "How India Can Conquer the world. " In his concluding remarks, he said, "Arise, awake, and stop not until the desire end is reached. Be not afraid, for all great power, throughout the history of humanity, has been with the people. From out of their ranks have come all the greatest geniuses of the world, and history can only repeat itself. Be not afraid of anything. You will do marvelous job. "

Later the same year he spoke on "The Future of India" to an audience in Madras. At that time, he observed, "The problems in India are more complicated, more momentous than the problems in any other country's economy... The solution is not by bringing down the higher but by raising the lower up to the level, of the higher.

Vivekananda's words of wisdom are as valid today as at the time he addressed his audiences world-wide. I believe he succinctly captured the nature of our

problems and the spirit in which those problems must be solved. Unfortunately, India's problems have increased several-fold since Vivekananda's time. We are now living in a world which is significantly more hostile, competitive, turbulent and volatile. The fact that our problems have multiplied clearly indicates that we have failed to identify and eliminate the basic causes of India's miseries.

On a more positive note, however, we should recognize that scientific and technological developments leave a much wider range of solution options at our disposal. Today, I would like to explore the possible strategic options for our country, and the actions our scientists and technology specialists in particular, and our future generation in general, could take to begin the process of building a "New India" - an India which stands for hope, freedom for mankind, respect for the individual; an India in which each citizen can fully express his/her latent energy, whether in fields or factories, the Olympics or business, and truly become a part of the creative process; an India which the entire world accepts as a true leader of human Progress.

That is my vision of India. We may be far from it, but we will never achieve it if we do not make bold moves toward it now, following innovative, carefully designed programs aimed at leveraging our grass roots strengths to exploit global trends.

FACING THE CRISES: A QUESTION OF SURVIVAL?

Since independence, our population has doubled (and now accounts for more than 15% of the global population), but we have increasingly become out-of-step with more progressive economies. We have become a very lonely nation.

Today, *very few* world leaders in business and government talk of India when they discuss major economic issues, except to make sympathetic remarks about our multidimensional problems. In a world where progressive economies are increasingly integrated, we are facing a major crisis which to me raises the question, "*Will India survive?*"

We have a time bomb on our hands. *Unless* we act fast, face the underlying causes of our problems rather than the symptoms, and design strategies to eliminate them, the bomb will explode, leading to a disintegration process which will be difficult to arrest.

Our economists, social scientists, political leaders and historians can be divided into two major groups when we view our problem as one of survival.

One group, the more optimistic, is internally oriented. This group says that we have survived almost 2000 years of various forms of turmoil, so why not another 25-30 years (a time span limited by their own time horizon)? This group also takes comfort in comparisons between our current aggregate level of economic activities and that of 1950. Indeed, our production of *electricity*, steel, fertilizers, and fiber has increased dramatically. We have put in place several world-class engineering, technological and management institutions, like the IITS, and the IIMs, and can talk intelligently about the modern marvels of artificial intelligence, aviation, biotechnology, nuclear and semiconductor technologies. In light of all our

achievements, this group argues, why should survival be an issue? India should slowly unfold itself at its own pace. *What's the big rush?*

The other group is less optimistic and more externally oriented. This group believes in comparing India's performance with that of other countries, in measuring economic output on per capita basis. It recognizes that we live in a dynamic, competitive and yet interdependent world where opportunities have limited life cycles. I count myself as a member of this group - not pessimistic- but definitely concerned.

Today, the *number* of Indians living below the poverty line exceeds two-thirds of Africa's total population; the number of illiterates is equal to the entire population of Latin America. If the projected trends in population growth come true and no fundamental reforms take place, my rough analyses indicate that by the year 2000 the number of people living below the poverty line will climb to a level almost equal to fifty percent of India's total population in 1978. Illiteracy, of course, 'will also soar. Could we revive our pre-independence courage to face and solve these *problems boldly?*

Other countries have pulled themselves out of enormous social and economic difficulties . South Korea (whose population is approximately equivalent to that of Tamil Nadu or West Bengal) had, in the early 1950s, a per capita GNP similar to ours, (India Avg. = approx. US\$30/capita), Korea Avg. = approx. \$60/capita.) Today, on a per capita basis, South Korea is 10 times richer than India. Last year its per capita GNP increased by \$500/capita, which is almost twice India's total per capita GNP (\$270/capita). Singapore, with only a quarter of Bombay or Calcutta's population, exported \$35 billion of goods in 1987, while our exports in that year totaled only \$12 billion -- approximately the same amount that Hong Kong earns from garment exports alone. Why don't we want to market India?

In the field of science and technology also we have fallen behind, and it's no wonder - with an R&D budget of only about \$1.5 billion we try to cover the entire range of industries and scientific disciplines, from steel to silicon, from space to marine research, from agriculture to aviation and automotive technologies. In none of these areas have we been able to meet critical mass requirements. Over the last quarter century, the share of patents filed by Indian nationals in the U.S has decreased: even after 100 years of experience in steel, we need an *injection* of foreign technologies from time to time to keep our *steel* plants alive. Soon after the establishment of Nobel Prize, we were able to earn two Nobel Prizes in less than 20 years; since independence, despite being far greater number of institutions of higher learning we have not claimed a single Nobel Prize. "where has our creative genius disappeared?"

Another worrisome trend is the widening gap between our product/ service standards and those of the rest of the world. Over the past forty *years*, we have protected our industries, discouraging foreign companies from participating in our economy. As a result, we have created a country of shortages, and have become accustomed to accepting whatever is available. Meanwhile, our industries have fallen out of sync with their counterparts in more progressive economies.

The biggest revolution in recent history is what I call the "consumer revolution." *Because* of the exponential increase in consumers' power to choose, corporations worldwide have had to constantly improve the value and quality of products and services. This phenomenon has *been* the single most important force behind economic development. In our country, however, the trend has been exactly the opposite. *Our industry today* is the victim of our own short-sightedness and lack of perspective, and we have not been able to devise a strategy to correct its long-standing bad habits. we have fallen into a vicious cycle. With our *share* of exports decreasing, we do not generate sufficient hard currency. That discourages investments, and leads to a decline in relative economic efficiency, This in turn inhibit c employment creation, breeding more poverty and more frustrations.

Today, our situation is so dismal that "hope" and "vision" are often discounted as purely theoretical and idealistic terms; "opportunistic moves" and "beating the system" are considered pragmatic and wise. in the absence of hope and vision, and as the relative size of the economic pie shrinks, people. In the name of religion, caste, language, and political ideologies - fight with one another, further draining our creative energies.

Largely as a result of British legacy (which justifiably emphasized control) and partly because of the "beating the system" mentality of our people, government departments have become institutions of "Don'ts," bogged down by complex rules and systems, as opposed to "Do's", based on simplicity and transparent working methods In a country where there is so much to accomplish, wrestling with the "Don'ts" only adds to the frustration and further contributes to our decline.

Because of the speed at which so many countries are surging ahead, it is becoming increasingly unattractive and difficult for the advanced nations to link up with India. With the rise of developing countries in Asia-Pacific and the signs of Gorbachov's success with Perestrioka in the U. S. S. R ., opportunities for marketing Indian products/services and attracting foreign capital are drying up. We have missed the postwar economic wave of the fifties and sixties, we have missed the consumer revolution wave of the *seventies* and eighties, and now we are missing both the globalization wave and the Asia-Pacific wave.

Furthermore, unless we undertake major, innovative educational reforms, even those children lucky enough to attend school will have difficulty relating to their counterparts in other countries. The massive gap between the environments in which they grow up, the wide disparities in available technologies, and the major differences in exposure to progressive thought, will all take a heavy toll. When the children in our schools assume leadership positions, India's inability to relate with other *nations* will only be further reinforced.

All these factors contribute to my idea of the "time bomb" and force me to raise the issue of survival. Today, we find ourselves in an environment of increasing economic uncertainty and instability, and with no zeal consensus as to what is happening, what is causing it or what should be done next.

In my view, people who regard our speed of economic progress as adequate, who argue that our fundamentals are sound, and who believe we do not need an Indian version of Perestroika, are being unfair to themselves and their own children and

grandchildren.

Recognizing reality can be painful, and addressing it is even more painful, requiring sacrifices and courage.

HOPE BEYOND THE CRISIS' CULTIVATING "COURAGE" AND "RE-ENERGIZING OUR "WILL"

I do believe, however, that if we are willing to honestly face the fundamental issues which are holding us back, and take a few, bold steps forward, India will experience a reawakening. To do this, however, we need to ignite our courage, and re-energize our will.

I do believe that the speed at which we grow will only be determined by the breadth and depth our own vision of the future, by our own will to act, and by our own ability to orchestrate individual and collective initiatives at various levels of the society.

Postwar Japan, South Korea, Taiwan, and more recently China_ have all shown us that leveraging on a country's own socioeconomic strengths and mobilizing the creative energies of the people can bring about rapid progress.

In drawing up our future plans, we must first put a few fundamentals in place. Specifically I would like to spend a few moments on two basic points which should be at the heart of India's future strategy.

- o Resurrection of ancient values

- o Redefinition of economic principles and processes

Resurrection of Ancient Values; Power of Benevolence and *Faith* in Ourselves

The most valuable asset we have is our own rich philosophical heritage. In India, great religions have mingled for thousands of years and have given birth to philosophical principles which have been studied and admired all over the world. Of course, we must not forget that many of these philosophical principles have been distorted and misapplied by the privileged to ensure that they could remain in power -- giving rise to caste systems, religious riots, etc.

If we put aside such distortions, and go back to the basics of our ancient philosophy, we should be able to identify "values" which could indeed be the greatest source of our creative energy.

Key highlights of Indian philosophy include emphasis on (i) "quality of the process" rather than the "end product" only (Gita), (ii) the individual at the center of the creative process, (iii) balanced development of the individual along the three dimensions - spiritual (Bhakti. Yoga), intellectual (Gyan Yoga)

and physical (Karma Yoga), (iv) the individual's ability to detach from pleasure and pain, and (v) the *permanence* of the creative process and the impermanence of the individual, Interestingly enough, it is just these principles which have been the driving forces behind progress in many advanced economies, particularly Japan

For example, in my view, a continual urge to improve the quality of individual/group activities -- be they in the kitchen, the shopfloor, or the boardroom -- is what drives the creative process in Japan. A society which is constantly looking for ways to do things better will naturally create products and services which are of the highest quality and the best value. To illustrate this point, let me take an example from Japan's color TV industry. Between 1970-80, the total labor processing time was reduced by a factor of five while the number of defects dropped from 280 to 40 per million -sets. Japanese industry and agriculture are full of such examples.

Japan also has benefited from nurturing a respect for the individual. If an individual respects himself/herself, he/she will obviously expect others to respect him/her, too -- and that respect can only be earned if an individual first demonstrate his/her respect to the others. Through this process, what I call the "respect loop" develops, instilling a sense of trust and mutual dependence, and accordingly the confidence to perform. In the recent history, Japan has been able to use the "respect loop" to build a "trust- based" team spirit, and in turn solve many difficult problems - earthquakes and typhoons, wartime destruction, oil shocks, and more *recently*, the yen shock.

During my travels, I have seen evidence that values similar to those in ancient Indian philosophy have -- whether consciously or unconsciously -- adopted in the advanced nations. in Switzerland, Scandinavia, and the European Community, these values have played a part in the blossoming of art, music, science, technology, and above all, quality of life. Countries which have deviated from those values have had to face the consequences. Many observers believe that some of the recent problems in the U.S. are directly attributable to the weakening of the country's "moral fabric".

I believe the time has come to resurrect our ancient values and repair the holes in our "moral fabric." As a starting point perhaps we could organize a national campaign to draw the attention of our masses, as well as our elite, to the continuing significance of our traditional philosophies.

Redefinition of our Economic Principles & Processes:

In India we suffer from a syndrome which limits the effectiveness of every program we undertake. The genesis of this syndrome may have been in our single-minded emphasis on ideologies like "self- reliance" and our relative lack of concern about "microeconomic" realities. Our economic plans and macroeconomic policies are influenced by ideologies *which* may sound *catchy* but do *not* adequately take into *account* the global economic forces *at work*, *which* in turn are driven by technological trends, priorities of giant corporations like General Motors and consumer attitudes/fashions in advanced countries. We cannot ignore the behavior of wealthy nations in designing our own economic strategy, After all, to make our own country rich we must earn wealth from where wealth resides. By doing so, we will be able to create employment, put pennies in the pockets of our masses, stimulate domestic demand, generate wealth for new investments, create further employment and so on and so forth, entering into the virtuous circle of growth.

To make all this possible, we need to design "winning" economic strategies, prioritizing a handful of employment-intensive, export-oriented industries and building on our country's strengths. My own back-of-the--envelope analyses lead me to believe that if those priority industries are carefully chosen and innovative strategies are defined and executed for the selected industries, a per capita GNP of \$750 to \$1000

will be within our reach by the year 2000.

My direct and indirect experience with country strategies and the planning processes of more progressive economies, however, suggests that we must first totally overhaul our economic planning process *in* order to make this happen. Specifically, I believe we should follow a three-step sequence:

1. First, economic objectives (e.g. GNP/per capita, literacy rates, etc.) should be set on the basis of our own vision and the economic targets of competing nations.
2. Next, we should carry out an economic strategy development exercise, spelling out how to achieve those objectives, and providing clear "*Do's*" and "*Don'ts*" (as opposed "*to do little bit of everything*"). Our economic strategies should define how India should *leverage* global trends, and it's own hard and soft assets to solve internal problems, and should prioritize *specific* industries.
3. Finally, we should draw up plans detailing the action programs that will support each strategy, spelling out targets, resources and short- and long-term budgets.

Throughout this *three-step* process, the central and state governments must work with each other and in *consultation* with industry and academia to ensure that our best thinking is cross-fertilized and that consensus is achieved. The key to successful strategy is to get *people* involved; unfortunately, too many *people* who want to be the part of the process and could indeed make major contribution, today feel left out, and as a result the doers/thinkers do not have any sense of *ownership* of our current plans and the plans themselves do not get implemented. At the end of each planning cycle, we find ourselves almost right where we started.

ROLE OF SCIENTISTS & TECHNOLOGY SPECIALISTS: SEIZING OPPORTUNITIES TO CREATE

In a world where the pace of technological change is increasing almost every hour, and new opportunities are constantly being created, India's current and future generations of scientists and technology specialists should be able to harness the dynamic power of technology to break our status-quo. Since the *Industrial Revolution*, great social and economic aspirations of *societies* around the world have hinged on science and *technology*. *Science* and technology have provided the foundation for establishing long-range economic policies, for coping with energy, natural resource and environmental preservation issues, for satisfying citizen demands for *improvement* of living standards -- in short, for paving new *avenues* for human progress and creating a stable, prosperous future for mankind.

It is ironic that India, with the third largest pool of engineers in *the* world (after the U.S. and U. S. S.R.), has not been able to leverage on existing technologies to educate and inspire the people and ensure that our products and services are competitive worldwide.

To correct this situation, we need to channel *the creative* energies of our *scientists* and technological specialists toward a few fundamental problems. Only when technologies are wisely adapted to our needs and traditions at the grass roots level will we truly stimulate production. If technological innovation, as a key problem-solving and competitive tool, does not become an integral part of our everyday industrial and economic thinking, we will run the *risk* of further slipping backwards, perhaps to a point where we are irreversibly behind.

with so many economic challenges ahead of us, I believe we should consider organizing

an all out "technology campaign" around what I call the "3Es" - energy, education and efficiency. The primary objective of this campaign would be to resolve shortages in the 3Es, thereby stimulating gainful employment creation, which in turn would allow us to build a "*launching pad*" for the 21st Century.

Energy: India's biggest natural resource is the energy it receives from nature - sun and rain (*lakes, rivers and ocean*). In developing and applying technologies to harness this important natural resource, I believe we must take an integrated view toward the cycles of nature, the rains and solar energy -- we must be determined to use them to solve our problems instead of allowing them to victimize us. In short, we need to adopt a broadly-scoped, proactive policy of "energy management.", strategic components of which could be as follows:

1. Our solar energy strategy should focus on efficient conversion of solar energy to direct applications like heating and electricity through solar cells, and most importantly, indirect storage through natural photosynthesis (i.e., involving strategic management of forestry). Particularly to help the rural sector, we should harness biotechnologies to breed fast-growing trees with high calorific values, so that we could improve the energy efficiency of our forestry on a per acre basis, and in turn improve our ecological balance. By the same token, we should exploit, biotechnologies for our agricultural/food processing sectors and thereby make the conversion of solar energy for our daily use more Efficient.

Solar cells are reality today, with uses that go far beyond electronic gadgets. Small villages for which *electricity* through conventional means (i.e. draining power from the grid) is expensive -- can now enjoy their own solar powered electricity, Similarly, industrial and commercial energy requirements can be economically met with solar energy., In 1982 only nine megawatts of solar cells were sold worldwide; in 1987, sales had reached about 30 megawatts. This growth has largely resulted from increase in the *efficiencies* of photovoltaic cells through improvements in both conversion efficiencies and manufacturing costs. If India could do a good job developing a solar energy conversion system and find alternative ways to commercialize Fuel Cells to ensure a stable supply of electric power in remote villages, it could indeed become a major force in the emerging of global energy industry which could fundamentally transform by the first decade of the next century.

2. Our water management strategy needs to be developed in parallel with the solar energy strategy, specifically along two dimensions: (i) managing the cycles of nature by compensating for the shortage of one source with the surplus of other source and (ii) developing innovative distribution and recycling methods by adopting energy- and capital-efficient purification technologies (e.g. utilization of membranes) which ensure a proper ecological balance.

3. An infrastructure development strategy for management of solar energy and water is also required. For example, we should consider creating lakes and canals (in conjunction 'with our tourism strategy) as buffers against drought and flooding; at the same time, we *should* establish an efficient delivery and maintenance services to introduce and service solar heaters, solar energy collectors, fuel cells -; and cogeneration systems at remote locations.

4. Furthermore, we must improve the conversion efficiency of our conventional coal-fired power plants by adopting the latest electronic control technologies and modern *management* methods for power plants and national/State *electricity* grids. We should also apply more advanced preventive and maintenance technologies to boost the very low utilization *levels* of many of our current plants.

5. Similarly, we must make a major effort to increase our overall efficiency in energy utilization. This will require our engineers to design energy-efficient cooking ovens for village families, and to identify new ways to save energy in middle-class households- and in industry. It is indeed ironic that in India, where energy is a scarce resource, efficiency of energy conversion and *energy* utilization levels are one of *the* lowest in the world.

By undertaking these programs as part of an integrated energy strategy, we will not only create millions of jobs, but will also gain *easy* access to *cheap* power, a basic requirement for making our industry competitive and our economy weatherproof. This in turn will allow us to prepare for the next stage of economic growth (beyond the *year* 2000), when we will be ready to pursue more value-added opportunities.

With a little entrepreneurship, we could create thousands of opportunities for our engineers to design and commercialize new indigenous products and in the process develop new industries for India. Government has to implement policies which will encourage industrialists, engineers and entrepreneurs to rally around the word "energy" and in process develop affordable solutions to our energy problems. Civil engineers should work with communications engineers, who in turn should work with physicists and chemists, to implement *an integrated energy model*. The concept is practical, and its implementation should be lot of fun. Needless to say, once it is implemented, it should help us make tremendous strides toward eliminating one of our greatest obstacles to growth.

Education: The most important asset of any country is its people. In India, we need to develop innovative approaches to educate our masses, instill in them a basic work ethic, and regularly share with them essential knowledge on India's priority industries and their progress vis-a-vis *competing* countries, We could, for example

- Explore the possibility of equipping every village with rugged user-friendly monitors which would be accesible 24 hours a day. With new broadband communication technologies emerging indeed as villages are connected by the year 2000 India could aim at turly launching robust programs on mass education. Once a national education policy framework is established, each state could run its own programs in the appropriate local language, in English and/or in Hindi. Needless to say, this would be a great opportunity for cross-fertilization and cooperation among electronics, communications and software engineers.
- Introduce the concept of three shifts in high schools, colleges and universities to overcome the chronic shortage of good educational facilities in our urban areas. This would allow us to triple the output of skilled people, provide more opportunities for our teachers and professors, and also improve the economics of our educational institutions.
- Require high school and university students to spend six weeks *every* school year teaching the underprivileged. In many countries, participation in national defense programs is compulsory; why don't we adapt a similar approach aimed at education?
- Introduce the concept of "weekend engineers," an idea I picked up in China last week: Engineers -- i.e. *students* and professors from universities, as well as employees of large corporations -- would spend one weekend every month providing free consulting services to small entrepreneurs in *cities*, towns and villages, thereby helping improve the quality of working methods, products

and services.

I can think of half a dozen other ideas and I am sure you can come up with even brighter ones. In any case, we must find *innovative*, cost-effective ways to mobilize our educated masses and get them involved in the nation building effort. We must make the most efficient use of available facilities, technologies and resources to build a more dynamic education system -- a system which *encourages* students, teachers, and graduates alike to share their perspectives and problem solving skills with less privileged people, *and* spread the wealth of knowledge around the nation.

Efficiency: India's wage rates rank among the world's lowest; at the same time, relative to many countries, we are endowed with significant natural resources. Yet Indian products are not competitive compared with those from countries where wage rates are 'the highest. This is because we do not place a priority on time and accordingly allow our productivity levels to lag *far*; behind. Indian managers, laborers, and government officials alike often appear to enjoy making other *people* wait, without *realizing* that all of us suffer as a result.

Clearly, we need to cultivate in our people an appreciation for the value of time. But we will have to go beyond that if we want to raise our productivity. I would like to see our experts in industrial engineering and operations research take a genuine interest in the average Indian's daily life, identifying the bottlenecks which limit the "real" time available to perform any given job, and assessing the efficiency level of current work methods. Through this approach, I *believe* we can identify many new opportunities for economic growth, and begin to take urgently-needed steps toward blocking three types of "value leakages":

1. "Value leakage" because of poor alignment of the delivery system to customers (i. e. users of products or services),
2. "Value leakage,- because of poorly designed interfaces and long distances between decision makers and doers,
3. "Value leakage" because of inefficient and often *obsolete* work methods.

Please note that I am not suggesting all-out use of robots and computers. (We should of course make selective use of robots and computers, either to complement our own creative power or to carry out tasks which are beyond human physical or intellectual capacity.) More importantly, I would like to emphasize the need for (i) switching our people from the "wait" mode to the "work" mode, and (ii) coming up with fresh ideas as to how a specific task might be carried out. We must not forget that productivity is the basic driving force behind economic progress, we must particularly ask our scientists, engineers and technology specialists to help us eliminate the barriers to achieving higher productivity in the months and years ahead.

In the 1950s and 1960s, Japan imported a great many technologies and machines from the U.S. and West Germany. Since then, the Japanese have been able to exploit these technologies and machines to make major gains in productivity - often far beyond what the original U.S. and West German designers ever dreamed of. For example, the press machines which the Japanese automotive industry imported from West Germany typically required two hours of change over time. Within a decade, however, the Japanese average press change over time was reduced to ten minutes, and in the case of Toyota, it was down to only two minutes.

In India, unfortunately, we have difficulty operating our imported machines even at the specified level of operating efficiency. I refuse to believe that this is because that it is because we cannot. Rather, it is because we do not put our minds to challenging given limits. We need to develop the "courage to think,, and the "will to act". Technologies are not inanimate, they are organic. Unless they are regularly improved, unless "rate-determining" bottlenecks are consistently removed, unless the man-machine interfaces are frequently enhanced, technologies die.

As you graduate, and begin to participate directly in the nation building process, I encourage you to find ways to deal with the issues related to the "**3Es**." No matter what field you enter, the 3Es will have direct *bearing* on your day-to-day work. If the thousands of engineers in this country begin a campaign around the 3Es, even without a grand strategy, we will all benefit from the consequent change. In this context, I would like to suggest that engineering institutes, along with engineering associations, consider promoting contests for innovations in productivity and quality improvement. If all the principal engineering institutes could join in such program, we could carry out a productivity/quality campaign all year round, with each institute sponsoring the campaign for a two-week period.

RENEWING INDIA'S IMAGE ON WORLD STAGE

For many centuries, even before Alexander the Great 'visited' India more than 2500 years ago, India has been a wellspring of inspiration for the whole world. Philosophers and rulers alike *viewed* India as a tremendous source of intellectual, spiritual and material wealth.

Unfortunately, as people from other parts of the world began expressing their interest in India either in the form of military aggression or in quests for spiritual enlightenment and intellectual know-how, our country slid alarmingly - we could neither defend ourselves nor could we sustain our ancient creative processes.

Today, the world's economic and intellectual power centers draw very little inspiration from India. The best indication of this is how poorly India is covered by the foreign media, and how infrequently India's name is mentioned when business, economic and political leaders discuss global issues. In the last two years, for example, the time that I have read of India in the Japanese press has been 'news related only to our floods, droughts, political riots, or the deterioration of cities like Calcutta. Meanwhile, leaders from the economic power centers talk about Latin American potential, Chinese reforms, ASEAN progress, Asian NIEs' global economic role, and Soviet Perestroika, but have *very* little to say about India. How can we regain our rightful place on the world stage?

It is my belief that the only way for us to earn the image we deserve is by working very hard, by delivering to the world ideas, products, and services which are simply better, more *valuable*, and/or more cost-effective than those of any other nation. Let us create success stories in our villages, towns and cities, and let those success stories be a source of inspiration for others. *Let us* practice our ancient principles in our day-to-day lives, and let our products shine on the shelves of supermarkets worldwide. Only then will the legacy of our past be a bright light, and only then will "made in India" signal "superior value" to people around the world. Engineers, technology specialists and scientists are best positioned to make this happen, as they are the ones who will design India's products, and will either stand at the interface between investors and laborers, or will act as owners, creators, engineers and motivators all rolled into one.

In his recent book, *The Rise and Fall of Great Powers*, Professor Paul Kennedy of Yale University notes that the Indian subcontinent accounted for almost 25 percent of world manufacturing output in 1750.

The figure is now less than 1 percent. I think we can extract two messages from this:

- First, given our track record, we should be able to renew our past success. Only about 250 years ago we were the No.2 (after China) manufacturer in the world. Why not go for it again?
- Second, if we don't keep up with technological changes and select our priorities accordingly, we will only fall further and further behind. By missing out on the Industrial Revolution, we have suffered a fifty-fold drop in the share of manufacturing output, despite a four-fold increase in the size of our population. The lost value is difficult to calculate, but it could easily run into several hundred trillion U.S. dollars. Do we want to continue on this path?

To begin the process of change, we need to promote the concept of renewal among all our citizens, and draw upon the strengths and aspirations of each individual. I have often proposed the idea of national economic poll, which our students would carry out by systematically interviewing Indians at all *levels* of society. This would help us gain a better understanding of the dreams of our people at the grass roots level, going beyond the basic need for food, clothes and shelter. Let's try to draw on the dreams of our people. If they cannot dream, let us help them dream. Let us get everyone actively involved in the nation building process, cultivating a new confidence and spirit of renewal throughout India.

Finally I would like to remind ourselves what John F. Kennedy, President of the U S (1961-63), one of the greatest visionaries of the 20th Century had to say on individual's responsibility to the country he/she belongs "*Ask not what your country can do for you - ask what you can do for your country*". Often non-resident Indian friends of mine share with me "*we will return when conditions are right*" I remark back "*it is our responsibility to create the right conditions*".

Thank you very much indeed.