

## WHY "NO" TO TECHNOLOGY-BASED DEVELOPMENT?

Many critics accuse environmentalists of opposing economic development wholesale. But this is not so. Environmentalists oppose development which involves large-scale displacement of people, or severe pollution which affects the health of many or large-scale destruction of nature and of traditional livelihoods of thousands!

Unfortunately today's technology-based development inevitably gives rise to all the above problems. Why is this so? Let me explain.

Science can be divided into pure science and applied science which is basically technology. Research in pure science is mostly restricted to astronomy or space science, quantum physics and ecology (how life survives on this planet). It is applied science or technology which has made modern life possible on this planet. But what in essence is technology? It is redirecting sun's energy towards things that benefit Man only. That is why we feel happy when new inventions increase our amenities and comforts. But it creates imbalances or entropy in nature which we generally designate as pollution.

Moreover, it essentially violates basic laws of physics. Technology on large-scale has only become possible since the discovery of fossil fuels, i.e. coal and oil. These are the cheapest sources of energy on this planet simply because Nature has done the work of concentration of energy over millions of years. We only have to extract these from the earth.

When energy is applied to convert matter, the 2<sup>nd</sup> Law of Thermodynamics tells us, entropy increases. This means more energy and matter are wasted than are converted into useful product. More energy comes out as heat and more matter comes out as waste than are incorporated in the product. In economic terms it involves loss. That is why all modern industry is interested in getting energy, labour, raw materials, land etc. as cheaply as possible. In historical times technological advances were possible only when western nations established political control over nations and people and made them provide resources, labour, energy etc. at almost no cost. They also completely ignored technology created imbalances in nature.

Today all this is not possible for a country like India. Today's technology-based development therefore, is based on grants or subsidies from the govt. Govt. finances research in technology, it makes land and power available at concessional rates, offers tax exemptions, promotes export through subsidies etc. One must clearly understand that technology-based development is impossible without such help.

It creates imbalances in nature and even in our economy. I may recommend everyone to go through two excellent reports prepared by India's leading economists. Their titles are: Desequalizing Growth and The Decline of the Welfare State. In them the economists have clearly shown that poverty and inequality of income have greatly increased in India since 1990 i.e. when the present prime minister liberalized the economy and imported technology.

There are many instances of the use of wrong technology or even dangerous technology promoted by the govt. The latest is the invitation to a French company to install atomic power plants on the Konkan coast. The incipient technology has not yet been successfully tested, has yet to become operational. When Finland adopted it, it created insuperable problems even in its installation. Yet our govt. wants our people to accept it without protest! Such is the pressure of multinationals and western powers who want bolster their economies by exporting technologies that they cannot use in their own lands.

Be assured that technology-based development will never create mass employment as it wants to minimize labour costs to reduce overall cost of production. It may create employment in fields which give rise to high and ostentatious consumption.

The alternative development path is nature based development, i.e. enhancement of our natural resources. Unfortunately there are no facilities in India to train people in this field.

In the present circumstances therefore, social inequalities, social strife, economic disparities and destruction of natural resources in India are likely to continue!

Prakash Gole

## The Technological Man

This is the age of Science & Technology. We all know how they have improved our lives & we are always looking forward to miracles they are expected to achieve tomorrow or day after. The computer and the mobile phone are the symbols of modern life.

Biotechnology is expected to give us the power to control all other life forms for our benefit & provide us with all the wherewithals of life including food, fibre & medicine.

But have we ever stopped to ask the question what really are science & technology?

What do they involve? Why is it that what they do appear as miracles to us? Let us try to answer these questions.

Science tries to unravel the secrets and mysteries of the universe, and enriches our knowledge of the physical & biological world. Technology is the practical manifestation of science. By applying Principles of Science, it provides us newer & newer means & tools to mould & bend the physical & biological world for the benefit of human beings. It caters to our wants & desires, increases our command over resources, thereby saving labour & providing more comforts to human beings. Therefore, it is technology that everyone is enamoured with.

How technology achieves this? that is, how it gives us greater command and control over resources? It does this by diverting & making available exclusively to human beings the natural flows of energy and materials evolved on this planet. What are these natural flows of energy and materials?

Everyone knows that energy flows to us from the Sun. Seventy percent of the energy that strikes the surface of the earth warms the planet, contributes to the movements of winds & sea water & generates the hydrological cycle. A small part of the Sun's energy is converted by plants through photosynthesis into food on which all living beings including humans depend. Sun's energy thus flows from plants to insects & higher animals ( herbivores & carnivores) and enables them to survive, grow, mature & carry out various movements & work. Energy is again used by decomposers to break down plant & animal waste & release nutrients stored in them so that they can be recycled in the system. Materials are then brought back into the system continuing the flows. Energy concentrated in the plants is converted over geological time into coal & oil which we increasingly use as fuels.

Nature therefore, is a wonderful system & an organization whose working depends on these flows of energy & matter. This system has evolved certain processes which ensure continuity of life on this planet. They are: the hydrological cycle which gives us rain & fresh water, the atmospheric balance which ensures a continuous supply of oxygen, the work of decomposers, which assimilates waste & assures the continuation of flows, the making & supply of soil which enables plants to survive & diversify & a pool of genetic resources embodied in various life forms whose survival and multiplication depends on these processes & who become an integral part of Nature's organization.

Technology tinkers & interferes with this system so that more energy & materials are available to human beings. Less energy & materials are then available to other life forms, plants and animals of every hue, thereby affecting their lives & populations. They are deprived because the total flows of energy & matter on this planet are given; these can neither be created nor destroyed as laws of physics inform us.

The principal technologies through which Man interferes with energy & material flows are agriculture & industry, i.e. use of machines. Energy available to a variety of plants is diverted to a single plant by agriculture. The plant then provides ample food to human beings by taking away energy from other plants. More & more lands for agriculture means less plant variety, change in landscape, in soil chemistry, in insect & animal life, more erosion, sediment flows & creation of bare areas. If rivers & streams are used to provide irrigation to agriculture ( through dams & canals ) and power to industry, energy incorporated in rivers & streams which provides wherewithals to a number of riverine plants, animals, fish etc. is diverted to ensure survival of a few plants. The change in river flows affects the life in river basins, percolation & evaporation rates, ground water, the moisture holding capacity of soil and encourages water- logging, salinity & breeding of mosquitoes.

More & more use of machines leads to greater extraction of materials, cratering & gulleying the landscape, creating huge piles of waste, encouraging leaching of minerals & materials, emissions of heat & gases, effluents & chemicals polluting atmosphere, water, soil, & affecting vegetation and animal life.

The question before technological man is: in the pursuit of technology & benefits derived from its use, how far the changes described above should be allowed to proceed? These changes in energy flows & materials affect nature's system & processes which are essential for our survival also. Should we, for our short term benefits, kill the goose that lays the golden egg? Much depends on the question how far the technology be allowed to proceed? The future of you and me, our children and grand children depends on how we handle technology today. Put your conscience to test & answer this question to the best of your abilities!

Prakash Gole

## Google - Ecology of Technology

Is Canada underpopulated? Every Canadian stomps the Earth like 80 peasants.

The gigantism that industrial T confers is largely material. It effectively extends the power of material bodies without doing much for our immaterial minds. Our artifacts increase but our reasoning power & meditations of wisdom stay the same or shrink before a TV set. We must restore a better body/brain ratio. In industry more 'soft' projects, in agr. a larger eyes-to-voice ratio. Latest trend however, is to buy up brain power with the latest T: Artificial intelligence! We need to separate T that assists our symbiosis with the universe from the poisonous & destructive T.

T is an alienating influence. Contact between biosphere & people is steadily reduced. Cut-off from nature's sights and sounds people end up in single-species confinement.

T is the system of values, beliefs & techniques by means of which a society, a culture, taps into, uses & modifies the biosphere. As with mother & fetus, the only safe, sustainable ecological relationship between people & planet is one of moderate demands in a symbiotic alliance. Indeed all organisms are inseparable from their environments except in thought, & life is more an attribute of the Ecosphere than of the organisms encapsulated. Sophisticated T does nothing to reduce the people-planet dependency.

Conventional T is purposive & aggressive. Unless we recognize this fact we slide into the popular technology is neutral mode of thinking that backs away from any kind of control over inventions & shoves off the need for ethical choices at T's leading edge.

A sounder standard for judgement is ecological, measured against the requirements of symbiotic survival in the biosphere. T's goodness or badness is its effects on the earth system.

An appropriate T will respect the air-water-soil-sediment-organism matrix that is the milieu of life.

An inclusive definition of T is: a reproducible & communicable way of doing things. The keyword communicable shifts T into the world of ideas, language, beliefs, culture. Which explains why T-transfer from industrialized to non-industrialized countries is difficult, until,

either directly by acceptance or indirectly by acculturation, the receiving populations adopt western values, beliefs & perceptions. They must believe what we believe & want what we want.

Essential part of T consists of cultural ideas - values & goals espoused by influential people, by business people. That philosophy fixes material production & the built environment.

### Traditional Ecoknowledge

Diverse cultures adapt to various physical & biological landscapes of the Earth. Cultures are subject to historic selection, responding to what is outside them. External forces are environmental conditions - soil, water, climate, biota - large-scale environmental change & local human actions (Co-operation & competition)

The question is whether, in a world rapidly being overrun by Western civilization, the study of any but our own practical engagement in the world has relevance to the current scene? Does historical ecology of various indigenous cultures here & there around the world illuminate our future path?

But what we learn from tribal cultures does not conform to our understanding of biology, ecology, psychology, evolution, geology, cosmology nor to our understanding of sociology, economics & politics.

Can we move towards a sustainable living through traditional cultures or must we develop our brand new set of beliefs. F. Capra in his book web of life defines spirituality as a sense of belonging, a sense of connectedness to the cosmos & ∴ ecological awareness is spiritual in its deepest sense.

One thing we seem to have forgotten along the way is that there is a cost to every technology. Technology has improved productivity in agriculture but have not improved farmers' incomes.

A study by Jules Pretty & Rachel Hux at University of Essex looked at 208 cases from 52 countries to assess sustainable agri. which seeks to make the best use of nature's goods & services as functional inputs. They found that such agri. involves 8.98 million farmers on 28.82 million ha. Another study in Nature, April 17, 2001 issue found that organic systems ranked first in economic & environmental sustainability, integrated systems ranked 2nd & conventional systems last.

We should be putting at least 25 to 30% of our research into exploring appropriate ecological approaches to solving production problems.

Roots of Internet: The cultural & institutional history of W. Europe is, largely, a history of European engagement with classical notions of humanity. Humanism, the feeling of fellowship among human beings & that peculiar, positive <sup>conception of</sup> concern for man, not as sin (soul) & dust - which is how Christianity came to describe mankind, but as mind & body, i.e. reason & form, was born in ancient Greece. - 5<sup>th</sup> C. B.C. Athens

The development of a positive view of man has been a crucial factor in the development of liberal societies. Even wars limited to righteous causes. The Mosaic Law reinforced the primordial sympathy towards kin & neighbour & transformed it into a religio-ethical obligation. Christian humanism extended these sympathies to the whole of mankind. Both placed equal value on every man & universalized the scope of individual commitment & obligation. Humanism, as an impersonal doctrine found its typical application in the impersonal city. Strangers transformed into fellow citizens. City, as a social institution, became synonymous with freedom, of thought & association, for freedom was always territorialized, taking so many forms as there were cities.

Japanese Roots: It seems Japanese reached Japan only recently from Asian mainland, & displaced the Ainu, but one theory is that they evolved from ancient 9c Age people who occupied Japan before 20,000 B.C. There is a theory that they descended from horse-riding nomads to conquer Japan in 4<sup>th</sup> century; they may be descendants of immigrants from Korea who arrived with rice-paddy cultivation in 400 B.C. The mythical story is the sun-goddess Amaterasu sent her grandson Ninigi to island Kagayaka to meet an earthly deity. Ninigi's descendant became the first emperor of Japan in 660 B.C.

Japanese are much concerned about maintaining their traditions. They believe that their distinctive language & culture required uniquely complex developmental processes. Japan has a standing animosity with Korea.

Japan is far more isolated than England. It is the warmest temperate country in the world, giving highest plant productivity in temperate world. An average farm<sup>sq. mile</sup> supports 8 times as many people as does an average <sup>sq. mile</sup> acre in Britain. Forests quickly regenerate (70% forest). Their leafy deciduous forests produced many types of nuts. Surrounding seas teem with Salmon, trout, tuna, sardines, snappers, herring, clams, oysters, shellfish, & sea-weeds. Until 19<sup>th</sup> century Hokkaido & Honshu were

inhabited by Ainu & Japanese occupied southern islands. Ainu are classified as Caucasoids. They may be descendants from original hunter-gatherers while Japanese invaders from Asia mixed.

Japanese language is quite distinctive & has only relation with Korean.

Chinese chronicles depict heavy traffic between Korea & Japan in ancient times.

During Ice Ages Japan was connected to Russia & Korea as sea levels were low.

Dust - has hair human beings must have reached Japan 0.5 m. years ago.

World's oldest known pottery was made in Japan 12,700 yrs ago. Pottery & hunting-gathering went together. The Jomon hunter-gatherers had only slash & burn agri., dog was the only domestic animal, they had no metal tools, no writing, no weaving & little social stratification. There was a population explosion around 100 B.C. & all suitable agri-land was brought under cultivation. Wars became more frequent. Buddhism, writing, horseback riding, ceramics & metallurgical techniques entered through Korea.

Effects of Technology on Commerce: It supports & develops an economy, maintains jobs, level of economic welfare. It increases efficiency & reduces cost.

D. Ludwig, R. Milborn, *Cont. States - Science* Vol. 240, 2 April 1993

Uncertainty, Resource Exploitation & Conservation: lessons from history

Trade → Health → political power - unlimited exploitation of resources  
Lack of controls & replicates hamper scientific understanding, reductionist approach not possible due to complexity of underlying biological & physical systems. Optimum levels of exploitation determined by trial & error. Large levels of natural variability mask the effects of over-exploitation. Over-exploitation is not detectable until it is even irreversible.

Resources as managing humans. Large & immediate gains only govt.s with special interest groups - forestry - govt. subsidy

Harvesting of irregular or fluctuating resources is subject to a ratchet effect. During relatively stable periods, harvesting rates tend to stabilize at positions predicted by steady-state bioeconomic theory. Such levels are often excessive. Sequence of good years encourages additional investment. Conditions normal or below normal leads to appeals to govt. for help. The ratchet effect is caused by the lack of inhibition on investments during good periods, but strong pressure not to disinvest during poor periods. Subsidized industry overharvests the resource.

We shall never attain scientific consensus concerning the systems that are being exploited. There have been many spectacular failures to exploit

resources sustainably, but to date there is no agreement about the limits of new failures. Fishing industry has always opposed quotas. Pacific salmon, Sardine, Peruvian anchoveta all had overexploitation & collapse.

Controlled & replicated experiments are impossible to perform in large-scale systems. Sustainable exploitation is impossible without first overexploiting the resource. Time scales may be so long that observational studies are unlikely to provide timely indications. Scientific certainty & consensus in itself would not prevent overexploitation & destruction of resources. Irrigation in arid lands is known to be destructive but continuous.

Address problems of population growth & excessive use of resources. Confront uncertainty. Once we free ourselves from the illusion that science or technology, if lavishly funded, can provide a solution to resource or conservation problems, appropriate action becomes possible. By and large the scientific community has helped to perpetuate the illusion of sustainable development through scientific & technological progress. Resource problems are really not environmental problems. But human problems under a variety of political, social, & economic systems.

### India's Technology Situation

3rd largest scientific & technical manpower in the world. A govt. publication says that the country's resources are used to derive the maximum output for the benefit of society. About 85 p.c. of funds for science & technology come directly or indirectly from the govt.

The country has mastered the expertise covering the complete nuclear cycle from exploration & mining to power generation & waste management. Presently 8 nuclear stations are producing light-bulb-like KW of electricity. 4 more are planned. The peaceful nuclear programme also includes producing radioisotopes for use in agriculture, industry & research. India is the only 3rd world country to develop its own remote sensing satellite. There is special emphasis on microelectronics, telematics, & high performance computing & software development. A no. of R & D projects have been initiated to help electronics industry. India has 1250 coastal islands, its exclusive economic zone covers 2m. sq. km. & continental shelf extending up to 350 nautical miles.

9 - Aug, 1987 India was allotted a mine site of 150,000 sq km in the Central Indian ocean. A National Institute of Ocean Technology

for harnessing resources of the Coastal belts & Islands.

A dept. of biotechnology was created in 1986. Biotechnology Consortium India Ltd. It will play a catalytic role in bridging the gap between research & development. Initiatives include techniques for gene mapping, conservation of biodiversity & bioindicators research, special programmes for the benefit of scheduled castes & tribes & plantation crops - Cattle herd improvement through embryo transfer technology, in vitro propagation of disease resistant plant varieties for obtaining higher yields, & development of vaccines

Technological Change & Material Flows: Many times technologies for processing or purifying one type of discharge do not destroy the residuals but only alter their form. In the mid-1960s the weight of mineral materials used in the US was estimated at 2422 million tons (fuels 58%, minerals 23%, agri. & fisheries 16% & forestry 7%). Stone, sand & gravel were excluded, mine tailings & soil loss were also excluded as they just move from one location to another.

Env. technology industry developed with the passage of env. legislation. Pollution control techs. proliferated. Research was directed to develop new products that reduced ~~new~~ pollution & improved product quality. A new field of industrial ecology developed focusing on material flow analysis (life cycle planning of products for durability, reuse & recycling & aiming at near complete recycling of materials back into production system at the time of disposal. This to be combined with an analysis of human health & env. risks associated with material flows.

There has been a decline in material intensity of use in the US due to reductions in the weight of automobiles, substitution of plastic for metals, recovery of mercury from fluorescent lights & of elemental sulfur from oil & gas refineries. But intensity of use of plastics, aluminium has risen.

Development of General Purpose Technology  
Tech. change has occurred through development of general purpose technologies over time:

- 1) Steam engine in 19<sup>th</sup> century
- 2) Early 20<sup>th</sup> Century: Electric generator, the dynamo
- 3) Advances in chemistry, chemical engineering
- 4) Computer & semi-conductor industries - later 20<sup>th</sup> century
- 5) Biotechnology - end of 20<sup>th</sup> century

A lengthy period has always been there between initial emergence of these & their general acceptance & impact.

Govt. has always played an important role in technology development, in US etc. It supported agri. tech. through research, automobile industry through highways, it developed computer through military procurement - & biotechnology through basic research.

It has supported basic research in molecular biology  
Client-oriented public research is the close articulation between  
public sector suppliers & the private sector users of knowledge &  
technology. Universities & small entrepreneurial firms conducted  
a much larger share of research.

An important path of technical change in Western economies  
was the development of processes for the conversion of low-value  
raw materials into commercially useful products.

Transition to a sustainable society in developing countries  
will involve: 1) a stable population 2) urban society 3) stable  
material consumption.

Now natural resources will involve renewable & non-rene-  
wable plus social value of env. & eco-system services.

Private sector research & technology development can hardly  
be economically viable unless the product can be embodied in  
proprietary products.

Food production will have to compete with non food uses  
of land & water.

Knowledge about eco-system processes & the role of  
biological diversity remain uncertain. More intensive research  
is required in 1) understanding & monitoring transitions that are  
now underway; 2) identifying safety limits for the earth's life  
support & ecological systems; 3) understanding the process of  
learning about & adapting to the changes in global environment  
and 4) building capacity to design the technology & institutions  
that will be needed for a sustainability transition.

Our knowledge about the role of technology in widening  
the substitutability among natural resources & constructed capital  
is clearly inadequate.

Over the very long run almost no scenario involving conti-  
-nuing economic growth appears sustainable. Elements of physical  
& social environments continued to be understood. There is no  
coherent conceptual intellectual foundation for deciding what to  
develop & what to sustain & over what time period. Sustainability  
indicators are selected more for political acceptability or their consistency  
with ideological commitments than on the basis of objective knowledge  
of ecological & economic implications

## Positive

## Negative

supports & develops economy  
 maintains jobs, economic welfare  
 increases efficiency & reduces cost.  
 scientific consensus & certain  
 - only difficult to achieve.  
 Resource problems are not  
 environmental but social,  
 political & economic (systemic) theory.  
 Indian govt. says that  
 the country's resources used  
 to derive maximum output.  
 consensus.

Invades privacy, manipulation of facts,  
 pornography. Destroying cities, countryside  
 culture, state. Terrorism, increasing  
 cost of installing & maintenance of PC  
 Exploitation not easy to detect. Natural  
 variability masks the effect. Normal rates of  
 exploitation stabilize by steady-state bioeco-  
 nomic theory. Many good years encourage invest-  
 ment. Poor periods clamour for subsidy.  
 - overharvesting results. No scientific

- 85% of funds for develop.  
 of science & technology come  
 from govt. Only country  
 to develop remote sensing  
 satellite.

E = Energy flow  
 N = Nutrient cycling  
 P = Population dynamics  
 B = Biological productivity  
 S = Biological succession  
 M = modification

India has 1250 Coastal islands,  
 its economic zone is 2 m. sq.  
 km.

- Biotechnology programmes  
 include cattle herd improvement  
 through embryo transfer, in vitro  
 propagation of disease resistant  
 plants, for obtaining higher out-  
 put & development of vaccines.

## Technology: Postive Negative

Human mind is the ultimate technology

Scarcity of natural resources  
Demand for env. amenities  
Compensate <sup>w</sup> owners of non-renewable stocks if they do not use them.

Popu. dynamics of a species being exploited.

Optimal scale of human activity.  
Appropriate policy for unique natural environments, endangered species, & biological diversity. Equitable distribution bet. human & non-human beings.  
Present & future generations.

Total global gross national product - 18 trillion per year. Annual value of eco-system services 33 trillion \$.  
A better body/brain ratio. Eyes to acres ratio in agriculture. T that assists our symbiosis with universe.

Moderate demands on ecosphere in a symbiotic alliance. Appropriate T respects the air-water-soil-sediment-organism matrix. T is reproducible & communicable way of doing things.

Enters the world of ideas, language, beliefs, culture. Transfer possible only if populations adopt western values, beliefs & perceptions. Do traditional cultures illuminate our future path? Ecological awareness is spiritual. Ecological approaches to solving production problems. Better control of diseases; save species, prevent catastrophe.

Stores information, knowledge, new social structures & institutions.

Earth as spaceship. A large second hand market necessary for T.

Price of labour high

High value of open access natural resources.

Strain on nature's absorption capacity  
Inaccessible stocks of fossil fuels  
price rises more than the market rate of interest or discount rate.

Spillover effects on environment.  
Undervaluation of open access resources - air, water, natural env. & services.  
Price below marginal social cost  $\rightarrow$  over exploitation.

Power of material bodies, mind  
Artifacts increase but not our wisdom & reasoning  
Poisons & destruction Technology

Man's contact with ecosphere steadily reduced. Cut-off from nature's sights & sounds.  
Modifies ecosphere, breeds new values and beliefs. People planet dependency not reduced. T is purposive & aggressive

not neutral. Shrugs off the need for ethical choices. Beliefs, values, goals of influential & business people are pursued. Material production & built environment fired by tech. Traditional knowledge does not conform to our

knowledge of different disciplines. There is cost to every T. T has improved agricultural productivity but not farmers' incomes.

Concentration of industry & population: crowding, diseases, stresses, crime, anonymity, generation gaps. Frustration, Acid rain, chemical contamination, Mass education, Increased dependence

IT creates unemployment, deskilling jobs, reducing utility of Govt. to control economies

## Technology & Social Systems

Changing patterns of needs & fulfillment

Higher wages in industry, higher productivity - migration from rural.  
Concentration of industries at particular places - concn. of labour

Space constraint, crowding, crime, diseases, stresses

Anonymity, mobility, generation gaps

Unions, cliques, communication - less interaction

Environment:

Acid rain, nuclear test pollution, chemicals in water, soil,  
Dimensions, tourism, animal migrations, oil spills,  
Better understanding - control of disease - life in deserts, some en-  
dangered species, reclaim wilderness, prevent eutrophication

Individual psychology

What to believe? Observations & threats

Specialization - alienation, personal identification with work, reduc-  
-tion in pride, honesty, integrity - frustration, fear, anxiety

TV - carnage in Vietnam brought home - trauma - counter movements

Science fiction movies - fear, robotics, artificial life?

Rate of Change

Stores of information, knowledge & wealth. New social structures

Institutions

Religion, - Galileo, Copernicus, Martin Luther, Protestants

Printing press, comparative studies, travel

Education

Mass education, Home TV

Government

Fundamentalism, Middle class, Economy, Participation  
Privacy - trusts, Copyright

Freedom

Feeling & elevating. Housing, autos, oil crisis,  
Home lighting,

Perception of Reality

New perceptions: Earth as a spaceship

Mutual Dependence

Increased dependence, food, oil, global village.

Substitutes

greatest effect

Agri. - Ancient Civilizations

6. Hon in US south - N & S divide - Civil War

Who is affected? Who puns? Who benefits?

Values

Militarism: high regard for T

Naturalistic: Pleasure & Value in diversity

Ecologicistic: Systemic Studies

Aesthetic:

Symbolic.

Humanistic

Moralistic

Dominianistic: Dominance over nature

Negativistic: Fear & alienation

Role of education

Disruption Technology:

Internet, - regulation - democratic values

Virus-writing, civil disobedience, privacy & spyware, re-interpretation of property, software as infrastructure, state censorship

UNEP Workshop on E TA (Env. Tech. Assessment)

- Manual - Risk assess. - cost-benefit - Subjective.

Weighting procedures

IT is blamed for -

creating unemployment, deskilling jobs, reducing ability of govts to control their economies, invading privacy, increasing delinquency in children, manipulation of the truth, pornography

Destroying cities, threatening countryside, terrorism, anarchy, destroying culture, destabilising state . . .

Predicting of Capabilities of IT = every 18m. to 2 yrs.

IT scenarios of for the 21st Century

Dimension	Enthusiast -	Pessimist -
Social Structure	Golden age of leisure	Homes & home-nets
Economy	Shared affluence	Very rich / very poor
Geography	New rural society	Electronic hermit
Politics	Genuine participation	Manipulation
Consumer Choice	Mass produced individuality	Any colour as long as it is black

Entertainment	Unlimited Choice	Electronic label
Equality & access	Information as equaliser	Capable/incapable
Financial Structure	Cashless society	Informal economy w/ large
State & citizen	Electronic freedom	Big Brother c. 1954

The set-up costs of acquiring a computer, modem etc., and affording the running costs are an issue. Perhaps the need is for a larger secondhand market. Providing computer at home is cheaper than real estate.

Externalities: Techno. developed or enhanced in a given sector of activity are embodied in marketable products & the economic advantages related to this kind appear in the sale & purchase of these products on markets, firms & consumers benefit.

Spread of knowledge & research. Firms cannot appropriate benefits of all their in-house research. Public R&D essential.

Costs: 1) of acquiring new knowledge on market, opportunities & competitors 2) of adapting Tech. to new conditions 3) of adapting to firm itself 4) cost of giving up existing products 5) of not being able to discover alternative ways of research 6) transac. - lion costs between the source firm & recipient firm.

From Vernon W. Ruttan: Technology, Growth & Development  
OUP, New York 2001

### Technology, Resources & Environment

Since the beginning of industrial revolution increases in the price of labour relative to raw materials & capital have been a powerful force for inducing technical change. During the latter half of 20<sup>th</sup> century, increases in the value of open-access natural resources have become a powerful force inducing both technical & institutional change.

In 1952 the US President's Materials Policy Commission first expressed concern about the scarcity of natural resources. But a rise in prices led to discovery of new sources & this scarcity vanished. Then came concern for the capacity of environment to assimilate pollution generated by growth. On the other hand, as std. of living increased, there was intense demand for environmental amenities.

Since late 1980s concerns about global warming, ozone depletion, acid rain, increased. There was also a demand for enhancing environmental quality & sustaining economic growth. Global change has been defined as "transformation processes that operate at a truly planetary scale plus processes that operate at small or scales but are so ubiquitous & pervasive as to assume global importance" (e.g. urban air pollution).

Since non-renewable natural resource stocks provide no service by being held in undeveloped form, owners must be compensated for holding them instead of depleting them as fast as possible. If costs rise as extraction is extended to more marginal deposits, the price can be expected to rise more rapidly than the market rate of interest or the discount rate.

One of the objections was that the price of the raw material itself can rarely be observed. Only the price of the processed raw material can typically be observed. It may depend on capital intensity of the processed raw material, process technology & imperfections in the market for the in situ raw material. The price may not capture spillover effects

on the environment from mining operations.

But during the 1980s & 1990s the real prices of energy resources resumed their downward trend. The real price of most minerals also declined. This was due to substitution of inputs for non-renewable resources & technical changes induced by resource scarcity. Investment in technology development & exploitation of backstop technology typically lags until either physical or economic indicators of scarcity become apparent.

In the case of renewable resources like fisheries the how far a species may be driven to extinction is influenced by the cost of operating fishing vessels relative to the price at which the fish is marketed. But the firms may not understand the pop. dynamics of the species being exploited in a particular area.

The focus of environmental economics is the regulation of the flow of the residuals generated by production & consumption & the valuation of env. amenities. Problem of externalities arise ∴ open-access resources such as water, air & natural environments continue to be undervalued for purposes of market transactions even as their economic value has risen. This is termed as market failure. Where they are priced below their marginal social value, the technical change will be biased to accelerate the demand for these resources. There will be an increasing wedge between the private & social costs of env. services. At first economists considered externalities as an aberration.

With Ecological Economics, there developed a common concern about the optimal scale of human activity - protecting eco-systems from negative externalities of ever expanding human activity. There should be appropriate policies toward ~~our~~ unique natural environments, endangered species and biological diversity. Equitable distribution of resources should not only be between present & future human generations but also between human & non-human beings.

For the entire biosphere, the estimate of the annual value of eco-system services was valued at US \$33 billion comparing with a global gross national product total of around \$18 trillion per year.

## Ecology of Technology

Pre-technology economy in Asia & Africa.

(From: *The European Miracle*, 2nd Ed.: E. L. Jones, Cambridge University Press, 1987).

**Africa** There were towns of some size in Africa (W.) & stone building of moderate skill in Zimbabwe and a chain of forts across S. Africa. There was Kongo empire of 15<sup>th</sup> cen. & empires of ancient Ghana, Mali, & Songhay that rose & fell in the Niger bend. But there was no wheel or plough. Man was part of natural eco-system: The most evocative symbol of this ecological oneness may be the honey guides (Indicator spp), birds commensal with man. They fly, chattering loudly, ahead of bands of hunters, leading them a quarter of a mile or more to the tree hives of wild bees & feeding on the wax after the men have broken open the hives & taken the honey (p. 154).

In wet Africa, notably W. Africa, living was easy but infant mortality was very high. In dry Africa, hunting & gathering was rewarding but agri. was not productive. Centuries of shifting cultivation lowered the productivity of forests. Fire & grazing pressure encouraged thickets of unpalatable shrubs. Indeed, by the opening of the modern period there were no great virgin tropical forests left in Africa (p. 154).

Asian food plants (yams, bananas, rice) arrived as early as 200 B.C. Only 46 million people occupied the continent in 1500 & only 70 m. in 1800. (8% of World).

Use of slaves was common. Trade was in luxury goods — small in bulk but high in value. Without a sizeable

agri. surplus, there was neither much incentive to develop private property rights in land, nor much room for the emergence of multi-layered social stratification. Infertility of soil, insecurity due to raids & wars, ferocious human and animal diseases affected social & economic development.

In S. America among the Aztecs wheel was invented but not used in transport. Agri. surplus had built up populations gradually touching some millions by the 16<sup>th</sup> ce.

At the time of Capt. Cook, there were only 2.5 million people living there (Australia). Australia was palaeolithic.

Till middle ages, Japanese popn. was kept low due to their vulnerability to diseases from Asian mainland. Geophysical disasters were common. In the latter part of Tokugawa period, there were frequent famines. Most foreign contact was forbidden.

The Tokugawa shoguns required the samurai to settle in the castle towns & made the lords, the "daimyo" spend half the year in Tokyo (Edo) under the sankin Kotei system. The enforced urban growth caused an expansion of the market. Tokugawa period also saw a move from communal farming to nuclear farm family. Infanticide was commonly practised.

In deep seated economic ratios & social structures Japan was a surprisingly "western" country (p. 157).

India & China together held 80% of the popn. of the world in 1500.

Ottoman empire in the Near East, Mughal in India & Manchu in China were all military despotisms. Oriental philosophies are said to emphasize emotions, values & cosmologies and relative absence of empirical enquiry & criticism. Tolerance of deviation & lack of a crisp tradition of logical debate may have contributed to failure of science to develop. In Trade & Commerce, Indians had developed competition, specialised brokers, credit instruments, insurance etc. Yet markets were mainly local, transport costs high & state power very arbitrary. Taxation was confiscatory. There was little bulk cargo to stimulate ship-building, dock construction & warehousing. Royal courts also monopolised trading. Little or no capital was formed in the hands of independent-traders. There was no legal system to protect the merchant. There was no mass purchasing power in Asia.

The lack of maritime exploration did deny Asia that special European windfall of food, raw materials, colonies & business opportunities. Technological change was not sufficient to sustain growth. Economic behaviour was distorted by perpetual sense of insecurity. Chinese technological advance was confined to earlier ripening varieties of rice & their diffusion of dryland crops brought-in by Portuguese.

India

Much potential dispute was resolved before it could occur, by the prior dispositions of the caste system. Hindus distrust for touching refuse or excreta produced insanitary conditions & taboos on killing rodents & insects produced potential reservoirs of plague & other diseases. Caste & Joint family system produced social barriers & disincentives to some or limit births & to innovate

Townships still remained throughout history. Each productive nuclear area was separated by hills, forests & deserts. Hence it was difficult to unite a control team. Only Asoke, Mughals & British succeeded. Also there was a permanent N & S divide. Sustained government, innovation & technological progress were not possible. Taxation was high throughout Muslim period. There was no written legal code. Most taxation was devoted to supporting the elite. There were state monopolies extended to grain. Irrigation projects covered 5% of cultivable area. Persian wheel was the only technological advance. Pastures became increasingly scarce.

There was trade & ship-building. Land transport was expensive. Maritime trade was subject to war & piracy. Navigable rivers were few. Towns depended on local agr. & trade & were small. Handicraft production was organised in guilds. Bankers & merchants could not wield any political influence. There was no secular education.

Mughal policy was to prevent aristocracy from becoming hereditary, there were yet many autonomous Hindu states under the empire.

In 1400 China was technologically advanced with water-powered hemp-spinning machine, iron output was 1.5 million tons. Ming dynasty was hostile to mechanical contrivances & demolished the astronomical clock built in 1090. They also retreated from sea. They had trade with east Africa but only in luxury items like rhino horn & pearls which did not stimulate industry. China suffered a defeat in 1528 which was a setback to maritime trade.

## Fisheries

Global fisheries depend on fossil-fuels

In 2004 marine catch was 80.4 m. tonnes

Fuel spent 620 litres per tonne.

Total consumption about 50 billion tonnes of fuel in 2000. (1.2% of world's fuel consumption)

(equivalent to consumption in the Netherlands)

In 2000 fisheries emitted more than 134 m. tonnes of  $\text{CO}_2$

Only a  $\frac{1}{3}$  of the energy generated <sup>by</sup> the engine reaches the propeller and a  $\frac{1}{3}$  of this used in the sea on pulling the net.

In 2000 fisheries directly emitted 134 m. tonnes of  $\text{CO}_2$ . The fuel requirement goes up by 1000 lit. every year. ∴ vessels have to venture into deep seas to fish.

For every gram of protein, the input of fossil fuels for catching fish may be upto about 14 times higher than for the production of vegetable protein. Still this energy use is more efficient than many other animal food production systems

## Public Transport

The share of public transport is decreasing by 0.2 to 1.4 p.c. annually. In India buses accounted for 11% of registered vehicles now they form only 1%.

## Ecology of technology

What is technology

Changes in natural flows

Agri., Pastoralism, Early industry - low scale use of fossil f.

Modern industry - increase in capacity of machines, High use of fossil f.

Impacts: Destruction of fertile lands etc.

Towards a synthesis

Restoration,

Alternative systems of management of resources

the example of water

The landscape approach.

Towards a synthesis:

A knowledge based society where knowledge is conceived as an intelligent understanding of the working of nature & understanding liberty is a system of restraints - a moral & spiritual approach towards consumption. A consumer visualised by A. Smith.

Proposed Sessions:

- 1) The evolution & working of nature & natural systems
- 2) The evolution of modern economic system and its contrast with natural systems
- 3) Significance & impact of the technological age  
The ecology of technology
- 4) Towards a synthesis
- 5) Restoration of nature
- 6) Alternative systems of management of resources - the example of water
- 7) The need for an alternative system of education
- 8) The landscape approach
- 9) The coming of age of Homo sapiens.

## 1) Genesis of today's environmental problems

a) Evolution of the modern econ. system: Generation of surplus  
Consumer sovereignty, The Machine Age & its  
implications - the discovery of new sources of raw materials  
International Trade & the wealth creation - shift in  
production system - rise of inequities - relative scarcity

A dismal science & Rortian & Hobson, failure of education  
to build a moral society. Concentration of purchasing power  
20<sup>th</sup> century - overproduction, failure of demand. Depression

b) Keynesian solution to failure of demand - State intervention  
Obsession with Production. Economic growth

Ignoring just distribution - Growth in prod. will solve all  
problems. Only war can provide a stimulant - as well as  
bring about forced just-distrib. & curtail consump. of the rich.  
Cold war also provided a stimulant.

Losses & competition avoided through mergers & formation  
of giant corporations. - Throwaway culture: Aggregate wants  
are infinite. (Keynesian push). Waste creation & pollution  
- against the cultural grain. - especially stimulated demand  
Subsidies - a right: it creates employment.

Inflation & deficit-financing necessary: it creates employment.  
Increase in debts.

Circulation of money - investment in share market &  
speculation. Mass production - Compulsion to sell.  
Hire purchase & credit-cards.

Faith in technology

b) Nature is a system that works through certain processes  
Evolution of circulation of energy - mechanisms: soil, forest,  
flowing water, the sea, the atmosphere.

Survival instincts - habitats & niches

Mechanisms that do not enter economic transactions

Regenerative & absorptive capacity

Technology used as a substitute to these mechanisms.

Higher costs.

People's use of nature: Extraction & services free of cost.

Overuse of services - thresholds crossed.

Global warming - a case in point.

Increase in scale of extraction & in no. of services.

Limits to growth. - cheap energy & raw materials

Stockholm Conference - 1972 - Oil crisis 1973-74.

Our understanding of the role of energy & matter

Qualitative development & not quantitative. Diversity

Dominant life forms in different ages.

2nd law of Thermodynamics: Entropy. Heat & Waste

Reduction in costs by nature: Rates of metabolism - high

short life span - low, longer span. Trees & grasses.

Surpluses are small & temporary, profits are assured.

Externalities. Subsidies - Moderate profits - the goal.

Nature conservation - a benign predator.

People vs wildlife conflict. EPA & controls.

Environment vs development - Brundtland report.

Eco. system needs permanent. Regenerative & absorptive.

Biokinetics. Subsidies for non-renewables, Nature's Services.

Computer connectivity - expansion of markets

Capital movements. Transport subsidies

Globalization Thatcher & Reagan. Requirement of developed nations to comply with international norms.

Keeping down prices of natural resources. Not valuing nature's services.

Market system maintained by - investing in goods & services that save human labour - or make it redundant.

1) Discover new sources of energy & matter 2) Commercializing education. to satisfy needs of market.

Relation to compartmentalized solutions.

The compartments:

Waste minimization techniques & effect

Hats off to the Technological Man out to conquer the whole planet! Hats off to technology bent upon redirecting energy & material flows towards human beings!! What grander achievement can there be when one consumes & consumes more than 40 p.c. of the total terrestrial biomass? But no push the proportion to 60 to overcome poverty & hunger. With genetically engineered foods & biotechnology, this is already within our reach. Why? Even creating superman & super races is not difficult. Let us enslave every living being on the earth & realize God's dream of giving birth to a supreme being that will ultimately rule the universe! Or is it a dream of Satan?

Those of us who have such obsessions and confidence in our scientific ability, what do we call them! Scientists! Visionaries! or doom sayers? They are not scientists for they hardly understand the basic laws of science. They are not visionaries for their over-riding ambition inflicts incalculable harm on non-humans. They can well be doom sayers because their blind faith in technology is fetching them ever near the abyss of self-destruction.

How? Simply because ecological science tells us that humans can never totally separate themselves from ~~processes~~<sup>principles</sup> & cyclical processes of nature. If they attempt to enslave others in their greed, they ~~will~~ will destroy the very web of life & foundations on which their own survival depends. If technology attempts to replace nature's services & processes, the costs will escalate so much that only a lucky few can afford it & that too will be possible only by enslaving ~~other~~<sup>other</sup> fellow human beings!

The Supreme triumph of technology prebodes utter disaster & strife & violence among human societies!

Who is to blame? Technology or the use of Techno-

by human beings? To make a telephone call is perfectly benign but to tap the call may be sinister & illegal. Technology is power & power is most likely to corrupt. With the help of machines & technology, we have produced a system which has forced the people forget all the good things in life. In last over 300 years our training, culture, civilization have failed to produce a human being morally <sup>sound</sup> socially responsible and materially a conscientious consumer. Liberty, equality & fraternity are corrupted to lack of restraint, disqualifying progress and a disintegrated society.

Let us understand science correctly & not through the sunglasses of technology. Let us find out what science has to tell us about natural evolution: How a weak, diffuse energy source is utilised to create innumerable life forms forming a web of life expressing & manifesting distributive justice no human society has ever been able to match. A simple principle underlies this wonderful biodiversity. Species with high metabolism have large populations & but short life cycles while species with low metabolism have small populations but longer life cycles. This has enabled species to look for and cultivate a variety of habitats containing a mind-boggling variety of niches. As habitat is the address & niche the progression of a species evolution progresses through distribution of energy & resources towards diverse life forms. Technology however, progresses through uniformity & mass production. It has no formula to bring about distributive justice. The call of the Gita saying: *सर्वं कर्तव्यं विना श्रद्धां न विना श्रद्धां न विना श्रद्धां* is muted in the age of technology.

While the march of evolution is ordained by the basic laws of science, technology has overruled by perverting these laws. It was able to do this because human beings evolved in tandem an economic system

3 conditions that should weigh with business & industry are what they take, what they make & what they waste. In the last ~~more~~ than 100 yrs. we have been exploring, mining, extracting & processing stored wealth & resources worth many many trillions. We have in a way even stolen the wealth of the future.

To make matters worse, we are adding 9 crores of people every year to world's population & destroying 25 billion tons of soil every year. No wonder overall food production of the world is declining every year. And along with food all kinds of insect are many poisons in our bodies that the immune system of every unborn child may soon be adversely affected irrevocably.

Clearly business & industry need a new language, a new role, a new way of realizing itself within the larger environment. They must realize that all nations depend on solar income which comes from diffuse solar energy & energy stored over millions of years. It is the secret of wind & tiding diversity & capacity to turn all waste into food.

If business & industry feel that they can call upon nature to submit to their wishes, without constraint, they will destroy the foundation upon which the society they are supposed to serve, is based. Ecological science has proved that all work is illusory if it is not based on the principles & cyclical processes in nature. We just cannot turn our backs on the web of life that sustains us & live in an illusory world, engineered by technology.

Our management systems so far have concentrated on economy which, by demanding ever-increasing resources, mimics a young & growing eco-system. But it is a "linear" industrial ecology where waste accumulates & is not decomposed & assimilated.

All this needs to be changed. We need to set up a system which mimics mature systems in nature.

by working diversity in all its forms & establishing linkages that can restore eco-systems, to protect the environment which brings fast innovation, profit & unity, meaningful work & true security. We have the ability & capacity to create a different economy.

Let us therefore, enter the fascinating world of green management, re-establish our connections with nature not only on the shop floor & the office blocks but also in product mix & product movement. Top management experts will facilitate your understanding & interact with you in the 5 day residential workshop scheduled from 5 to 9<sup>th</sup> Feb. 2008 in a sylvan environment.

There will be sessions on ecology of commerce, the essence of green management, the organization of green marketing, the marketing of a green consumer together with legal and international provisions, protocols, agencies & collaborations. The expected outcome may be networking for a green market where conscientious producers & consumers come together.

Here in brief are the salient features of the workshop.

~~Dates: 5<sup>th</sup> to 9<sup>th</sup> February  
Venue: BAIK Campus, Wajje  
Off Mysore - Bangalore Highway  
Fees: Rs. 18,000 per person  
Rs. 16000 if there are 2 persons or more  
from the same organization.~~

a perfect hand-maiden to its powerful mistress!  
The collaboration between technology & economy  
has produced all the strife & stress that afflict  
human societies today.

Our economy is based on the assumption  
that consumer is sovereign & his/her free choice  
is always right. But the consumer is trained to  
obey & cultivate a technology bent upon redirecting  
flows of energy & resources to human beings by denying  
them to non-human beings & nature. Technology confers  
power that nurtures greed & avarice among consum-  
ers & flows their choice. To redirect energy & resources  
technology has to constantly convert resources by  
using energy. Each conversion brings about losses  
of energy & creation of waste matter, the latter  
increasing entropy in nature. Like evolution,  
technology cannot use sun's diffuse energy  
at ambient temperature. It has to use energy  
of fossil fuels. The economy has to invest large  
sums in exploring, extracting and processing the  
fossils before energy is produced. Any loss of energy  
in conversion means a negative return on  
investment made to facilitate use of fossil fuels.  
If these losses are internalised in the cost of  
production, the cost becomes higher than the  
value of the product. If the costs of social and  
environmental costs of entropy are internalised,  
cost escalates so much as to make all manufac-  
turing impossible to continue!

In such a scenario profits can never be  
made possible. Then how are the colossal profits  
made by individuals, companies & the corporate  
sector? In the past, developed nations made  
profits by acquiring political control over raw mate-  
rials from their colonies & importing cheap labour  
& even using slave labour. A developing country

Like India

help industries

has no colonies to exploit. But the govt. can give <sup>enough</sup> subsidies to industry & modern agri. in the name of development, to cover their losses & allow them to earn profits to augment our national income. The subsidies take varied forms concessional prices in land allotment, artificially reduced prices of raw materials like bamboo concessional prices in allotting water, electricity, support to fertilizer prices etc. The total amounts to many thousands of crores. This also means less govt. expen. & investment in health, education & denial of support to necessities of life. As everyone knows the structure of most govt. schemes is such that they favour the rich in villages. Govt. support to industry & modern agri. ultimately results in production of goods <sup>nee</sup> needed by the rich while production of <sup>nee</sup> necessities of life goes a-begging. The gap between the rich & the poor becomes wider & wider in such an economy.

Who is to blame? I squarely blame the wrong use of technology by us! Most of us are ecologically illiterate simply  $\therefore$  this subject is utterly unknown to our educational system. No one is aware of the ecology of technology. Priority should be given to technology that strengthens our natural resource base. Natural resources are the foundation of our life, especially the rural population which still forms  $\approx 7$  more than 60% of our people. City people must understand that cities are primarily supported by natural resources. If they degrade, & we have to import - food, water, timber & many other products the living cost in a city will become exorbitant. Today we are simply directing more & more resources to the cities without providing anything for their maintenance, revival & enhancement in quality & quantity. Restoration of

natural resources is the primary need. Unfortunately very few people are aware of the significance, techniques & how to involve rural India in this vital job. Everyone including rural people, are taught to believe that technology is a perfect substitute to nature. Nature can be safely ignored: It is technology that is going to provide everything to human beings!

This is not only wrong, it is extremely costly too. Ecologically speaking, indiscriminate use of technology is destroying so many linkages that make our atmosphere, the quantity & quality of <sup>our</sup> water, the quality of <sup>our</sup> soil, the waste assimilating capacity of nature, the pollinating insects that enrich our crops & horticulture, & lastly biodiversity which is a wonderful reservoir for our future needs of food, medicine, & raw material. This indiscriminate use is destroying not only our own life but that of our children & grandchildren too.

In a former era Jawaharlal Nehru had called our irrigation & power dams as temples of newly-independent India. That era is long over. The new temples of India, if I may venture to say so, are our restoration projects, though they are as yet not many. Let us build these temples all over India to make our lives both materially & spiritually richer. Let all the NGOs gathered here build a temple, start a restoration project, in their area to <sup>provide</sup> build for our beloved India a solid foundation & bring prosperity to all those millions who have been denied fruits of development so far. Let us unite to restore the glories of Mother India.

Appropriate action.

Once these services provided by nature are disturbed & destroyed, technology tries to substitute itself for nature. Technological services, based as they are on costly energy, escalate their prices & also cause pollution. Technologically produced water available for drinking is almost as costly as milk. Insecticides is a terribly costly substitute for natural pest control. Biotechnology is many times costlier than biodiversity.

Our experiments in restoration of nature have demonstrated their cost-effectiveness in comparison to technological & engineering solutions. Moreover they tend to re-establish natural linkages to become sustainable & obviate the necessity of expenses <sup>on</sup> care & repair. So we must restore soil, restore our streams, restore vegetation on hill-tops, hill slopes, stream banks, in-stream habitats, saline wastelands, degraded & industrially derelict land, saline & water-logged lands, deciduous & evergreen forests, Savanna & grasslands & littoral & seashore areas. Restoration techniques for all these are available. Our only task is to understand & practice them. These can be combined with our traditional wisdom to involve villages & communities.

## INFORMATION TOMORROW

II

Everyone agrees that we are passing through an information revolution. With PCs proliferating, internet popping in, the world is increasingly coming nearer our doorsteps. It is the distribution and dissemination of information that is gathering momentum everyday. It will markedly influence our preferences, will lead to rapid changes in life styles and to increased rates of obsolescence. It will put every manufacturer and distributor on toes, put additional strains on him or her to quickly adapt to a rapidly changing situation. What impact these rapid changes will have on the environment is still unclear. As one interested in ecology, I wish to discuss the information revolution in the context of the environment. What information we may need in future, how we can go about gathering and disseminating it and what impact the information revolution will have on the environment and ultimately on our lives.

The science of ecology deals with inter-relationships--between abiotic and biotic factors and between these and the techno-industrial-commercial realm that Homo sapiens have created on this planet. The biological approach current in the past took a more restricted view; it looked at some species, more often threatened or endangered ones like the tiger and the rhino, and tried to define the environment in which they operated. When satellites were not orbiting the heavens, even the inputs that went into prediction of the weather, were of limited range and localized. With the recent advances in space and long distance communications technology, we have gained both in depth and breadth of vision enabling us to take a more holistic view--one that the science of ecology prefers and preaches.

Let me take an example from my own experience. I am at present studying Maharashtra's coastline that stretches 720 kms between Mumbai and Goa. As you this coastal zone is coming under increasing pressure from industry, trade and tourism. The influx of men and materials is fast changing the landscape. The indigenous flora and fauna are under great biotic pressures. As I go on examining these changes, I am increasingly becoming aware of their inter-relationships. If I had been on location 20 or 30 years ago, I would have only looked at the extent of forest and mangrove destruction, the threats to such animal species as the estuarine crocodile and sea turtles, the factors that affect their habitat and suggested measures to protect them. Now I am aware that I need much more information to make a really meaningful environmental statement.

To understand the rapidly changing landscape, environment and human and non-human lives, I must look at the geology of the coast, its past and present, how the sea is affecting it, the impact of waves and currents, the rates of deposition and removal of coastal materials, the effects these will have on the zonation of vegetation and distribution of marine animals, what impacts the resident and migratory birds will suffer, and how and to what

extent the lives of people who depended on bounty of the sea will be affected.

As you know the whole coastline is dissected by a number of streams and rivers that originate in Western Ghats and debouch into the sea. A number of estuaries with wide mouths open up where the streams come to meet the sea. Estuaries convey the tidal influence far inland and give rise to environmental conditions in which a specialized flora and fauna thrive. They are vitally dependent on salinity and temperature gradients that are a feature of estuarine environment. In turn the streams influence the estuaries through the quantity and quality of sediment that they bring with them. Now if I want to study the estuarine environment, besides looking into their flora and fauna, the salinity and temperature conditions, I must examine the conditions in their catchments----what activities are going on there, what changes are envisaged and what will be their impact on the river discharge on suspended load and the dissolved material. I must also take into account the present socio-economic condition of the people and what changes are expected if their environment alters fast.

As you will see when all this information is assembled and analysed, you will be able to talk not only of a region's environment but of its present and future development also. And this will determine the location of industry and commerce, what can and cannot be manufactured and distributed. This will in turn redefine income patterns, your marketing strategies and future product development.

As we get involved deeper and deeper into the information revolution, we become increasingly aware of inter-relationships between science and technology on the one hand, biology and physical sciences on the other and social, economic and cultural aspects on still another front. But is availability of information and the grasp of inter-relationships within leading us to take a more holistic view of life on this planet? I do not think it is. At present all the information that is becoming available is put to serve our short-term or immediate interests, to maximize profits today and not to sustain them over a longer period. From heaven we look at the land to locate minerals and other valuable products to exploit, to tap more ground water, to utilize more surface waters, at the sea to locate shoals of fish and other sea animals, to locate hidden sources of oil and gas and at the atmosphere to look for more rain and clouds so that soils can be used to harvest more and more crops. The whole approach is exploitative. The information revolution is leading to a quantitative abstraction of life, not a qualitative one. It is flooding the markets with goods that satisfy intermediate wants, that generate ever more trifling wants while we are increasingly being starved of the basic necessities of life---pure air and water, a work environment that promotes health and happiness, friendship, care of children and the aged and what not.

Is anybody looking into the quality of life that the information revolution is promoting? Is it promoting social equity? Is it bringing about a more contented and happier society or is it generating a society prone to violence and sensationalism? Is the sanctity of life and dignity of a person being protected or is every act of a citizen becoming open to the prying eyes of official and non-official agencies who care to exploit it scrupulously or unscrupulously?

I am far more concerned about the quality of information being made available, what its impact will be on our lives, and whether all those concerned with generating and merchandizing information are consciously putting together a happy nevironment and a a happier andmore contented society.

One should also consider the cost of making information available tomorrow. Is it going up or going down? Is the common man being thrown out of this revolution or is it becoming available to him within his means? That again brings me to the issue of social equity. To me social equity, better environment and a sustainable life style are far more important than availability of information. It is upto all of us to decide whether the tool of information is being used to promote these.

Prakash Gole.

## DAMAGING TECHNOCRAT ILLITERACY

Please pardon me if I talk a little frankly and explicitly.

Let me begin by asking when our engineers are going to be environmentally and ecologically literate? This illiteracy is tragic especially when many of the best minds and intellects in this country are afflicted by it. The present conference too shows this affliction: lack of awareness of environmental and ecological considerations. All of you know water is life but you treat it as if it is devoid of life. Aqua Tech should really be Aqua Eco-Tech.

Let us hope the coming millennium will encourage you to link your projects with environment and ecology. For, in their absence do you know what your projects have done and achieved. You have undoubtedly provided water to cities and towns but it is a bad quality, polluted water which only helps the medical profession and medicine-producing industry! I am not far off the mark if I tell you that all your reservoirs are simply sinks for silt and pollution from their surroundings, and their water, if taken untreated, is poisonous to man and animal alike. Even after costly treatment which few cities and towns can afford, the water is not fully potable. Well, it has promoted industry: look at the thriving bottled water industry!

The more serious thing is the demise of our rivers and streams. By arresting their flows and inverting their flow regime, your projects have effectively marginalised these eco-systems, very important for the maintenance of hydrological cycle. As their natural uses have ceased, they are increasingly being turned into cesspools of sewage, industrial effluents and filth, poisoning the surrounding soils and landscape. The non-point discharge of fertilizers and insecticides in river basins from cash-crop agriculture that your projects promote, has further destroyed river-basins by encouraging the growth of weeds and harmful insect and microbe life. *The mosquito menace is not the main problem*

Mere technology cannot provide solutions to these problems.

The secondary and tertiary effects of your projects are: destruction of habitats and eco-systems in mountain catchments including forests and mountain springs; erosion of hill slopes, sedimentation, destruction of river banks and riverine vegetation which act as filters, encroachment of flood plain areas by settlement and construction and collapse and choking of hyporheic zone thereby obstructing the recharge of groundwater.

Our technocrats and engineers are not only ecologically illiterate but they are bad economists too. The benefits that your projects have conferred are meagre compared to the money spent on them. This has plunged the nation into a debt trap and made it completely dependent on external, costly finance.

Technology seems to be another name for profligacy and inequity.

That is why I wish to advocate an eco-tech approach to problems to water. It lays great stress on the regeneration of river and stream ecology, natural regeneration in catchment areas together with natural forests and mountain springs, revival of in-stream habitats, of riverine vegetation and buffer zones on both the banks, adequate flood plain maintenance, and even intelligent maintenance of reservoirs and canals. For the last over 10 years I have been discussing details of these with the engineers of Maharashtra's Irrigation Department which I am proud to say, is the only technical department which has taken an interest in eco-technology.

Many things can be done that will enhance the ecological value of your projects. I must commend this approach especially to newly constituted river valley corporations. It is a sure way to make them user-friendly and enhance their image nationally and internationally.

Eco-technological approach is a holistic one and you will need the cooperation of other government and non-government agencies. This is difficult in the present set up. Yet you have the prestige and sufficient clout to influence policy-makers and bureaucrats to change the present set up for the better : of course, <sup>if</sup> you are ecologically literate. An internally cooperative official machinery will radically change the shape of things to come.

Developed countries have already adopted the eco-technological approach in a number of spheres. India, so competent in information technology, will prove intellectually and technically backward if we do not pay adequate attention to these novel techniques. For they alone ensure the quality of life.