The Future of Science and Technology Diplomacy for Pakistan

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Introduction

The concept of Science Diplomacy, although gaining prominence in the 21st century, has been a relevant and significant component of a state's political system for centuries. Science Diplomacy refers to international cooperation across various scientific domains, aiming to foster effective communication and collaboration in science between nations. In the past, cross-border scientific collaborations have not only enabled significant knowledge exchange but also contributed to major political successes, fostering peace and security among nations. After the second World War, countries actively engaged in Science Diplomacy as a means to foster international collaboration, build trust, and promote peace. Two vital organizations that emerged as a result of these efforts include the United Nations Educational, Scientific and Cultural Organization (UNESCO), founded in 1945, and the International Atomic Energy Agency (IAEA), founded in 1957. Another notable project that came into existence as a result of Science Diplomacy was the International Space Station (ISS) which was a collaboration between five space agencies of USA, Russia, Japan, EU, and Canada. Through these attempts and the resultant organizations, even countries which were unable to see eye-to-eye ideologically were able to cooperate for the advancement of science for their country's development and global peace promotion.

Now, as the forms of international collaboration are developing, Science Diplomacy is also evolving to encompass not only scientific but also the broader realm of technology. This evolution recognizes the interplay between scientific advancement, technological innovation, and foreign affairs. Technology is increasingly becoming one of the most essential components of global, economic and industry agendas. In 2021, Forbes published an article stating that "The era of Tech Diplomacy is here."[1] The article uses the example of semiconductors to explain how technology is defining diplomatic matters while at the same time, diplomacy is also influencing the development of technology.

Science Diplomacy and Tech Diplomacy are distinct in the sense that Science Diplomacy mainly focused on matters like nuclear proliferation and space exploration while Tech Diplomacy is now centered around chips, Artificial Intelligence, Telecommunication etc. However, current global challenges like climate change, food security, and global population on the rise, require solutions resulting from both scientific research and technological innovation.

Despite significant progress in certain areas, Pakistan still lags in terms of technology infrastructure, digital inclusion and equity, and faces many challenges. Especially in comparison to regional leaders in technology, Pakistan's science and technology infrastructure is relatively underdeveloped. Pakistan must take urgent measures to develop a robust Science and Technology Diplomacy framework as a sizable portion of the country's population is young and their natural inclination towards Information Technology is an asset for the country's economic development.

Significance

Science has remained one of the most effective and instrumental diplomatic tools through the ages and scientists have often been referred to as natural diplomats. Civilizations have always progressed and prospered by embracing scientific discoveries and wars have been won by leveraging technological superiority. Therefore, the vital role of science and technology in shaping human societies cannot

[1] Chiang, Mung. "The Era Of 'Tech Diplomacy' Is Here." Forbes, July 7, 2021.

be disputed. Science and Technology Diplomacy comes into play when the horizons of innovation are broadened beyond borders and international stakeholders are involved. The dominant understanding of Science and Technology diplomacy is that it has the capability to bring about a better international order, driven by the values of science[2]. International cooperation in the fields of science and technology, in addition to its primary objective of producing scientific benefits across borders, also has the potential to generate other advantages for countries by fostering positive ripple effects. These positive effects include promoting better understanding between nations and acceptance of foreign cultures as well as easing international political tensions. In this way, Science and Technology Diplomacy serves as a catalyst for both scientific progress and diplomatic understanding, contributing to broader societal and geopolitical advantages across the globe.

Science and Technology Diplomacy is more relevant and important than ever considering the globalized nature of the challenges we face today. Our planet is facing several global challenges ranging from its atmosphere and inhabitants, to resources. These serious problems such as climate change, over-population, pandemics and epidemics, and food, water, energy, and cyber security require cross-border collaboration to find long-term and sustainable solutions. It is science that provides our understanding of these issues, and it is science and technology that will lead to solutions.

Pakistan is a resource-rich country with ample coal and gas reserves in Balochistan, minerals worth over a trillion dollars in Reko Diq, one of the world's largest salt mines, fertile soil, and significant renewable energy resources. Pakistan also boasts a significant human capital base, with over 64% of its population below the age of 30 (UNDP, 2018). Harnessing this potential of the young population for the development of the country through advancement in science and technology holds the promise of alleviating economic crises and fostering growth. Moreover, the importance of knowledge exchange and collaborative international training programs cannot be

[2] Ruffini, Pierre-Bruno. "Conceptualizing science diplomacy in the practitioner-driven literature: a critical review." Humanities and Social Sciences Communications (2020).

overstated, particularly in the fields of cost-effective mineral exploration and mining techniques and the integration of renewable energy sources. Pakistan already possesses ample resources, however acquiring necessary expertise to harness their potential is essential.

Pakistan's Science and Technology Diplomacy Efforts

Pakistan has made notable progress in Science Diplomacy through the years. Some of the most prominent projects in this regard include Pakistan-U.S. Science and Technology Cooperation Program, Pakistan-China Science and Technology Cooperation which includes the Space Silk Road (SSR) Program, and Pakistan-Germany Technical Cooperation Program. Some university-based international projects include the International Center for Chemical and Biological Sciences (ICCBS) located at the University of Karachi. This center has produced some excellent joint research projects and is one of the leading Science Diplomacy centers in Pakistan.

China and Pakistan have enjoyed a longstanding collaboration in the field of space projects, with some of the joint research projects dating back to the 1970s. Pakistan's first indigenously developed satellite Badar-1 was launched from China in 1992. China has also played a substantial role in modernizing Pakistan's satellite program. China-Pakistan Economic Corridor (CPEC) is the flagship project of the Belt and Road Initiative. To support CPEC, China-Pakistan Joint Research Centre (CPJRC) was established to focus on the frontier scientific problems in earth sciences, hazards and risk, and regional sustainable development along CPEC and become an international-level platform for China-Pakistan scientific and technological cooperation with prominent experts from both countries. CPJRC was established jointly by the Chinese Academy of Sciences and Higher Education Commission of Pakistan[3].

The U.S.-Pakistan Science and Technology Cooperative Program aims to increase cooperation between the two countries in the fields of science, technology, engineering, and education. The U.S. National Academy of Sciences, in collaboration with the Pakistani Ministry of Science and Technology (MoST) and the Higher

[3] http://www.cpjrc.net/page/introduction

Education Commission of Pakistan (HEC), implements this program, which is co-sponsored by USAID and the Department of State. Its goals are as follows:

1. Increase the capacity of the scientific and technology community to promote Pakistan's human and economic development.

2. Raise the standard, applicability, and capacity of science and technology-related higher education and research at Pakistani institutions of higher learning.

3. Boost the capability of Pakistani research institutes to assist competitiveness in industry[4].

As an ongoing project, the US-Pakistan Science and Technology Cooperative Program has achieved significant outcomes, benefiting numerous graduate and postgraduate students. Through the program, these students have received grants to conduct their research, leading to valuable contributions in various scientific disciplines. The initiative has fostered a supportive environment for research and education, enabling students to pursue their academic aspirations and make meaningful advancements in their respective fields.

The Foreign Ministry of Pakistan started its Science Diplomacy Initiative in 2018, recognizing the potential of Science, Technology, and Innovation (STI) to address global issues and as a platform to promote the accomplishment of Sustainable Development Goals (SDGs). Science Diplomacy Division under the Ministry of Foreign Affairs was established, and in March 2022, the Ministry of Foreign Affairs, in collaboration with the OIC Standing Committee on Scientific and Technological Collaboration, held the launch of the first issue of its Science Diplomacy Journal, 'Science Diplomacy Perspectives'. The Journal consisted of comprehensive papers by Career Diplomats, experts, and academics on a wide range of science and technology matters.

The National Science and Technology Park (NSTP) located at NUST, Islamabad, has been at the forefront of leading national and international science and tech projects,

[4] U.S. Pakistan Science & Technology Cooperative Program | Archive - U.S. Agency for International Development (usaid.gov)

often engaging in collaborations with other countries. One notable collaboration was the recently held Rising Stars Start-up Competition, organized at NUST and powered by the US Embassy. The Rising Stars Start-up Competition aimed to support and empower women and minorities in the entrepreneurial ecosystem. It provided a platform for start-ups led by women and minorities to showcase their innovative ideas and business models. The competition not only provided recognition but also offered funding opportunities to the winning start-ups, enabling them to further develop and scale their ventures.

While there have been efforts by Pakistani embassies in various countries to foster more avenues of S&T collaboration, there is a lack of a coordinated policy and vision by the government of Pakistan to promote Science and Technology Diplomacy. There is a lack of coordination and synergy among various stakeholders, including government agencies, academia, and industry. This makes it more difficult to execute science and technology programs cogently and reduces the effectiveness of diplomatic efforts. In addition, the lack of adequate science outreach and communication initiatives causes a disconnect between public understanding of scientific developments and Pakistan's scientific potential. For Pakistan's scientific and technology diplomacy to be more effective, these issues must be resolved along with better resource allocation, coordination, and science communication.

Analyzing the Science and Technology (S&T) Landscape of Pakistan: Exploring Strengths, Weaknesses, Opportunities, and Threats

Figure 1: SWOT Analysis of the S&T Landscape of Pakistan

Given the challenges that Pakistan's scientific and technology infrastructure faces, it is essential to ensure Pakistan's relative superiority in the sector despite the technical breakthroughs of regional nations like China, India, and Bangladesh. Against this backdrop, it is critical to understand the internal factors that have the potential to positively influence Pakistan's science and technology environment, as well as its external opportunities for growth. Being cognizant of these elements is essential for Pakistan to strategically manage its S&T environment, utilize its strengths, address regional and global challenges, and seize opportunities for advancement.

Natural resource wealth in Pakistan offers a large opportunity for Science and Technology Diplomacy. Pakistan can efficiently utilize and use its natural resources for sustainable development and economic progress by making use of scientific and technical developments. Collaborations with foreign partners can be facilitated through Science and Technology Diplomacy, allowing for knowledge exchange, technology transfer, and capacity building in resource exploration, extraction, and management. Through these collaborations, Pakistan may have access to cutting-edge methods, affordable approaches, and creative solutions in fields including mineral

exploration, the development of renewable energy sources, water management, and agricultural practices. This technical and scientific cooperation may improve Pakistan's know-how, optimize resource use, and address issues like food insecurity while strengthening diplomatic connections with partner countries. All of these joint ventures can be carried out successfully as there is a large portion of young population in the country, which is actively taking interest in the emerging start-up culture. The youth of today is more inclined towards becoming self-employed and thus entrepreneurial innovation is being encouraged across universities, S&T parks, and incubation centers all over the country. Furthermore, Pakistan's geographical location provides a favorable setting for trade and connectivity initiatives. With this geographic advantage, Science and Technology Diplomacy may boost connection, support economic integration, and boost trade. Pakistan may make use of science and technology to boost trade corridors, increase connection networks, and promote regional cooperation through partnerships in sectors including transportation, logistics, and infrastructure development. The sizeable diaspora community of Pakistan, which is distributed all over the world, is a considerable asset in the field of science and technology diplomacy. The Pakistani diaspora is made up of talented individuals who have achieved success in a range of scientific and technological sectors in the countries where they reside. They bring essential experience, networks, and resources to the table and have a thorough awareness of the scientific landscapes in Pakistan and throughout the world. The diaspora can also play a very important role in building soft power for Pakistan.

The lack of a coordinated Science and Technology Diplomacy policy in Pakistanis a major weakness in effectively and completely utilizing the potential of science and technology for diplomatic purposes as well as for national development. Without a consistent policy framework, initiatives may be dispersed, which would impede stakeholder synergy. Significant issues also include inconsistent messaging and lost chances for cooperation, technology transfer, and resource allocation. Coupled with other shortcomings such as lack of adequate funding, weak infrastructure, and digital divide, create an unfavorable environment and a poor outlook for the S&T landscape in Pakistan.

Successful Science and Technology Diplomacy is significantly hampered by Pakistan's ongoing political instability. Concerns regarding the frequent renegotiations of agreements with new administrations over brief periods of time have been raised by foreign countries. In addition to interfering with diplomatic efforts, this instability reveals a deficient democratic system and erodes the faith of foreign investors in the government's dependability and commitment. Therefore, it becomes essential to have a strong, stable administration that has the support of the populace. The confidence of foreign investors may be restored with the aid of a strong administration, which can also offer the assurances required for long-term cooperation and investments in science and technology projects. Moreover, Pakistan faces formidable regional competition in the realm of science and technology, necessitating its urgent efforts to catch up as other countries in the region have already made substantial progress. To remain competitive, Pakistan must bridge the existing gap by accelerating its advancements in scientific research, technological innovation, and human capital development. The importance of effective scientific communication for Science and Technology Diplomacy is frequently overlooked in Pakistan. By acting as an intermediary between scientists and the general public, science communication fosters comprehension and reasoned decision-making. It improves Pakistan's visibility, credibility, and dependability as a scientific partner in the context of diplomacy. Pakistan must focus on bolstering its efforts in science communication.

With these threats, Pakistan also has promising potential in the field of Science and Technology Diplomacy. First and foremost, regional cooperation offers a way for neighboring nations to work together and exchange knowledge and expertise. Pakistan may benefit from shared resources, expertise, and infrastructure by utilizing regional collaborations, promoting growth and development, and friendly relations for all parties involved. Second, Pakistan is facing a severe economic crisis and S&T Diplomacy can offer potential solutions to improve the economic situation of Pakistan. Pakistan can draw in international investment, encourage entrepreneurship, and provide employment opportunities by using the potential of innovation and technical breakthroughs. Science and Technology Diplomacy may open avenues for cooperative R&D initiatives, technology transfer, and capacity building, all of which

support long-term economic growth. Third and most importantly, The globalized nature of issues afflicting the world of today presents Pakistan with an opportunity to participate in research and technology cooperation internationally. Climate change, public health concerns, and cybersecurity are just a few of the issues that call for international cooperation and scientific competence. Pakistan could play a role in addressing these complex problems and increase its visibility and influence in international fora by actively taking part in global efforts.

Recommendations

1. A dedicated task force comprising experts from different areas of science and technology must be constituted to identify measures to ensure that Pakistan remains at the forefront of Science and Technology Diplomacy.
2. Regional collaborations must be fostered by strengthening relations with countries in our neighborhood as well as Central Asian countries. This can involve joint research projects, technology sharing, and knowledge exchange programs to leverage collective resources and expertise for mutual growth and development.
3. To close the communication gap between scientists, decision-makers, and the general public, we must invest in science communication initiatives. To successfully convey scientific discoveries, improve public awareness, and include diverse audiences, we must develop science communication training programs.
4. Designate experienced individuals as "tech diplomats" who can serve as liaisons between scientific communities, governments, and international stakeholders. These tech diplomats should possess a strong understanding of both foreign policy and science and technology to facilitate collaboration, negotiate agreements, and promote science and technology diplomacy on the global stage. The first tech diplomat was appointed by the Dutch and sent to Silicon Valley. It proved to be a successful exercise and since then, many countries are beginning to appoint tech diplomats across the world.

5. We must develop a Science and Technology Diplomacy Policy which is a comprehensive and well-coordinated policy framework that harmonizes the goals of science and technology diplomacy with those of foreign policy, while also ensuring progress of Sustainable Development Goals (SDGs). To fill the gap between foreign policy and science diplomacy policy, this policy should address resource allocation, capacity building, collaborative structures, and financing methods. Moreover, it must guarantee the long-term consistency and continuity of diplomatic activities.

Conclusion

Developing countries often tend to prioritize other, more pressing matters over areas like advancement of Science and Technology and their alignment with foreign policy, however, recent climate catastrophes in Pakistan have highlighted the unequal distribution of damages regardless of global shares. It is evident that we need to keep pace with the world and prioritize the establishment of a strong Science and Technology Diplomacy policy to address such challenges. Recognizing the importance of advancing alongside the rest of the world and working towards having a strong Science and Technology Diplomacy policy are essential for Pakistan. Pakistan may achieve this by making sure that its interests and concerns are sufficiently represented in international forums and accords, enabling it to successfully handle the problems posed by climate change and other global issues. Pakistan will be able to make use of these emerging technological and scientific developments for sustainable development, economic growth, and the general welfare of its inhabitants with the help of a well-defined Science and Technology Diplomacy policy.