Indian Science Diplomacy

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Some Basic Concepts

- Science is the basic knowledge of nature- Technology is the practical application of such knowledge.
- Innovation – is the adaptation of knowledge to solve problems. Frugal Innovation – is Innovation which costs little in terms of resources.
- Sustainability – is the use of resources with minimal ecological impact.
- There are many layers in our progress in S & T. Chemistry, penicillin, etc.
- Governance objectives – national security and quality of life for the people. To be understood in broadest sense. They are interlinked. GDP per capita is only one aspect.
- S & T has a strong impact on society and international system – its ability to give economic and military power – and its disruptive effects on societies.

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S & T advances

- S & T has moved up from small groups and individuals to large institutions and large budgets.
- Governments and business have increased funding of S & T, built institutions, put in place policies.
- Disruptive effect – changes the balance of power, and economic activities – can increase inequalities.
- Pursuit of economic and military power – control over technology –IPRs - formal and informal – denial regimes
- Means to acquire technology by overt and covert means. Indigenous development of technology.
- Policymakers, business and civil society face challenges from Technology– will continue to do so in the future.

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Science diplomacy

- Science diplomacy is analogous to economic, cultural, sports or military diplomacy
- **It means the full integration of science and technology into foreign policy and diplomatic practice.**
- **Formalised since 2010 by AAAS USA and RS UK.**
- Increasing importance and impact of S & T in international relations.
- S & T contributes to power (hard and soft) and influence - economic and military.
- Growing importance of knowledge based activities for competitiveness and economic benefits.

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Types of science diplomacy*

- "**Science in diplomacy**": Science can provide advice to inform and support foreign policy objectives.
- "**Diplomacy for science**": Diplomacy can facilitate science and technology development, through cooperation, negotiations etc
- "**Science for diplomacy**": Scientific cooperation can improve relations between states through cooperation.
- These are not hard and fast categories. Science diplomacy may overlap more than one of these.
- There are other views of Science Diplomacy by scholars. A good working definition is "The integration of S and T into diplomacy"
- For developing countries, Diplomacy for Science is important for supporting national development efforts.

* The Royal Society(UK) and the AAAS (USA), 2010

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Science in diplomacy

- Increasing number of global challenges such as WMD controls, climate change, cybersecurity, availability of food, water and energy, human health, environmental degradation, exploitation of outer space and ocean space, etc.
- These challenges are transborder, require application of science and technology, as well as diplomacy.
- Therefore S & T experts must dialogue with policy makers to fashion informed and appropriate diplomatic and foreign policy responses.
- Advanced countries have been setting the agenda and proposing solutions to global challenges while developing countries are at a disadvantage.

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Science in diplomacy

- Policy makers must have a minimum level of scientific knowledge, or at least awareness and access to it
- Scientists must communicate their work in an accessible and intelligible way, which is sensitive to its wider policy context.
- Linkages between the scientific and foreign policy communities - informs scientists about the realities of policymaking; and the policy makers about the role and limits of science in policy.
- Improving the scientific capacity of delegations from developing countries is particularly important, especially in areas of complex and emerging technology.

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S & T in Foreign Policy

Areas of S & T	Issues involved
• Nuclear technology • Aerospace technology, outer space • Chemical technology • ICT, AI, Cybersecurity • Biotechnology • Nanotechnology • Climate change and energy • Ocean science & technology • Human Health • Technology diffusion, IPRs	• Military power and balance • Economic competitiveness and development. • Harmful impact management and control • Positive cooperation and building relations • Technology control and regulation • Misuse by non state actors, terrorists, etc. • Access to Technology

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Diplomacy for Science

- To gain access to emerging S & T and related knowledge and to use it for national S & T ecosystem development, and economic competitiveness
- S & T information gathering, advance information, and negotiating with those involved.
- S & T collaboration with advanced partners,
- S & T cooperation with developing countries. Export of knowledge related products and services
- Participation in large international S & T programmes
- Negotiating S & T exchanges and commercialization of S & T.

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Diplomacy for Science – human resources

- S & T human resources are most important.
- Training, Research partnerships involving R & D institutions and Universities.
- Retaining S & T human resources is a challenge. Requires flexibility and realism and a good S & T ecosystem
- India's diapsora STEM professionals are very important partner for building up the STI ecosystem.
- NEP2020 opens up new opportunities

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Diplomacy for Science – Large projects

- CERN Large Hadron Collider, ITER Fusion energy research, LIGO, TMT, SKA, etc – India is participating.
- Human Genome Project, International Space Station (ISS) – India did not participate
- SESAME Project in Jordan
- International Solar Alliance (ISA), ICGEB – India invested substantial resources and effort in these projects.
- May be single mega facility (CERN), or big networked type (HGP, LIGO, etc)
- All such projects require detailed international negotiations to finalize agreements. Diplomats and scientists need to work closely together.
- India can get access to cutting edge science with relatively low investment.
- With costs of basic research rising, more such international projects are likely.

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ICGEB and the ISA

- International Centre for Genetic Engineering and Biotechnology
- Promoted by India and Italy
- Headquartered in New Delhi and Trieste, additional Centre in Cape Town. Network of affiliated Centres.
- Established under UNIDO, 1983; Became an independent IGO in 1994; 65 Member States

- International Solar Alliance
- Promoted by India and France
- Headquartered in Gurugram
- Launched in 2015 ; Framework Agreement entry into force 2017, Now 86 ratifications, 107 signatories incl US, Germany, Italy.
- Membership now open to all UN members
- Membership of major countries like USA, Germany, Rep of Korea a challenge

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Diplomacy for STI – Development aspect

- STI for development is very important for many developing countries.
- Development to be seen in widest context – including national security.
- Target – achieve development goals – SDG 2030 etc. Technology Facilitation Mechanism (TFM) set up under UN for meeting SDG targets.
- Importance of experience sharing among the South, frugal innovation.

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STI and SDGs

- S & T is critical for progress in many of the 17 SDGs
- Some sectors where there is strong impact are Health, Agriculture/Food/Nutrition, Energy, Water, Environment, Biodiversity, Industry, Education, Governance, etc.
- SDGs progress requires finance, technology, and human resources.

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Diplomacy for science – developing countries

- S & T in India developed for tackling Indian development challenges may be more relevant and useful.
- Many areas of S & T offer opportunities for mutually beneficial S-S cooperation. Export of goods and services and access to resources.
- Training, capacity and institution building activities.
- Activities can be supported under ITEC programme.
- Leveraging STI for exports of goods and services
- Role of Mission is critical in identifying cooperation activities and leveraging the impact on relations

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S&T ecosytem – components

- Government - S & T departments and research institutions, funding for R & D, Regulatory bodies, State governments.
- Academic and Research institutions – private and public.
- Business community – business development
- IPR system, commercialization of S & T, incubators, business environment.
- Civil society – consumers, social activists
- If the ecosystem is weak, elements will seek to migrate to better ecosystems.

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S & T acquisition issues

- Research centres in countries may tap S & T talented workers by funding R & D to generate IPRs.
- Benefits of commercialization of IPRs may be taken over by MNCs with access to larger markets and resources.
- Similar issues may arise in externally funded S & T activities, with unaware partners.
- How much of the value goes to the host country ? Case of Israel, India.

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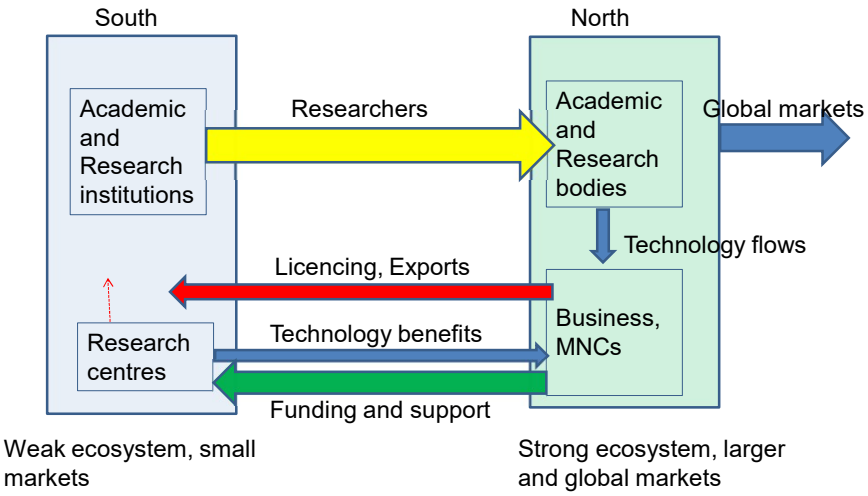
Technology flows and benefits



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India's STI ecosystem data

- India's total spending on R & D was 0.7 % of GDP (2019 est), much below that in major nations such as the US (2.8), China (2.1), Germany (3.0), Israel (4.5) and Korea (4.6).
- The number of researchers per million population in India was 255 in 2017 , well below that of China (1225), Brazil (888), Russia (2822), USA (4245), S.Korea (7498), Israel (8342) and South Africa (492).
- Gross Expenditure on R&D (GERD) - Central Government 45.1%, State Governments 7.4%, Higher Education 3.9% and Public Sector Industries 5.5%, Private Sector Industries contributing 38.1%.
- R & D per researcher is moderate, ahead of Russian Federation, Israel, Hungary, Spain and UK. India is 5 th in world in Scientific Articles output(SCOPUS).
- STI Policy being reviewed by the Office of PSA, new STI policy expected to replace 2013 policy.

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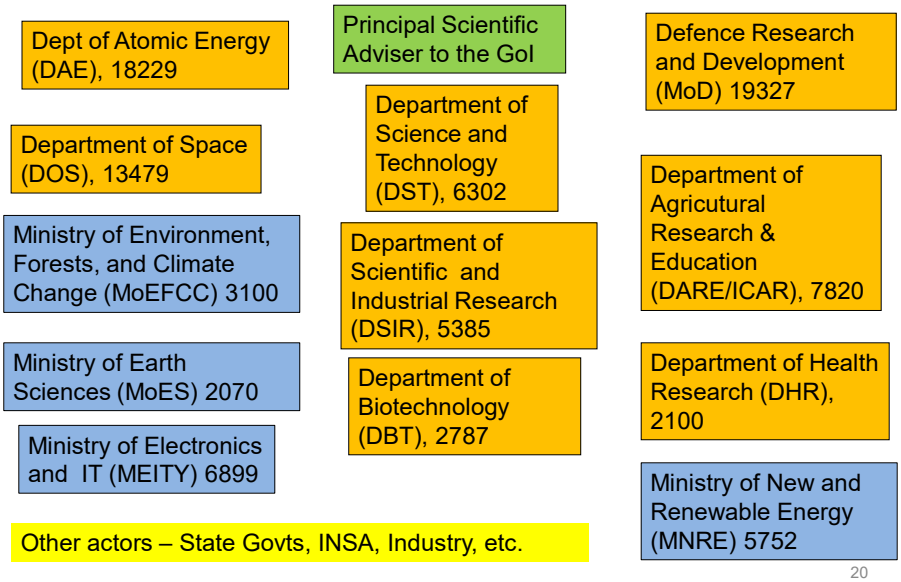
India - Central Government – Main S & T related Departments

(Extracted from 2020-21 budget Rs Crores Total budget = 3,042,230 crores)



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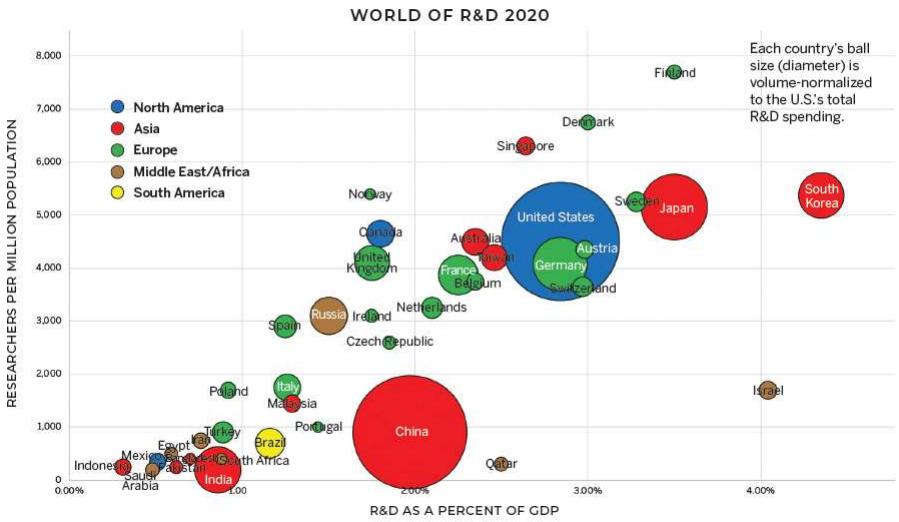
Where do we stand ?



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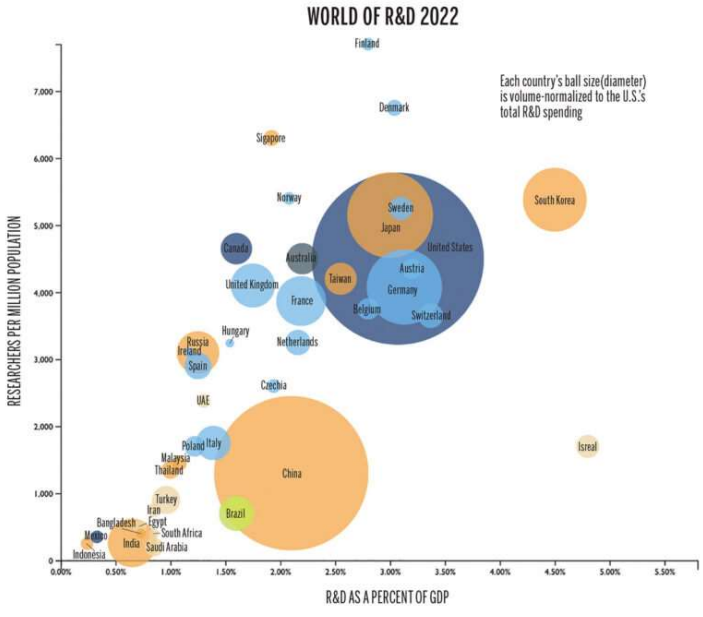

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What needs to be done ?

- Increase GERD to at least 2.5% of GDP
- Increase researchers per million to over 2000, improve quality, exploit NEP 2020
- Strengthen R & D infrastructure – more institutions, laboratories, research facilities
- Develop incubators and translate R & D into IPR and start ups
- All the above must be done together, with internal and external resources.
- Strengthen S & T external cooperation and network of science officers; and coordination among Indian agencies.

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Bilateral S & T agreements

- Bilateral framework agreement – cost sharing, sharing of IPRs, facilitation clauses, joint implementation committee, etc.
- Programme of cooperation, specific activities, partners identified, project approval and monitoring, etc.
- DST - bilateral S&T cooperation agreements with 83 countries.
- DAE – agreements in nuclear energy with 13 countries
- DOS – agreements with 36 foreign entities.
- Dispersed nature of S & T cooperation agreements.
- Lack of coordination among Science agencies and MEA-on Foreign Policy and exploiting synergies. Case of China.

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China – S & T agreements

- 16 Agreements/MoUs during 2003-2015
- Break up – Earth Sciences (5) , Space (2), Agriculture (2), Environment (1), RE(1), Traditional Medicine (1), Higher Ed (1), S & T(3)
- MEITY – MoU(2014), JWG, Strategic Econ Dialogue.
- Coordination among agencies, analysis of benefits, strategic competition, etc.

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S & T agreements (DST)

- Agreements with 83 countries, only 44 are termed as active by DST.
- Agreements terminated (4) with Cuba, Oman, Trinidad and Lao PDR.
- Agreements with some countries with significant R & D but termed inactive – China, Turkey, Ireland, Malaysia.
- Regions with many inactive agreements – Africa, Central Asia, West Asia.

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MEA – Main STI actors

- NEST Division – New, emerging and strategic technologies – set up in 2020 to cover gaps. Role is emerging.
- DISA – deals with NPT, MTCR, CWC, BWTC, AI and LAWs, and Outer Space related issues
- UNES – Deals with SDGs
- MER – Deals with STI cooperation in multilateral forums, G20, IBSA, BRICS, etc.
- Territorial Divisions, Econ Division – deals with bilateral S & T cooperation , ITEC, etc.
- Need for experts and consultants for domain knowledge.
- Better coordination needed with IC wings of Science Ministries and other agencies.

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Present network for S & T cooperation

- 4 Science Counsellors located in Washington, Moscow, Berlin and Tokyo; deputed by DST on 3 year assignments.
- Scientific Officers from DAE at Paris, Vienna and Moscow; from ISRO at Paris and Washington, from DRDO at Washington, Moscow.
- No SC in important countries such as China, Israel, UK, Belgium (for EU), Rep of Korea, etc.
- Much smaller network compared to USA, France, Japan, UK, Russia, etc
- For the rest of the countries S & T cooperation work is handled from India. Event driven, mostly during HL visits.
- In most other countries, S & T related work is handled by IFS officers doing economic/commercial or education/culture work. Initiative is largely left to HoM.
- Need to enhance S & T cooperation work at country level, and better coordination in India.

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Science Attache's role

- Reporting on significant scientific and technological developments. S & T profile of the country.
- Assistance in the exchange of scientific information and personnel, handling of visits by S & T delegations.
- Assistance in the procurement of scientific equipment and services.
- Outreach to NRI/PIOs involved with scientific and technological work.
- General promotion of better cooperation with foreign science agencies.
- Arrangements for collaborative research projects with foreign scientists
- Scientific and technical advice to the Head of Mission, Coordination with Economic diplomacy, Defence activities.

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Science Officer Role

- Role may be combined with other functions – economic diplomacy, etc.
- Prepare a S & T profile of the country, including its S & T policies, institutions and programmes. Identify promising areas for cooperation. Update it regularly. Send it to key stakeholders in India.
- Prepare an plan of activities for S & T cooperation, get it approved by HoM.
- Report to MEA and to concerned Ministries, about S & T developments, especially of interest to India.
- Visit important R & D institutions research centres/clusters, universities, etc., discuss activities, identify areas for cooperation, make contacts, identify possible Indian partners.
- Review ongoing collaborations, projects and better implement existing agreements. Support R & D cooperation activities.
- Outreach to NRI/PIO S & T professionals.
- Engage with stakeholders at states and cities and outside the government also

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Science attaches networks

- Slovenia has SAs in the embassies in the US, Israel, China, Japan and the United Kingdom.
- UK's Science and Innovation Network (SIN) has approximately 90 officers in over 30 countries and territories around the world building partnerships and collaborations on science and innovation.
- Switzerland, Netherlands have set up separate agencies which run offices abroad.
- France has S & T Departments in Embassies in the US, India, and 8 other countries. In US alone it has 24 officers in 7 Missions. In India 8 officers in 3 Missions.
- US has career diplomats handling S & T work (given some training) in Missions abroad, coordinated by a Bureau at DOS Hqrs. Senior scientists as S & T advisers in the DOS and in the White House.

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Alternative models for SA networks

- Train career IFS officers to carry out SAs role (together with economic work), with specific guidelines and instructions from headquarters. (USA)
- Expand the network of specialist science counsellors to more countries (limitations of personnel, resources)
- Set up joint bodies for S & T cooperation promotion, including with funding.(France, Germany, USA)
- Use specialists from home for carrying out research and analysis, especially on sector specific topics.(USA)

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Science Diplomacy strategy

- Full time Science advisers in Missions abroad, or Officers assigned to do this work part time.
- Scientific advisors attached to PMO and Ministries
- Strategic objectives at country/regional level to be defined by Foreign Ministries in consultation with S & T institutions.
- Briefing of officers and instructions to Missions abroad.
- Periodic reporting on developments
- Contact building with local S & T entities. NRI/PIO outreach.
- Facilitate cooperation with home country institutions.
- Facilitate participation in large science projects.
- Office of PSA is revising STI Policy 2013, major changes expected.

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Science for Diplomacy

- S & T partnerships can help bridge differences among countries.
- Examples US/USSR, US/N Korea, US/Cuba, Middle East, etc.
- S & T contacts can help build confidence and provide alternative channels for communication.
- S & T cooperation to tackle common problems can strengthen relations with neighbours.
- Example South Asia – challenges of air pollution, disease control, water management, energy networks, disaster response, etc.
- Similar to cultural or sports diplomacy.

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Science for Diplomacy - examples

- Science cooperation agreements between the US/USSR and US/China in the 1970s and 1980s, US/Cuba(since 1997), etc.
- Creation of new institutions- CERN(Geneva, with 20 states) , ISS(with 5 space agencies), ITER, etc.
- SESAME(located in Jordan with 8 members including Israel, Iran, Pakistan and ME States, and 17 observer states)
- Iran nuclear agreement (P5+1 and Iran)
- Arctic Science Agreement, 2017

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THE SESAME PROJECT

Synchrotron-light for Experimental Science and Applications in the Middle East

SESAME is a 3rd generation light-source ('extremely bright flash lamp → very powerful microscope') **near Amman – starting to operate**

SESAME will foster
- science and technology in the Middle East and neighbouring countries (from biology and medical sciences through materials science, chemistry, and physics to archaeology)
- cooperation across political divides

Members:
Cyprus, Egypt, Iran, Israel, Jordan, Palestinian Authority, Pakistan, Turkey
Others welcome

Observers: Brazil, Canada, China, EU, France, Germany, Greece, Italy, Japan, Kuwait, Portugal, Russian Federation, Spain, Sweden, Switzerland, UK, USA

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Nuclear technology - science diplomacy

- NPT related issues – de facto NWS status and end of Nuclear isolation. Membership of NSG.
- Prospects of more NWS emerging. Security dilemmas- Iran, N Korea, etc. The Ukraine conflict and Russian posture. Taiwan situation.
- CTBT related issues.
- FMCT negotiations – pressures on fissile material production but no reductions of existing stockpiles.
- Nuclear disarmament initiatives led by civil society. The NW Ban treaty and India.
- Strategic challenges from Pakistan and China.
- Nuclear energy, fuel cycles, improved reactors, and climate change. Applications of nuclear technology

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Climate change and energy

- India plays a key role in global efforts due to its size and economic growth. No solution without India. Pledge to reduce Carbon intensity of GDP. Major RE programme launched.
- GHGs emissions have to be reduced to avoid major climate changes (1.5 to 2 deg C limits). How to share the reductions? Climate justice, cumulative and per capita emissions.
- Need for space for India's economic development. Reduce dependency on fossil fuels and pursue alternative energy.
- Cryosphere changes - the Arctic and the Himalayan Pole. Global climate models and extreme events prediction.
- New technology and finance for low GHG path and for GHG removal (CCS technology).
- Tax on GHG emissions ("Carbon Tax").EU Border Carbon Adjustment mechanism.
- Failure of international negotiations and role of civil society. Role of subnational entities, for example in the US. No progress on key issues of loss and damage, climate finance.
- New issues – "just transition", oil/gas business interests

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Some other issues

- Technology Control regimes – NSG, AG, MTCR, WA
- IPR issues and expansion into genomics, affordable access to health care, green technology.
- ICT, AI, digital manufacturing, cyber security, social media, 6G, IoT, and LAWS.
- Aerospace – ASAT weapons control, Outer space legal regime (Artemis guidelines by US), Space Debris, Hypersonic vehicles, etc.
- Ocean space – UNCLOS issues, UN BBNJ Conference, LMEs and MPAs.
- Biodiversity – CBD implementation
- BWC Review Conference 2022, Control and verification, non-state actors, bioterrorism.
- Regulation of R & D in biosciences, Biosecurity, gene therapy, gain of function, reproduction, etc.

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Large Marine Ecosystems – challenges

Bordering countries: Bahrain, Djibouti, India, Iran, Iraq, Kuwait, Oman, Pakistan, Qatar, Saudi Arabia, Somalia, United Arab Emirates, Yemen. **At Very High Risk**
LME 32 total area: 3,950,421 km^2 **Coastal population** 28 mn(2010) 109 mn(2100 proj)

Bordering countries: Bangladesh, India, Indonesia, Malaysia, Maldives, Myanmar, Sri Lanka, Thailand. **At Very High Risk**
LME 34 total area: 3,657,502 km^2 **Coastal Population** -323 mn(2010) 502 mn(2100 proj)

There are 66 LMEs across the world, identified under the Global Environment Facility programme. A new Treaty to protect marine biodiversity is being negotiated in NY (UN BBNJ)

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Conclusions

- International agendas and frameworks for S & T have been largely shaped by advanced countries.
- Developing countries need to integrate S&T into their diplomacy and be better prepared for international negotiations.
- S & T developments will give rise to new challenges and opportunities for diplomacy and public policy.
- Diplomacy for Science can be a powerful tool for development and achieving the SDGs.

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Going ahead

- Maintain interest in SD, and update regularly
- Subscribe to SD publications, news letters
- Write articles for RIS-FISD Science Diplomacy Review. Occasional papers also welcome.
- Send FISD news of any interesting S & T events in the host country.
- Send details of any institutions and key persons that RIS-FISD could link up with.

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Thank you

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