3rd STIP Forum Lecture

Technology and Indian Foreign Policy: Trends and Opportunities

by **Dr. Bhaskar Balakrishnan, Former Indian Ambassador**

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A very good evening! Dr. Chidambaram, Principal Scientific Advisor, Prof. Sachin Chaturvedi, DG of RIS, my distinguished colleagues who are here and friends, it is a great honour to be invited to speak this evening on this forum. The STIP Series of lectures is doing a very valuable service in bringing greater consciousness of science and technology issues to the public and policy makers and I am sure they will go on from strength to strength in the future. I am also thankful to Dr. Chidambaram for the kind words that he has said about my book and indeed also about the tennis we used to play in Vienna. I can tell you that if you play tennis and Dr. Chidambaram is at the net then you can't really get any ball past him. He was a formidable player at the net and I can remember that.

I must thank the RIS for organising this meeting and this occasion.

Now let me start by recognising the rapidity with which knowledge especially science and technology has been growing. This is almost a tautology, everybody knows this. We have gone through the 20th century witnessing unprecedented major advances in science and technology with promises of even more to come in this century, so the rate of growth of knowledge is really exponential, it is expanding at a tremendous rate.

This has profoundly transformed our lives, societies and countries. Examples are many, computers, internet, microchips, mobile phones etc. Indeed since my service in the government from 1974 onwards, I could personally see the way in which communications has evolved and transformed even our day to day working. The pace of change has been so rapid that we are finding it difficult to adapt and keep pace with it. Science and technology has had a growing impact on international relations and foreign policy. It has affected every sphere of life, so therefore foreign policy is not an exception. Nations interact within the global system based on power - military power, economic power or cultural. The science and technology capability of a nation directly affects its economic and military strength. This is quite obvious. For example, nuclear weapons and advanced aerospace technology enables a country to wield great military power. Therefore it is not surprising that science and technology has gained increasing prominence in diplomacy and international relations especially since the end of World War II.

Nuclear technology is a concrete example. It gave us the key to nuclear energy as well as the ability to make nuclear weapons of unimaginable destructive power. The value of peaceful use of nuclear technology has been universally recognised but reconciling this freedom of peaceful use with the need to prevent the spread of nuclear weapons beyond the limited number of nuclear weapon states is a serious problem even today. This has been aggravated by tendencies on the part of some NPT recognised nuclear weapon states to leverage nuclear weapons to adopt threatening stances or to gain global dominance or deter conventional threats. Countries that perceived an existential threat from any of the nuclear haves were motivated to seek nuclear weapons capability, and in order to do so they were prepared to beg, borrow or steal or as one leader famously put it, to eat grass.

India has faced this challenge squarely and courageously. India started by advocating the complete end to nuclear weapons but this effort was doomed by the cold war. The emergence of five nuclear weapon states recognised under the NPT gave priority to checking horizontal proliferation over nuclear disarmament. India was in the have not's category while facing threats from a nuclear armed China. Given the failure to achieve universal and complete nuclear disarmament, India had to go in for nuclear capability while facing a nuclear embargo on technology and nuclear material. India had to develop its civil and strategic nuclear programme in isolation and in the face of a hostile international environment. It is to India's credit that it observed nuclear restraint even when China developed nuclear weapons. After India developed its nuclear weapons, it sought a universal no first use policy on nuclear weapons and continuously and consistently worked to avoid proliferation. Meanwhile our

neighbour built up its nuclear weapons capability through clandestine transfers of technology and equipment from China and the West.

India will continue to face challenges in the nuclear field. These include the NSG membership, pressures to join the CTBT and protecting its strategic interests during the FMCT negotiations. India will continue to develop its nuclear programmes including using its unique thorium fuel cycle and fast breeder reactors while also pursuing the indigenous Candu type reactors and building more pressurised water reactors with international partners.

Today civil society is demanding the complete elimination of all nuclear weapons without exceptions. Even in the US there is support for this. Obviously this would result in a safer world for all, besides releasing a large amount of resources that are badly needed. Nuclear weapons have spread to Israel, India, Pakistan and North Korea and they may well spread further to Iran and other Middle Eastern countries, and to South Korea and Japan. A free for all may result as nuclear weapons can be developed by many countries. One hopes that the treaty on the abolition of nuclear weapons adopted this year by 122 countries in the UN will gradually gain widest possible acceptance and adherence in future. This treaty by removing the nuclear exceptionalism of the NPT restores the sovereign equality of all states and seeks a safer world for us all.

How should India react to this development? On one hand it is in line with the Indian goal of complete nuclear disarmament of the 1950s and even during the 1980s. But on the other hand, India has to face nuclear armed neighbours such as Pakistan and China. This will require careful diplomatic handling.

The dynamics of relations with two nuclear armed neighbours, Pakistan and China poses a formidable strategic challenge. The increase and diversity of nuclear weapons with Pakistan including tactical weapons poses a threat to peace. China's support to Pakistan in the nuclear field in order to weaken India is a challenge. The prospect of nuclear weapons in Pakistan going under the control of non-state or rogue actors is alarming. The very low transit time of missiles between Pakistan and India means that extra measures have to be put in place to avoid accidents that could lead to conflict situations. This is not unique to the subcontinent. It could happen in North and South Korea if nuclearization spreads. It could happen in the Middle East if countries near each other develop nuclear weapons.

Also it is now time to face the unthinkable. What measures should be taken to protect civil population and minimise casualties in the event of a nuclear conflict? Citizens should be given basic knowledge on what they can do to protect themselves in the event of a nuclear conflict. So we are going back to the 50s when in the US and the western countries this topic was very much in the news.

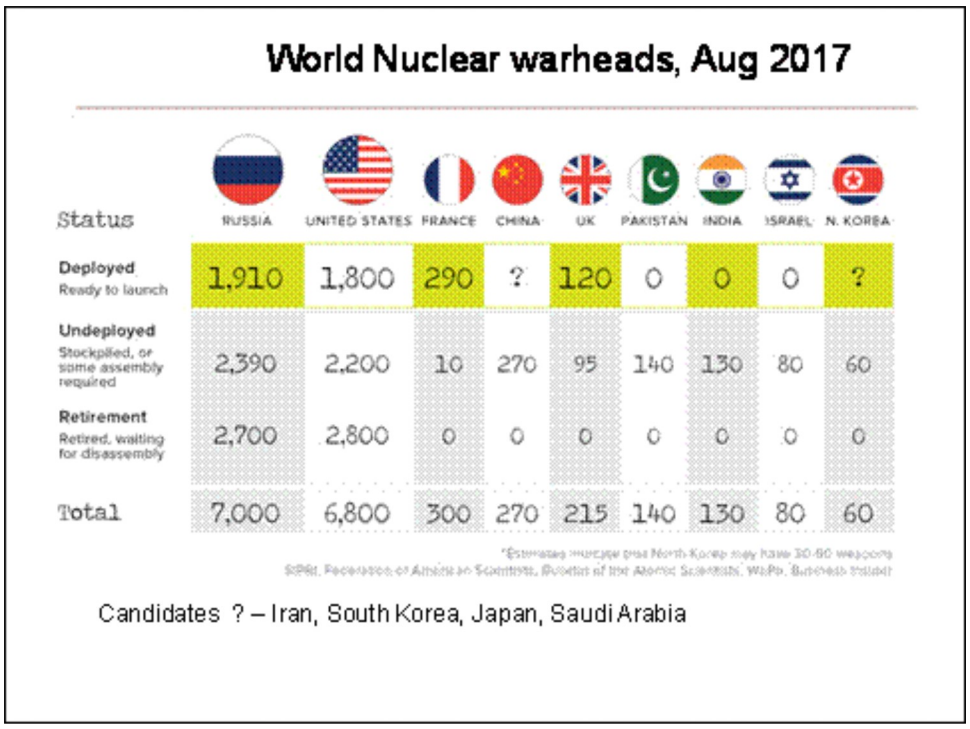

Figure 1

Here we have in Figure 1 a picture of the present position of nuclear warheads in the hands of nine countries. And the only good thing one can say is that the figure of undeployed warheads remains high and there is a zero against the figure of deployed in some cases although this is of course only a guess. The actual situation might well be more ominous. North Korea is a big challenge. It has few days ago tested a missile which has a range of 13000 kms which is really an ICBM category and it has number of nuclear materials which can be fashioned into devices. There are some candidate countries for nuclear weapons which are being talked about but of course this hasn't fortunately happened till now. Much will depend on how the world handles the situation. Iran, South Korea, Japan, Saudi Arabia are probable candidates. All of them could cite very good reasons for going nuclear.

Let us look at another important issue. Climate change is perhaps the defining challenge of the century. India is at the centre of this issue and whatever actions it takes has a profound global impact. The success story of the Montreal Protocol which was sought to be repeated through the UNFCC and the Kyoto Protocol has not materialised. In the case of the Montreal Protocol for ozone depleting substances there are alternatives that are technically and economically feasible and in fact generate some profits for industries. Ozone layer depletion would have most severely impacted the developed regions of the globe. Temperate areas would have been more affected. The threat of increased skin cancer was vivid enough to be appreciated. Skin cancer, Melanoma in your lifetime, the public can understand that. Pressure from civil society forced a global response to the challenge.

But in the case of limiting green house gases especially carbon dioxide, the major component, we need fundamental and far reaching changes in the way we produce, distribute and consume. The threat is in terms of decades into the future while our systems are used to reacting to much shorter term threats. There are even today some experts and leaders who question whether human activity is responsible for global warming or if it is a natural phenomenon. However almost all our global climate change models which we have, and which are still rather imperfect, predict that increase in greenhouse gas concentrations in the atmosphere will cause global warming and more frequent and severe extreme climate events such as floods, hurricanes, typhoons, droughts and what have you.

A word about global climate models. The weather of the earth is a very very complex phenomenon in which a large number of factors are involved. The global climate modelling art has progressed of course with more powerful computers but as you know we are still not able to calculate what the weather will be five or six days ahead. So what the global climate models at this stage of the art give you is only rough indications of what will happen, for example, if you increase CO2 concentration in the atmosphere. So there is a lot of uncertainty over that.

The precautionary principle should apply here. Take action when there is a likelihood of a threat and do not wait until there is scientific certainty. This is the principle which has been at the bottom of many environmental negotiations - that we do not wait until everything is certain before we take action because then it might be too late. The public perception of the threat of climate change is still hazy but is growing stronger. India faces a particularly severe challenge. It has boosted its economic growth rate and is accelerating its development but this requires more energy and natural resources and if it follows the development path of the industrial world there will be no hope for keeping greenhouse gases below the danger limit.

So it is obvious that the entire world has a stake in India's following the lowest possible carbon intensity growth path. This requires a cooperative effort and not a confrontational one. It also requires that clean technology and finance be made available. After all this is an investment in our common global future. The developed world has emitted greenhouse gases for the past 200 years, and its per capita carbon equivalent emissions are still far higher than India's, and therefore it bears a greater responsibility for reducing greenhouse gas emissions.

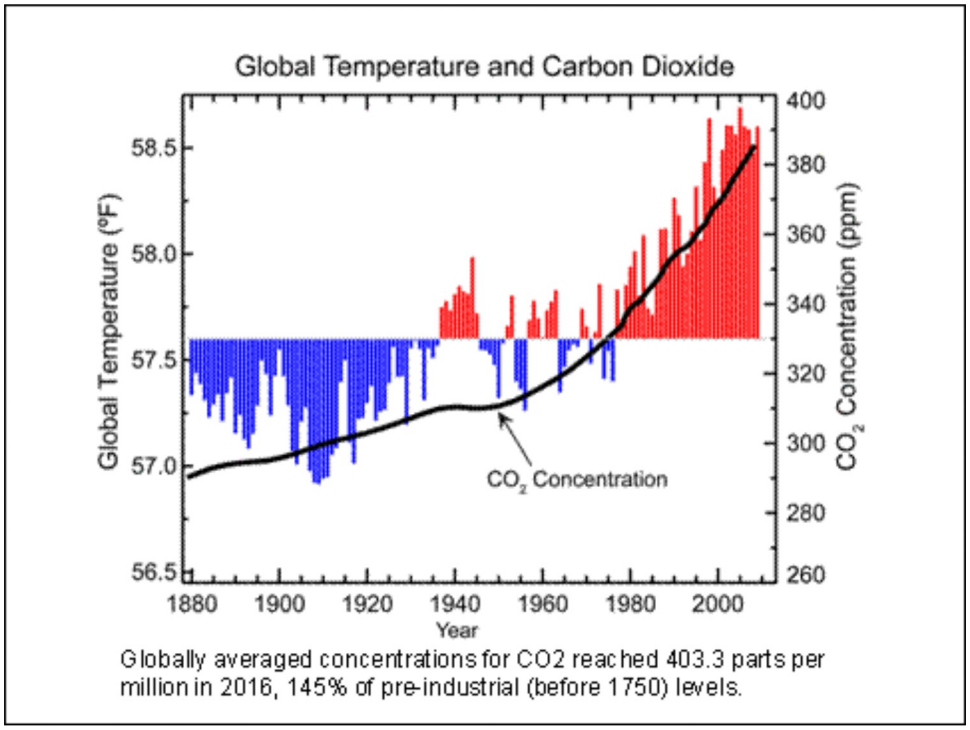

Figure 2

A logical and fair solution would be to calculate what should be the total global quantum of greenhouse gas emissions permissible per annum divided by the world's total population and fix that figure as the target for per capita emissions that all countries should try to attain. But the international negotiations do not lead in this direction. The developed world has become extremely stingy and reluctant in its efforts of carbon reductions and seeks to impose the greatest possible cuts of total emissions on large developing countries such as India and China. They deliberately seek to focus on total country emissions rather than per capita emissions and have even tried to create divisions among the developing countries and play off the LDCs and the SIDSs, the small island developing states against the large developing countries such as India and China.

On the other hand, India with its growing energy requirements has no other option but to tap non-fossil energy especially nuclear, wind, and solar energy on a large scale. This would free our economy from dependence on energy imports and give us a more sustainable development path. So while we continue to press the developed countries to do more to cut emissions and make greater efforts to remove accumulated greenhouse gases from the atmosphere, we must in our national interest cut down on the use of fossil energy.

One solution which may be considered might be for all countries to impose a carbon tax calculated on the amount of carbon dioxide equivalent arising from all production and distribution activities. This would immediately give all entities including consumers an incentive to move to a low carbon pathway across nations and even within nations. It would reveal the true environmental cost of the lifestyle of the relatively affluent among nations and within nations and prompt the adoption of more sustainable lifestyles. To give you an example, a carbon tax of $ 50 per tonne of CO2 would imply a rise in price of petrol in India of roughly Rs 8 per litre. And this would probably give an incentive to move towards electric vehicles. The carbon tax approach has the advantage that its administration is relatively simple. It is fair and it provides resources for adaptation and mitigation measures to deal with climate change. It has been tried in some areas of the world. For example, some Canadian states such as British Columbia for example, has had a carbon tax in place.

Figure 2 illustrates the point that carbon dioxide concentration and global temperature rise are linked and we have now crossed 403 parts per million, 145% of pre-industrial levels. Let me go to the case of methane. Methane has a global warming potential of 56 times that of carbon dioxide over a 20 year period. Many publications will not look at a twenty-year period, they will look at a 100-year period for which the global warming potential is much lower. So taking this figure understates the harmful impact of methane. What we should look at is a 20-year period because the lifetime of methane in the atmosphere is about 15 years. So, it is 56 times more damaging than carbon dioxide and atmospheric methane has reached a new high of 1850 parts per billion and is much higher than the pre-industrial level.

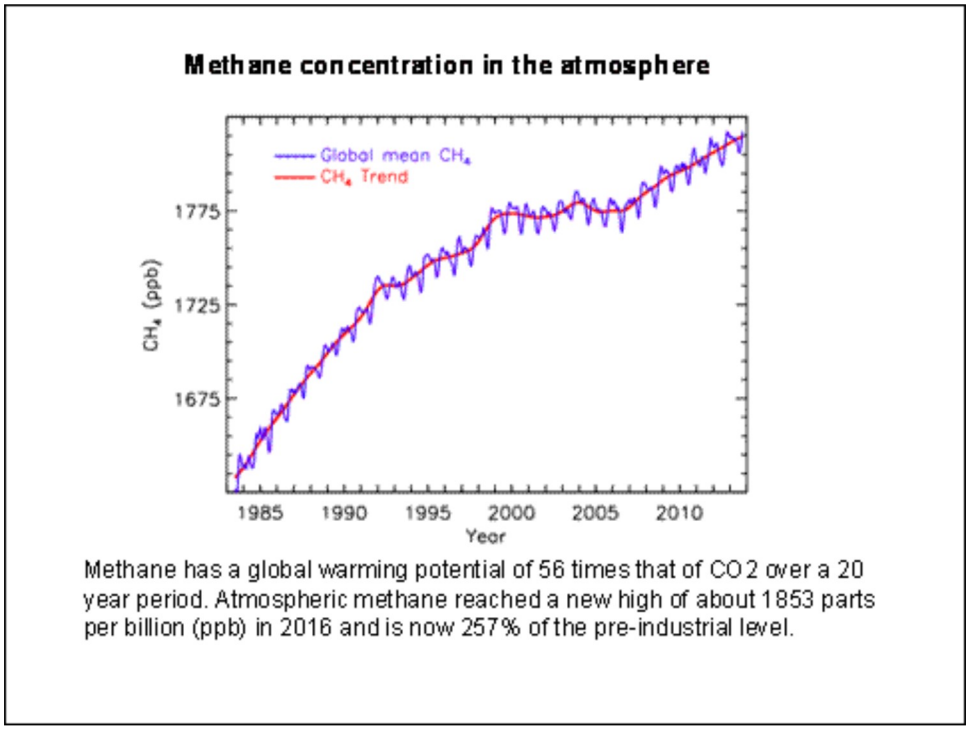

Figure 3

Not enough study has been done on the factors behind this rise in Methane concentration. You will see that from 1998 to about 2005 there was a flat plateau and then after that it started going up again from 2005. So we need to look at what has happened after 2005. Now agriculture has not changed. It is basically the same. We don't have more cows and livestock. But there has been a huge growth of the natural gas industry and methods like fracking and other non-conventional methods of extraction of natural gas, and all these processes could involve leakage of natural gas. I have looked at literature on this point, it is very sparse, you don't find much work being done on connection between methane concentration rise and the growth of fracking and natural gas industry. There are some studies done in parts of the US which bring out this connection but I think much more needs to be done on this before we accept any suggestion that methane in the atmosphere is due to agriculture and livestock alone. This is one of the problems which will probably be examined a lot in the future.

Other issues of importance to India are the ICT sector where India's competitive advantage is hampered by restrictions on services, trade by various modes. The emergence of artificial intelligence and digital manufacturing and cyber security and cyber warfare poses challenges. In the area of outer space there are numerous challenges ranging from the problem of space debris, ASAT technology and access to missile technology which is a dual one. ASAT technology is now available to three countries which have developed it - US, Russia and China. They are according to indications promoting an NPT type of arrangement whereby there will be three ASAT technology powers and the rest will all commit not to develop this technology. So the same kind of idea of the NPT is being sought to be advanced in the case of the ASAT technology. And this is something which will again repeat the injustice of the NPT if it comes through.

As far as the ocean space is concerned, there are a whole lot of issues connected with the law of the sea. The law of the sea basically divides the ocean space into different degrees of jurisdiction. It deals with who has control over what in ocean space. But the living creatures in the ocean don't know about these different lines and jurisdictions, they live and move about in a single ocean environment. So there is a problem of management of the living resources of the oceans. India has a large ocean space of interest to it. The health of the oceans and management of living resources of the oceans should be of great importance to us.

India has two large marine ecosystems, LMEs. You will not find any talk in the media about LMEs. In fact, I don't find even a single piece in the Indian media about what is an LME. In the Arabian Sea we have LME 32 and the Bay of Bengal we have LME 34 but very little has been done to manage these two LMEs so important to millions of people in the region.

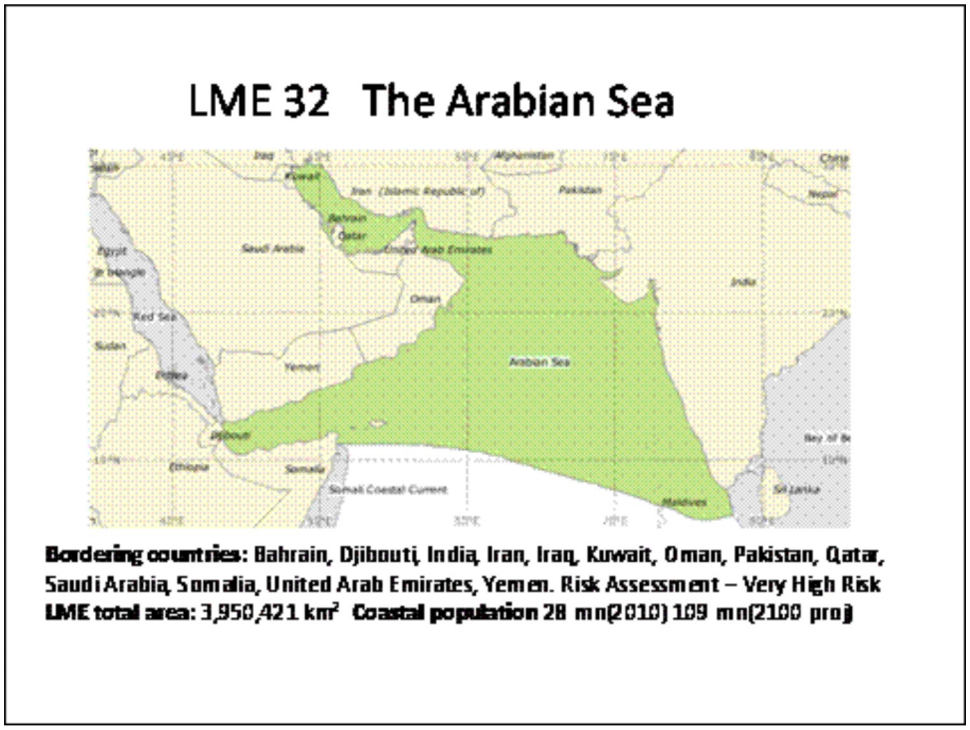

Figure 4

The oceans of the world have been divided into different large marine ecosystems and we have number 32 on the west and number 34 on the east. Figure 4 shows LME number 32, the Arabian Sea. It has a rather interesting group of countries bordering it and according to the LME scheme, the LME has to be managed by these countries as a group. The responsibility for managing the large marine ecosystem lies with the bordering states. They are expected to form appropriate framework to manage this living ecosystem.

Now the studies of the health of this ecosystem show that it is at very high risk. The total area is immense. The coastal population which depends on the large marine ecosystem is about 28 million in 2010 but it is going to go up to another 110 million by 2100. So clearly the management of this ecosystem is very important. The question is what kind of diplomacy and how do we get these countries to work together. We have both India and Pakistan in this group plus several Middle Eastern countries. So the present approach to the Indian Ocean does not reflect the large marine ecosystem concept. It is more linked with the strategic issues and freedom of navigation. But we need to look at this aspect too. There is no system of governance for LME 32 as a whole. There are some kinds of understandings between these states but it has not developed much..

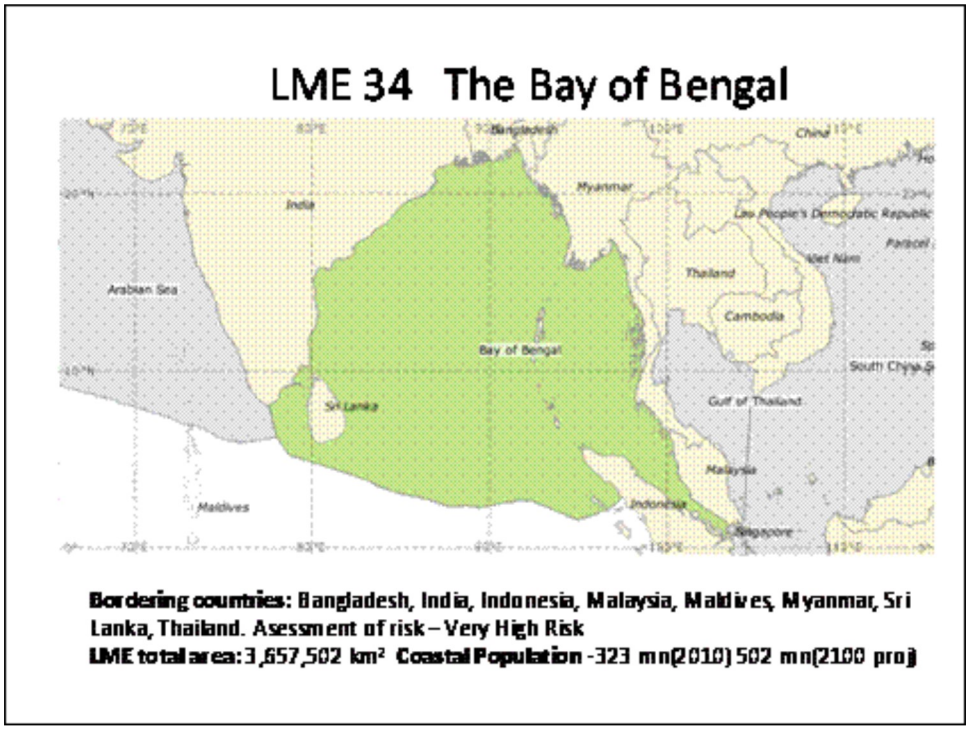

Figure 5

We look at LME 34 (Figure 5) which is more interesting because the number of people who depend on it is 323 million going up to 500 million in 2100. The group of countries which should be involved in managing LME 34 is relatively more harmonious, with less differences among them. So I suppose that this is an area where diplomacy led by India which has probably the biggest coastal area in this would be useful and productive. It would be important for India to develop its engagement with partner countries in both the LMEs which includes Pakistan in the Arabian Sea LME and evolve cooperative frameworks for managing both the LMEs which are rated as being under very high risk of degradation.

Now let me talk about international scientific cooperation. India has taken advantage, as Dr. Chidambaram mentioned, of some opportunities for international scientific collaboration such as CERN and JET, both led by our nuclear energy establishment. Cooperation with CERN has been based on a win-win model in which India supplies components including software while the revenues from its deliveries to CERN are used for meeting expenses of Indian researchers at CERN. So it is a good arrangement, both sides benefit. India's joining CERN as an associate member in November 2016 was an important and welcome step forward. However cooperation in outer space such as the ISS, International Space Station and the Human Genome Project has been a missed opportunity. India did not really get into both these projects. International space station, one would have thought would have been a good opportunity for Indian space research to get some benefit out of the ISS but somehow it didn't happen. Other countries have got into the ISS. Human genome project is a kind of wide scale project involving large number of laboratories and institutions all across the world. We did not have any kind of formal involvement in HGP. As scientific research becomes more and more costly it will be important for India to make better use of such opportunities and participate from the earlier stage in such projects.

Now we come to an interesting topic. Can science bring countries' closer and bridge differences? An interesting effort is Project SESAME which is Synchrotron-Light for Experimental Science and Applications in the Middle East which is a research facility set up by several countries of the Middle East including Israel and is promoted by CERN.

Here you have this project which is located in Jordan. Why Jordan? Because Jordan is the only country which has diplomatic relations with all the others. So it is located in Jordan. The idea is to produce seven electromagnetic radiation beams of wide range of energies, huge range of energies and the first such beam became operational few days back. The founding members are Jordan, Bahrain, Cyprus, Egypt, Iran, Israel, Pakistan, Palestine Authority and Turkey. This is an interesting group of countries from the diplomatic point of view. Countries which barely talk to each other like Israel and Iran are both in it. So is Pakistan. Cyprus, somewhere in between, is a more moderate country and Jordan which has relations with all of them, they are all

there. It is operated by CERN and the Jordan Atomic Energy Commission. The project cost of 90 million $ is met by 5 million from the 10 countries plus the CERN providing the equipment and the operating cost of 6 million per year is to be shared among the countries. So this is like an infant which is just starting to walk, one beam is there out of seven. Nobody thought that this project had a chance of succeeding few years back. Everybody said this is not going to work but somehow these countries have worked together on this and I think a lot of credit must go to the CERN establishment which really put its shoulder behind this and the European Union behind CERN.

So this kind of interaction is called Science for Diplomacy. It has been attempted in the case of the US and USSR, US and Iran, US-Cuba with some positive results. It is analogous to using culture or sports for diplomacy. Let us look at a few examples. In 1961, during the Cold War when arsenals were building up on both sides, scientists from the US and USSR met privately to discuss how to prevent a nuclear catastrophe. That same year President Kennedy helped initiate scientific exchanges through the US-Japan joint committee on scientific cooperation at a moment of broken dialogue between the two intellectual communities on both countries.

In 1972 the Nixon administration as part of its opening to China worked through a committee on scholarly communications with China and produced several initiatives for science cooperation that were part of the diplomatic package discussed with the Chinese government. Another example is the 1972 Moscow summit with Nixon and Brezhnev which led to the creation of Joint committee on science cooperation that resulted in seven science agreements. Cuba and the US are estranged neighbours, more so then India and Pakistan. Cuba and the US have been estranged for 50 years diplomatically, not even speaking to each other, across the 110 mile Straits of Florida. Cuban and US Academies of Sciences have interacted since 1997 and signed a historic agreement in 2014 to cooperate in four areas, infectious disease, cancer, resistance to anti-microbial drugs and neurological and neuro-degenerative disease. Despite tense relations, scientists from Iran and the US have found opportunities to cooperate on important public health projects.

US and North Korea relations is a current big problem. In June 2017 the US based International Peace Foundation reached out to North Korea by sending three Nobel laureates to hold seminars at three north Korean universities there. So this is right in the middle of this whole problem with North Korea's nuclear and missile development. Two of the Nobel laureates invited two students each to study and work in their labs in the US and in Israel.

One can think of possibilities in South Asia as well where scientists from South Asian countries can engaged in research on problems of common interest despite troubled political relations. Some people say that scientists are far more objective and less emotional in dealing with problems. I am not going to discuss whether that is true or not. I think that scientists can be as emotional as anybody else. But yes, I think scientists have a certain analytical framework which may help in communicating across political divides.

Diplomacy for science is a second stream which is also well known where diplomacy is used to promote science cooperation and to import and export science and technology knowledge. This is very important for countries like us where we need to access technology or new developments and new breakthroughs. We need to know about them, find them and adapt and incorporate them into our own development scheme. So diplomacy for science is something like our export promotion or attracting foreign investments, attracting technology, one part of it.

The other, the third area called Science and diplomacy is less well exploited. It involves an interaction of the scientific community with policy makers on important issues so that the scientific dimension is adequately taken into account in policy making. There is no doubt that all these three dimensions of science and diplomacy will gain salience in the future.

Now we come to an interesting question. How should India manage its science diplomacy? We cannot afford to have fulltime scientific officers in all our missions abroad. At present only four Indian missions in Russia, Germany, US and Japan have resident science advisers deputed from the Ministry of S&T.

What can we do with other countries which have important science and technology potential? One way is to enlarge the area of coverage of the science advisers to a few more nearby countries which we do in the case of defence advisers. Not all embassies abroad have defence advisers but some of them cover a few other countries

in addition to where they are resident. But this has its own problems, the same as non-resident ambassadors covering countries. It is not easy to go and visit that country regularly because the workload in the country where you are resident is already so heavy that it is very difficult to find time to go and visit the other countries. The same problem happens with ambassadors of other countries in Delhi. Some of them cover 6-7 countries. The ambassador of the Dominican Republic, I do not envy him, covers countries as far away as Malaysia and Brunei and Central Asia. So if he were to take his job seriously, he would need to multiply himself three times and be present in all these places. So non-resident coverage is not very easy in practice.

Secondly, if you are there as a short visit bird of passage, so to speak, you may not be taken that seriously by that country. They will say, okay, he has come here, the last visit was what, a year ago? So how much can you actually do? So extending the coverage to nearby countries has its limitations. Another way would be to make better use of ICT techniques and to have our R&D entities, the R&D institutions in India and their personnel work more closely with our officers responsible for economic affairs in missions abroad. The economic officers in our missions abroad are the logical people who should handle science subjects as well. It can be considered as part of the economic portfolio. The main motive is to gain economic benefits out of science and technology cooperation. So the economic officers are the right ones to be asked to do this, tasked to do this job. They could be given briefs with well defined strategic objectives of what is required to be done in each target country and its region in terms of science and technology. Regular reporting on science and technology developments in target countries would be useful.

In India the Ministries concerned with Science and Technology are more than one. There is Biotechnology, there is IT, Space, Atomic Energy, etc a whole lot of them and the Ministry of External Affairs which needs to work more closely together with them in giving guidance and instructions to each of our missions abroad. With some ingenuity all this and more can be done. This is a problem not unique to India. All developing countries have this problem - how do you have a presence in parts of the world have lot of science is going on. How do you tap into what is happening there? You can use the media of course, you can use what is in the public domain but if you really want to do things like get involved in startups, buy the technology or participate in the technology development at an early stage, you need to have some kind of presence to interact with the people who are doing the work. When some technology work is going on in a lab, it is only at a late stage that it gets patented. Well before the time of patenting or publishing, there are a lot of things which are happening. And not only India but all developing countries need to do this, even some developed countries need to do this.

There is much more that can be discussed such as human health, Nano sciences, biotechnology etc. but all this is not possible in limited timeframe available today. The areas where diplomacy, international relations and science and technology interact are bound to increase in scope and depth in the future. So in the last 50 years somehow in a creeping fashion, science and technology has come into the international relations sphere starting with of course nuclear technology but also now in many other fields.

Now we have things in biotechnology like GMOs, privacy of genetic information. Should we tamper with the genes of a foetus even if it is for a good reason? Should we allow research into harmful pathogens? H1N1 has been engineered to make it vastly more lethal and when the first papers were being published on this subject, people were alarmed to such an extent that the scientific community began to discuss ways of controlling such research. They said, look, this research is too dangerous. By accessing knowledge about this, harmful actors can do a lot of damage. So for the first time the scientific community began to discuss ways of regulating and controlling research which was previously quite going on. I mean biotechnology research and gene editing will soon become something which you can do in a garage size lab perhaps, so anybody can do it. It is not like a uranium enrichment plant. So all these issues are there and I am sure they will continue to engage diplomats, policy makers and the public in the future.

So thank you once again for your attention and this has been a pleasure to come here and have such a wonderful attentive audience like you. Thank you!