SOUTHERN PERSPECTIVES ON SCIENCE AND TECHNOLOGY COOPERATION

ITEC Programme on Science Diplomacy

7-18 January 2019

New Delhi

RIS
Research and Information System
for Developing Countries
विकासशील देशों की अनुसंधान एवं सूचना प्रणाली

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PREFACE

Prof. Sachin Chaturvedi
Director General, RIS

Science Diplomacy has emerged as a key component in diplomacy and foreign policy. Over the years it has emerged as a theme that has immense theoretical and practical relevance. This has resulted in an enormous increase in literature on Science Diplomacy, including studies on policies and case studies. In addition to this, literature on health diplomacy and innovation diplomacy has been increasing. But most of the literature is from the institutions in developed countries, which often reflect or reiterate the perspectives from policy makers, diplomats and institutions there.

In the recent years, post Paris Climate Agreement, climate change has emerged as a major concern in global development discourse and practice and Science Diplomacy and S&T cooperation are no exception to this. In this volume and in the presentations made the role of Science Diplomacy in Climate Change issues finds an important place. Similarly, the Sustainable Development Goals and the using Science Diplomacy to meet SDGs and harnessing S&T co-operation for achieving SDGs is another topic that has been discussed in this volume.

Since the first capacity building programme conducted in 2017 RIS has been bringing out a publication consisting of papers from participants. In the programme conducted in 2019 there were 36 participants representing 27 countries, from Africa, Latin America and Asia with a perfect gender balance of 18 females and 18 males.

As in the previous programmes, the agenda was a mix of lectures, study and group discussions, field visits and technical sessions. Eminent experts and, policy makers addressed the participants on a wide variety of topics, including Artificial Intelligence, Climate Policy, Genome Editing, and, Technology and Foreign Policy. The participants were divided in to six groups and each group made a presentation. In addition to this, they were to write a paper, as an individual or as a group of two. This volume consists of papers written by them. The papers cover a wide range of themes and topics, but what is important is that they bring in perspectives and insights on Science Diplomacy, South-South Collaboration and bi-lateral/multi-lateral collaboration. They discuss about their aspirations and expectations from Science Diplomacy and also South-South collaboration. It is heartening to note that the papers have identified new areas of co-operation and make suggestions for expanding the present ones. The suggestions are not wish lists but are backed by analysis and data. I hope these will be found useful by all stakeholders.

In fact these are welcome additions to the literature, which as pointed out, emanates mostly from developed countries. This volume, on the other hand, is a collection of views from the South, and reflects the visions and ideas of the new voices waiting to be heard and talked to. Thereby

this volume opens up opportunities for dialogues and discussions, and, has a focus on adopting Science Diplomacy by the South, for the South. The participants have written papers that go beyond traditional S&T cooperation and have identified new opportunities and themes for S&T cooperation and science diplomacy, such as climate resilience, role of universities, transfer of technology, advancing food security etc. Similarly, some of the papers have addressed issues like cooperation among three countries, SDGs, transformation to a middle income country. Thus it is clear that in science diplomacy and S&T cooperation, new ideas and approaches are the need of the hour. It is hoped that the stimulating ideas and analysis in this volume will spur more thought and action.

We thank the Ministry of External Affairs for supporting ITEC Programme on Science Diplomacy conducted by RIS. We are also grateful to the Department of Science and Technology for sponsoring the Science Diplomacy Programme at RIS.

Finally, we congratulate the participants and the RIS team for this excellent and timely publication.

Sachin Chaturvedi

Science Diplomacy and S&T Collaboration in Serbia

Dr. Mirjana Ćujić*

Development of S&T Capacity

In Serbia the first Ministry of Education was established in 1834. To meet its needs for teachers since 1839 Serbia had been sending teachers abroad for training. In 1946 primary schools for women were established. The developments in Europe in S&T had its impact on Serbia and

Period of rapid technological development on the world stage until the Second World War, and some of the well known Serbian researchers were, Mihajlo Pupin (1858-1935), Nikola Tesla (1856-1943), Milutin Milanković (1879-1958), Pavle Savić (1909-1994). State Universities in Serbia are located in major cities: Belgrade, Novi Sad, Kragujevac, Niš, Novi Pazar, Priština (Kosovska Mitrovica). Since 2007, a new concept of study has been introduced in Serbia, adhering to Bologna Declaration.

University of Belgrade is the oldest one in Serbia; it was founded by Dositej Obradović in 1908 as the Belgrade Higher School in Serbia. During the two centuries of its existence the University of Belgrade has served the country well and students from it had contributed to development of Serbia in all spheres. The University comprises 31 faculties, 11 research institutes, the university library, and 13 university centres. The faculties are organized into 4 groups: social sciences and humanities; medical sciences; natural sciences and mathematics; and technological sciences (The University of Belgrade, 2019). The University of Belgrade according to the Shanghai Ranking of World Universities, was positioned for the first time in 2012 between the 400th and 500th place, and it is currently ranked between the 200th and 300th place.

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The first research institute in Serbia Vinča Institute of Nuclear Sciences was founded in 1948, From its founding to the present day, Institute has been the most prominent multidisciplinary research institute in the Republic of Serbia. Today, the Institute employs 311 researchers, and 210 Ph.D. students working on over a hundred national and international projects, as well as in international scientific research collaborations in which the Republic of Serbia is a member (Vinča Institute of Nuclear Sciences, 2019).

S&T Planning in Serbia

Serbia in its ambitions to become a technologically developed country has taken various steps on the internal and external plan to achieve that goal. There are several key documents such as , Law on Scientific Research Activity (Official Gazette RS, No 110/2005, 50/2006-corr., 18/2010, 112/2015), Law on Innovation Activity (Official Gazette RS, No 110/2005, 18/2010, 55/2013), Law on Serbian Academy of Science and Arts (Official Gazette RS, No 18/2010) which give an idea about the plans for the university. The Strategy on Scientific and Technological Development of the Republic of Serbia for the period 2016-2020 - 'Research for innovation' (Official Gazette RS, No 25/2016) outlines the objectives and strategies. The strategy document includes information about the legal framework and other strategic documents, the current science and innovation system in Serbia, strategic objectives for the period 2016-2020, and the objectives include , to encourage excellence and relevance - in particular in relation to economic development, to improve human resources, to promote international cooperation and to increase investment in all sectors. The document provides guidelines for the implementation and an action plan, with a clear emphasis on the quality of education and research staff and competitive research for innovation. The Strategy relies inter alia, in part on the positive experiences of the Strategy on Scientific and Technological Development of the Republic of Serbia for the period 2010 – 2015, associated with regional EU programs and strategies

The scientific research system of the Republic of Serbia comprises the following institutions:

A. Accredited scientific research organisations

- Faculties which operate exclusively under the Universities
- Scientific institutes and Research and Development institutes
- Centers of Excellence

B. Serbian Academy of Science and Arts – SASA

C. Matica Srpska (the oldest cultural and scientific institution of Serbia)

Scientific-research institutions consist of: faculties which operate exclusively under the University, Scientific institutes and Research and Development institutes, and centres of excellence.

There are 129 faculties under the universities in Serbia . There are 28 accredited Scientific institutes and 32 Research and Development institutes in the Republic of Serbia. Two main centres of excellence are : Centre for Mathematical Research of Nonlinear Phenomena, Department of Mathematics and Informatics, Faculty of Science, Novi Sad and Centre for Solid State Physics and New Materials, Institute of Physics, Belgrade. The Serbian Academy of Science and Arts has 8 departments and 10 scientific institutes, while the Matica Srpska has 7 departments.

The Republic of Serbia invests in scientific programmes in the three main fields: basic research, technological development, and, integrated and interdisciplinary research and about 12,000 researches are working in R&D projects. In recent years, the Republic of Serbia has improved its scientific research output, in terms of publications , is ranked 54th among the 239 countries.

Bilateral cooperation agreements on scientific and technological cooperation have been signed with more than 70 countries, and among them active cooperation is with, Republic of Belarus (1996); Republic of Slovakia (2001); Republic of Slovenia (2002); Kingdom of Spain (2003); Republic of France – [Program of Integrated Activities – PAI 'Pavle Savić' (2003) and CNRS]

(2008); Republic of Hungary (2005); Republic of Croatia (2005); Germany –[DAAD] (2008); Republic of Portugal (2009); People's Republic of China (2009); Austria (2010); Republic of Italy (2013); Montenegro (2014).

Serbia is actively involved in regional cooperation programmes of the European Union such as the EU Strategy for the Danube Region (EUSDR) and Steering platform on research and innovation for Western Balkans. Multilateral cooperation takes place through Central European Initiative – CEI (Central European Initiative, 2019) and Organization of the Black Sea Economic Cooperation – BSEC (Organization of the Black Sea Economic Cooperation, 2019). As for international association and cooperation since January 2007 Serbia was associated to the Seventh EU Research Framework Programme (FP7). Also, Serbia has joined in July 1, 2014 to the Horizon 2020 platform, Europe's largest research and innovation program,. The EU has set the goal that total investments in science of member states should at least 3% of GDP by the end of 2020, and Serbia allocates 0.8% GDP for science. Three main pillars of H2020: Excellent Science, Industrial Leadership, Societal Challenges..

Horizon 2020 successful stories for Serbia

Births, mothers and babies: prehistoric fertility in the Balkans between 10000-5000 cal BC - BIRTH is the first project supported by the European Research Council in Serbia started in 2014. As the European Commission's science and knowledge service, the Joint Research Centre (JRC) supports EU policies with independent scientific evidence throughout the whole policy cycle. JRS holds the S3 Platform that provides advice to EU countries and regions for the design and implementation of their Smart Specialisation Strategy (S3). Through its partnership and bottom-up approach, smart specialisation brings together local authorities, academia, business spheres and the civil society, working for the implementation of long-term growth strategies supported by EU funds. The JRC, co-financed, enables researchers from Serbia to participate in working meetings organized within projects that are being implemented by JRC institutes. Also, researchers from Serbia have the opportunity to be engaged in JRC institutes (The Joint Research Centre, 2019).

At December 13, 2018 at CERN 191st Session the Council passed the Resolution admitting Serbia as a Member State of CERN. Serbian scientists have an involvement with CERN activities from the beginning, that goes back to 1954 when Yugoslavia was a founder Member State. Serbian physicists were active in the DELPHI, ISOLDE, ATLAS, CMS, ACE and NA61 experiments at CERN.

Throughout the history, Serbia was involved in many wars, defending its territory independence and the security of its citizens. In Serbia, the main aim of science is its use for peaceful purpose, taking that in mind, Serbia is a member of International Atomic Energy Agency (IAEA), Organisation for the Prohibition of Chemical Weapons (OPCW), and NATO Science for Peace and Security (SPS) participant.

Although Serbia has been a party to many collaborative endeavors and research programs, these are not sufficient. Serbia has to expand and diversify its S&T co-operation. It should look for new opportunities and alliances instead of limiting it to the current ones. Serbia should also increase its spending in S&T. To begin with Serbia should explore the possibility of co-operating with large developing countries in Asia, South America and Africa. It should use the experience in multi-lateral projects to develop mutually beneficial collaborations and create synergies in bi-lateral programs.

India-Serbia S&T Cooperation

In the recent years there has been significant developments in bi-lateral relations as evident from the flurry of visits and agreements in both sides in different fields. Regarding S&T

"Joint Committee on S&T: Established under Agreement on S&T Cooperation singed in October 2004, the first meeting of of India-Serbia Joint Committee on Science & Technology was held through DVC on 6th December 2016. The 2nd Session was held in Belgrade in October 2017. A new Programme of Cooperation (POC) was

signed with increased fields of cooperation. It was agreed to hold two workshops – in the scientific domains of (a) biotechnology & human health and (b) ICT in India and Serbia, respectively. Both sides agreed to announce joint calls after the workshops in accordance with priority fields as incorporated in the POC"

This is a good beginning and should be followed up with concrete plans for co-operation. Biotechnology and health is a key area that can be used to conduct joint R&D. In case of ICT, India's expertise in software, application of ICT for development purposes offers immense scope for co-operation. Such co-operation obviously will have to involve private sector also.

As Serbia has recognized Ayurveda and Yoga, there is enormous scope for co-operation in traditional medicine. The current level of engagement should be expanded and diversified.

Conclusion

In modern time, the development of a country and society in general, depends on the knowledge obtained as a result of research in science and technology. Serbia takes various steps on the internal and external plan to become a technologically developed country. In order for the best use of scientific potential it is necessary to establish a relevant interaction between links of the research triangle: knowledge dissemination (education) knowledge creation (scientific research), and knowledge application (transfer of technology and innovation). In this moment, the most important document for scientific developing in Serbia is: Strategy on Scientific and Technological Development of the Republic of Serbia for the period 2016-2020 - 'Research for innovation'. Also Serbian Ministry of education, science and technology development works intensively on the adoption of a new law on science. International partnership through science diplomacy, with the goal for better science, Serbia realized through bilateral; regional/ macro regional and multilateral cooperation. The enormous scope for bi-lateral co-operation in S&T with India should be explored and harnessed.

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Biotechnology, Bio-weapons and Science Diplomacy

Douglas Nascimento Santana*

Introduction

It is now possible to produce organic chemicals through biotechnology, as well as to synthesize biological molecules by chemical processes (Tucker 2010). The technical developments that allowed the approach of these two sciences are multiple: metabolic engineering, enzymatic engineering (biocatalysis), biopharming and traditional DNA-recombinant technology are examples of biotechnologies capable of producing organic molecules and chemicals substances; while DNA synthesis and semi-automatized peptide synthesis are examples of technologies for chemical synthesis of molecules with biological origin (Khosla 2014).

The technological convergence between chemistry and biology that underpins the current state of the art of biotechnology expands the range of products, services and solutions in the areas of health, agriculture and the environment, resulting in the promotion of economic development and improvements in the living standards of populations. An illustrative example of the economic and social implications of this technological convergence is the development of molecules similar to the polio virus through the genetic manipulation of the tobacco plant. The primary objective of the study is the production of vaccines, at a lower cost (Marsian et al, 2017).

. The difficulty in discerning the nature (whether chemical or biological) of these new agents provokes a need for institutional adjustments in the current systems of non-proliferation of weapons of mass destruction as well as the creation of new

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alternatives of international collaboration in the area (Trapp , 2014).

This article argues that the parameters of these regulations should start from the agenda of Science Diplomacy towards the agenda of Defense Diplomacy. Adjustments in the opposite direction can restrict access to essential technologies for various sectors of the economy, especially in developing countries, with no guarantees of additional security gains. At first, we will briefly present the *rationale* that has restricted the use by states of technological developments in chemistry and biology for non-peaceful purposes, in order to try to correctly evaluate risks, without alarms or negligence. Later , it will be argued that Science Diplomacy can contribute to biotechnology development and minimize risks.

New Advancements, Traditional Rationale

During World War I, the use of toxic gases resulting in a high number of deaths demonstrated a destructive potential that would bring chemical and biological weapons to be categorized as weapons of mass destruction. In the period between the First and the Second World War, recognizing the terror that this threat caused and the need to extend humanitarian protection in armed conflicts, states acceded to the Protocol for the Prohibition of the Use in War of Asphyxiating, Poisonous or Other Gases, and of Bacteriological Methods of Warfare, the Geneva Protocol of 1925 (Guillemin 2005).

Although it expressly prohibited the use of chemical and biological weapons, this convention was silent on the possibility of developing or acquiring them, so that some of its signatories, particularly the large industrial nations, set up robust government programs for the production of these "higher forms of killing "(Paxman and Harris , 2011). Taking into consideration the technical feasibility of producing these armaments, why were chemical and biological weapons not widely used in World War II and in subsequent inter-state wars? This question is important because it allows us to understand the rationality underlying the current reluctance to the use of these weapons by states.

Since the middle of the twentieth century, the development of large arsenals of chemical and biological weapons by major military powers, the inability of a state to defend itself against all the multiple types of toxins and pathogenic gases that can be produced by the enemy, and the permanent threat of retaliation with the same types of weapons inhibited - and have inhibited - the so called first strike. There are also technical limitations on the handling of these weapons in real combat situations. The impossibility of determining the necessary dose of the toxic agent to be sprayed and the difficulty to predict the wind flows that would spill over them would attribute an inconceivable logistical uncertainty to the military planning of a possible attack (Guillemin , 2005).

In addition to the imbalances among nations in their capacities to develop such weapons and the technical limitations mentioned above, the massive expression of public opinion, especially in democratic regimes, against attacks with lethal poisons had curbed belligerent impulses"(Paxman & Harris , 2011). Thus, it can be said that the decision on the use of chemical and biological weapons in inter-state wars is now, on the one side, between the certainty of violating international law and unacceptable behavior in terms of international public opinion and, on the other, doubts about military success of the attack and the type of retaliation to be suffered. As a result, decision of not using these weapons was found to be a better option.

The mastering of nuclear technology, whose use as a weapon of mass destruction would be more effective and with more predictable results, has definitively discouraged the use of chemical and biological weapons. Throughout the second half of the twentieth century, military powers gradually abandoned their offensive programs of chemical and biological technologies and promoted a deepening of norms and institutions that guarantee their use only for peaceful purposes (Guillemin 2005).

We argue that there is no reason to believe that the *rationale* underlying the future application by states of new technological developments in biology and chemistry is different from this historically settled *rationale*. Case-specific control measures can be an appropriate alternative to broad institutional changes and comprehensive interventions, even when the formers are well conducted under the rules of the Chapter VII of the United Nations Charter (SOSSAI , 2010). Historical experience from the nuclear regime further demonstrates that comprehensive restrictions can have the collateral effect of posing barriers to access to technology for peaceful purposes (Miller & Sagan 2009)..

Science Diplomacy: Offering Credible Alternatives

Science Diplomacy has been increasingly recognized as an important instrument for stabilizing relations between countries and reducing risks of direct conflicts. The technical knowledge and the apolitical language of science are capable of bringing erstwhile political enemies to the table of negotiation to solve current transnational problems.

The first contribution that Science Diplomacy could provide to the future international biotechnology agenda is related to the institutionalization of the regime of non-proliferation of weapons of mass destruction. With this objective in mind, specialists could systematically analyze the production of organic molecules by biological processes and the chemical synthesis of natural toxins, in order to help the surveillance work of the Chemical Weapons Convention (CWC) and the Biological Weapons Convention (BWC).

The normative and institutional system of CWC, what includes the Organization for the Prohibition of Chemical Weapons (OPCW), is considered exemplary in the area of disarmament and non-proliferation. It has succeeded in almost completely destroying the chemical weapons stockpiles of its 190 member states without creating additional obstacles to the technical and scientific progress of the chemical industry, which is aligned with the interests of developing countries (OPCW, 2008; OPCW, 2019b).

As BWC lacks a formal verification system, the burden of avoiding the production of lethal chemical agents by biotechnology and of monitoring chemical processes capable of synthesizing biological toxins would come under the CWC. This convention specifically provides for the types of industrial plants to be inspected by the OPCW. The current OPCW routines (products listed in Schedules I, II and III and OPCW inspections - production facilities of other chemicals), however, do not cover verification of the development and production of these compounds (OPCW, 2019a;Tucker , 2010).

In view of the need to create combined methods of verification within the BWC, including a declaration of activities by states, continuous monitoring and inspection of suspected plants, it is essential to guide the decision-making process by reliable scientific information (OPBW, 2019;Goldblat, 1997). At the BWC Review Conferences, the apolitical language of science may be crucial in avoiding the intensification of the already existing rivalries between Western Countries (WEOG) and the Non-Aligned Movement Countries (NAM) regarding a protocol for strengthening the institutional framework of the convention with verification mechanisms (Trapp, 2014).

The second contribution of Scientific Diplomacy can be in modeling the future agenda of biotechnology is related to the management of risks arising from the sharing of technical data by high-level laboratories and research centers, via specialized journals or through access to large online databases.

The publication of research results is fundamental for the maintenance of the peer-review process that has gradually improved the science since its origin. Considering the multiple potential applications of the recent advances in biotechnology, ensuring the peaceful use of information becomes part of the work of each researcher and each knowledge-producing institution. Updating the existing codes of conduct for the publication of scientific

information is a crucial step to guarantee an appropriate flow of knowledge. For this objective, it is imperative that Science Diplomacy help negotiating internationally – in multilateral fora on the revision of these codes of conduct.

Furthermore, it is important that these codes could be guided by the premise that vital information for the synthesis, replication and inoculation of new agents must be kept confidential. Due to the operational nature of this information, this reservation does not compromise the evaluation of the testability and falsifiability of the theories and conclusions which derive from the original studies. An analogous system of selective information disclosure has been practiced in the field of quantum physics since the mid-twentieth century, with full success in preventing the proliferation of the capacity to produce nuclear artifacts by non-state agents (Miller & Sagan , 2009).

A final contribution of Science Diplomacy to the peaceful use of biotechnological innovations is to support the construction of an international framework for regulating the use of computer systems and robotics in experiments of molecular engineering. The convergence between scientific disciplines is even more evident here. To biology and chemistry, it is possible to add computing, robotics and nanotechnology to forge a complex of scientific knowledge production that uses the most advanced equipment and research inputs (Van Hecke et al., 2002). The limited number of international producers or suppliers of these inputs opens room for the regulation of access to them to be implemented through an international register that associates technological capacity with security risks. Similar risk-scaling system has long been used to manage the availability and commercialization of equipment that uses enriched uranium (Miller & Sagan 2009).

The tendency to theoretical and empirical convergence between chemistry and biology is a hegemonic view in the specialized scientific environment, constituting the so-called Chemical Biology. It is also possible to add informatics, robotics and nanotechnology to this complex of disciplines (Khosla , 2014; Van Hecke et al., 2002). As a result, since the beginning of the 21st century the international society has witnessed an exponential growth in the possibilities of biotechnology intervention in the reality of people. New drugs, prostheses, types of food, chemical and biological agricultural pesticides are traded and take part in daily lives of families, companies and governments (National Research Council , 2006).

Technology, as an instrument of practical application of scientific knowledge, cannot be aprioristically defined as beneficial or harmful to the population that develops it. The uses of technology are socially defined, in accordance to moral, ethical, religious and cultural values as well as philosophical conceptions (National Research Council , 2006). After the atrocities practiced with chemical weapons by both contending sides during World War I, a consensus was generated in international society, which remains strong and intense, that whatever technology could be developed, it should never be used for the purpose of mass killing. With new biotechnologies, this article argues that the judgment is not different. Therefore, it is vital that former institutions could be strengthened and new ones created when necessary, in order to ensure that biotechnology applications remain for peaceful purposes.

As stated above, the existence of the threat of non-peaceful use does not, however, justify the migration of the future international biotechnology agenda from the field of Scientific Diplomacy to the field of Defense and Security Diplomacy. Comprehensive restrictive measures in the research, development and commercialization stages of biotechnology can amplify barriers to the access of advanced equipment and research inputs, especially for developing countries that do not yet manufacture them, as well as to widen the technological gap between developed and developing countries.

If Defense and Security Diplomacy can have limitations in dealing with the innovations in the area of biotechnology, the discussion above allows the conclusion that Scientific Diplomacy has much to contribute, either in the technical

underpinning of decisions in the context of non-proliferation regimes of chemical and biological weapons covered by the CWC and BWC, whether in the international covenants of codes of conduct for the dissemination of scientific information or even in the creation of an international framework for regulating the use of computer systems and robotics in experiments of molecular engineering.

Conclusion

Minimizing the risks of non-peaceful uses of new advances in biotechnology by collaboration outside the area of defense and security can also help to balance broader tensions in bilateral relations between countries; open new institutional and personal channels of communication; and increase mutual trust among nations. These are possible positive externalities brought by the Scientific Diplomacy, whose importance for international relations cannot be neglected. They have already emerged from negotiations involving, for example, climate change and pandemic control, so it is as possible as desirable that they could also emerge from the negotiations involving the future agenda of biotechnology.

At an organizational level – lower than the state scale –, it is also possible to envisage that efforts to build safer mechanisms for research, technological development and information sharing in the biotechnology realm can strengthen and internationalize the relationships between the institutions of the national systems of science, technology and innovation, such as universities, research laboratories, science academies and development agencies.

Endnote

1 In the context of the Convention for the Prohibition of the Biological Weapons (BWC), the negotiations are polarized by a political division between to unofficial regional groups that act as voting blocs: 1) Western European and Others Group (WEOG), composed by European countries, Canada, Australia, New Zealand, Turkey and Israel as members, and the United States as observer; 2) the Non-Aligned Movement (NAM), composed since 1961 by a variety of countries, such as Colombia, Cuba, Iran, India, Indonesia and other, that act against major blocs of power. For more information, see: United Nations Regional Groups of Member States (in: https://www.un.org/depts/DGACM/RegionalGroups.shtml) and Morphet, 2004

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Science Diplomacy and Sustainable Development in Mauritius

Gajjaluxmi Mootoosamy*

Introduction

In an increasingly globalized and interconnected world, the coupling of science and diplomacy refers to the use of scientific collaborations among nations to address global challenges and to build international constructive international partnerships. (Fedoroff, 2009). Science Diplomacy is indeed an essential instrument of foreign policy. As an apolitical language, science has the capacity to balance strained relationships, open channels of communication and build trust. Science can help address cross border challenges such as climate change, pandemics, security threat, poverty and sustainable goals which all revolve among common interests.

Mauritius is conscious that science cannot be dissociated from the global challenge of sustainable development. This is why, the Government of Mauritius has made science, technology and innovation one of the pathways on its Transformative Journey to a Smart Island Nation while ensuring that its achievements shall not only be measured by the amount of wealth created but also by their inclusiveness and sustainability.

The purpose of this paper is to give a brief description of the evolution of the concept of science diplomacy and show how, notwithstanding its constraints as a Small Island State (SIDS), Mauritius is striving to achieve sustainable development through science diplomacy at national, bilateral and regional levels. In the concluding section few suggestions will be made on how to make the link between science and diplomacy more effective.

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Evolution of the Concept of Science Diplomacy

During the colonial period, the establishment of many scientific institutions resulted from Europe's urges for empire building. Schools of Tropical Medicine were set up to develop the study of tropical diseases which included only those which were relevant to British interests. Natives were found fit to work only as technicians and laboratory assistants but were not allowed the opportunity to qualify as doctors or scientists or researchers.

The colonial period saw a ruthless suppression of non-western and indigeneous sciences on the one hand whilst on the other hand the colonial powers appropriated and plagiarized non-western inventions and discoveries from Arabic, Indian and Islamic cultures (Sardar and Van Loon, 2011).

At a time when the US and the Soviet Union were involved in a standoff involving nuclear weapons, both countries cooperated on the 1959 Antartic Treaty which made Antartica a continent dedicated to peace and science. The Apollo-Soyuz Test Project that is the first US-Soviet space flight conducted in 1975 was another project which involved the cooperation of the two countries during the Cold War (Turekian 2018).

At the end of the Cold War, the role of science diplomacy aimed at addressing global challenges. It was in this context that the Montreal Protocol on Substances that Deplete the Ozone Layer was made and the Intergovernmental Panel on Climate Change was set up.

The events of 9/11 followed by the Iraqi War were another turning point in the evolution of science diplomacy. The world became divided into two parts: the western developed world and Muslim majority countries. In his speech delivered in Cairo, President Obama made science central in his new vision for partnerships with Muslim majority countries. The ultimate objective was to forge links between the science communities of various countries (Turekian, 2018).

Today we are witnessing a more formal integration of scientists into the diplomatic process. This is because science diplomacy is viewed as an inevitable means to help the international community meet the sustainable development goals.

Mauritius as a Small Island Developing State (SIDS)

As a Small Island Developing State (SIDS), Mauritius faces several challenges such as limited resources, vulnerability to natural disasters, small populations, dependency on strategic imports like food and energy, a narrow range of exports, remoteness from major markets and susceptibility to external economic shocks. Mauritius like all SIDS continues to address those structural and external challenges with the ultimate objective of achieving sustainable development.

The Government of Mauritius is wholly committed to the implementation of Agenda 2030 and to the 17 Sustainable Development Goals which cover several social and economic issues including poverty, hunger, health, education, global warming, gender equality, water, sanitation, energy, environment and social justice. However, the successful implementation of the SDGs involves an optimal use of existing social and physical infrastructure but also searching for new technologies in order to make these goals a reality (Saner, 2015).

S&T and Innovation in Mauritius

The Vision 2030 Blueprint of Mauritius has as one of its main aims to become a high-income innovation-led economy. Whilst, Mauritius is currently ranked among the three highest performing economies in Africa, globally it is ranked 75th out of 126 countries according to the Global Innovation Index 2018/2019. Expenditure on Research and Development represents a meagre 0.18% of GDP.

It is believed that in order to turn Mauritius into a bustling innovation hub, there should be heavy investment in state-funded research institutions. The role of the private sector is

also crucial to drive innovation in Mauritius as Research and Development involves significant associated costs. Mauritius also needs to be open for collaborations with the world's leading institutions as we cannot depend only on our limited resources to promote innovation.

With a view to promoting an Innovation Culture in Mauritius, the Mauritius Research and Innovation Council (MRC) has initiated a number of projects, some of which are:

- Satellite Technology which involves the use of small and affordable satellite systems using equipment with small pay load for capacity building and research work;
- Flood modelling and Computational Fluid Dynamics (CFD) of high rise buildings in cyclonic conditions where the MRC has developed computational models to accurately predict and provide solutions for floods;
- Robotics where the MRC in collaboration with Indian experts has trained some 1000 students on two main tools used in Robotics: Raspberry Pi and Arduino. (Fakun, 2018b)

As an apex body to promote and coordinate national investment in research and innovation, the MRC accepts proposals for its various research and innovation grant schemes in priority areas such as renewable energy, ocean/marine technology, ICT, Life Sciences, (Health, Pharmaceutical and Biotechnology), and Manufacturing. Ultimately through funding research and innovation projects in the above areas, the MRC aims at commercializing research outputs with a view to enhancing job creation and wealth generation.

Artificial Intelligence (AI) is a field in which the Government wishes to create new opportunities for private investment and employment. The Mauritius Budget 2018/2019 makes provision for a number of measures relating to the sector such as the following:

- Setting up of a Mauritius Artificial Council comprising of public and private sector, including international experts to create the legal framework for AI and propose incentives for entrepreneurs;
- New scholarships for 50 students specializing in AI and other digital technology courses;
- Training of 2,000 students in primary schools and 2500 students in secondary schools in coding.

However, the formulation of an AI policy is considered mandatory to sustain an ethical and effective integration of AI in our local context. It is also important to fit the right curriculum in our educational system in order to avoid job mismatch once AI takes over the traditional technologies. AI investment is expected to bring major contributions in various sectors including transport (road decongestion); agriculture (identification of crop diseases and monitoring of soil productivity); government to citizen services (analysis to improve citizen satisfaction); industry (reduced time in doing repetitive tasks) and health (assisted surgery). (Fakun, 2018a).

It is with the objectives of positioning Mauritius on the world map of emerging technologies and fostering a new generation of entrepreneurs who master emerging technologies such as AI that the Government hosted the 2018 World Artificial Intelligence Show and Blockchain Summit 2018 from 28 to 30 November 2018. The event connected AI experts, startups, data scientists, technology innovators to discuss the impact of AI on commercial applications and the revolutionary ways it can transform business and government functions.

The AI Show featured humanoid robot Sophia developed by Hong Kong-based Company Hanson Robotics and named the United Nations Development Programme's first ever non-human innovation Champion.

Bilateral Perspective

Notwithstanding its limited resources, Mauritius is multiplying its efforts to incorporate science, technology and innovation into its national sustainable development strategies. However, it relies to a large extent on the cooperation and assistance of its major partners to attain this objective as shown below.

India is considered as one of the most important partners of Mauritius. The two countries share

strong historical, social and economic links. Since the establishment of diplomatic relations between Mauritius and India in 1948, several bilateral agreements have been signed. Some of them are the Agreement on Cooperation in ICT (2000), MoU on Cooperation in Biotechnology (2002), MoU in the field of Hydrography (2005), Agreement on Early Warning and Coastal Hazards (2010) and MoU on Science and Technology (2012).

Mauritius is one of the largest beneficiary countries of the Indian Technical and Economic Cooperation (ITEC). Lately an overwhelming proportion of civilian ITEC training courses slots have been used for training in IT related fields.

Joint projects between Mauritius and India in the area of science, technology and innovation include the Cyber Tower which made ICT one of the pillars of the Mauritian economy and the Rajiv Gandhi Science Centre whose objective is to create science awareness among young Mauritians.

Through the Japan International Cooperation Agency, Japan has been providing technical assistance in several areas, namely disaster risk management, coastal protection and landslide management. Last year saw the signing of a project which aims at enhancing meteorological observation, weather forecasting and warning capabilities of Mauritius Meteorological Services to disseminate highly accurate meteorological information.

During the World AI Show and Blockchain Summit held in Mauritius last year, a Memorandum of Understanding was signed between the Economic Development Board of Mauritius and Huawei Technologies (Mauritius) Ltd. The MoU focuses on four key components aiming at unlocking the full potential of the Information, Communication and Technology sector of Mauritius: capacity building, infrastructure development, strategizing future development and diversification of the ICT sector, and fostering development in AI and Blockchain.

As regards the bilateral cooperation with EU, the focus of the 11th European Development Fund (EDF) will be tertiary education including research and innovation. There is a growing awareness that research and innovation are key ingredients to enable Mauritius move from a Upper Middle Income Country Status to a High Income one. The EU will assist Mauritius in addressing major challenges such as how to increase the involvement of the private sector in research, increase public expenditure in research and encourage a culture of research.

Other long time partners of Mauritius like UK and France provide significant assistance in the area of training, higher education and research through inter-university cooperation and grants programme.

Regional Perspective

Mauritius belongs to various regional organisations namely Southern Africa Development Community (SADC) , Common Market for Eastern and Southern Africa (COMESA) and Indian Ocean Rim Association(IORA). The vision of these regional groupings is to make science, technology and innovation drive sustainable development, alleviate poverty and disease, create wealth and employment opportunities, and improve living standards.

Conscious that science, technology and innovation have crosscutting relevance in addressing the above challenges, SADC Heads of State and Government adopted the Protocol on Science, Technology and Innovation in 2008. The overall objective of the Protocol is to foster cooperation and promote the development, transfer and mastery of science, technology and innovation in member states in order to inter-alia pool resources for scientific research, technological development and innovation within the region; optimize public and private investment in research and development within the region; recognize, develop and promote the value of indigenous knowledge and technologies; work towards the elimination of restrictions of movement of scientists within SADC; and promote public understanding and awareness in science, technology and innovation.

The Common Market for Eastern and Southern Africa (COMESA) has also been turning to science, technology and innovation to foster trade and investment in the region. The 16th Summit of Heads of State and Government held in Kampala in 2012 endorsed the establishment of an Innovation Council. The objective of the Council is to support the mobilization and coordination of scientists and engineers and encourage innovation by individuals and small and medium enterprises (SMEs). The ultimate goal is the production of innovative goods and services for regional and global markets that can transform the region into a leading destination for technology investment (COMESA, 2019).

Within the IORA, it is also acknowledged that the contributions of science and technology have the potential to enhance the countries of IORA knowledge and capabilities in a number of fields including Indian Ocean phenomena such as biology, meteorology, coastal zone management and renewable energy. IORA further fosters sustainable ocean initiatives, projects and partnerships with the objective of supporting the Blue Economy Concept. The contribution of scientists in driving the ocean agenda forward is significant. Through research, scientists can provide the knowledge and understanding that feeds into policy considerations (IORA, 2019).

A recent example of science diplomacy in action within the IORA is the inauguration in May 2018 of the IORA Regional Centre for Science and Technology Transfer Coordination Centre on Medicinal Plants in Lucknow. The Centre will help disseminate knowledge of the use and benefits of medicinal plants among IORA countries and promote the commercialization of their resources.

Conclusion

Science alone does not drive successful policy outcomes while Diplomacy that ignores science is unlikely to achieve an effective outcome. Therefore in today's globally interconnected world characterized by rapid advances in science, technology and innovation, science diplomacy offers a unique instrument to build our common future. However for science diplomacy to be effective there should not be any disconnect between Foreign Ministries and Ministries of Science. One immediate solution to this disconnect would be the appointment of scientific advisers within the Foreign Ministries and in Embassies.

Since both science and diplomacy may involve dishonesty, the need for a code for the practice of science in an ethical and responsible way subscribed by all stakeholders is essential. Ethical norms and standards will help promote the aims of research (knowledge and truth) and values that are essential to collaborative work (trust and respect); provide guidelines for the protection of intellectual property rights; ensure accountability to the public; help to build public support for research; and promote moral and social values such as human rights, public health and safety, animal welfare.

Mauritius may be a small island developing state with all the constraints which that status involves. However, it also has several strengths including a secure investment climate, a conducive business environment, political stability and a bilingual workforce which it can make available to this new branch of diplomacy which is science diplomacy in order to achieve sustainable development and pursue its transformative Journey to a Smart City Island Nation.

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Science Diplomacy in Africa: Building scientific capacities through the Pan African university project

Tewfik Ahmed Othmane Tabeti*

"We shall accumulate machinery and establish steel works, iron foundries and factories; we shall link the various states of our continent with communications; we shall astound the world with our hydroelectric power; we shall drain marshes and swamps, clear infested areas, feed the undernourished, and rid our people of parasites and disease. It is within the possibility of science and technology to make even the Sahara bloom into a vast field with verdant vegetation for agricultural and industrial developments".

–President Kwame Nkrumah

First speech at the foundation summit of the Organisation of African Unity, Addis Ababa, 24 May 1963

Hadef Somia**

PAUWES Class of 2017 celebrates outside the University of Tlemcen Auditorium (*Nordic Africa News, October 1, 2017*)

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Introduction

The African Union (AU) is a Continental Organisation founded on May 26, 2001 in Addis Ababa, Ethiopia and launched in Durban, South Africa on July 9, 2002. AU comprises fifty-five Member States, and includes several organs(African Union, 2019). To implement its global vision of: "**An integrated, prosperous and peaceful Africa, driven by its own citizens and representing a dynamic force in global arena**", the AU adopted in 2013 a strategic framework for the socio-economic transformation of the Continent over the next fifty years called the "Agenda 2063". Under Agenda 2063, African countries have identified some priority areas and set specific targets, among which is the development of scientific, technological and innovation cooperation among African countries, as a cross-cutting cooperation enabling the achievement of a large part of the objectives of Agenda 2063, and thus the achievement of Sustainable Development Goals (SDGs), as defined in the framework of the United Nations Agenda 2030.

Realising the importance of the development of Science, Technology and Innovation (STI) in African countries and among them for the realisation of the Agenda 2063, the AU adopted in June 2014, after a long process of consultation with experts and a high-level panel of eminent African and diaspora scientists, its "Science, Technology and Innovation Strategy for Africa-(STISA-2024)".

STISA-2024 outlines the key socio-economic priority areas that Africa has to collectively address through scientific research and development. The implementation of STISA-2024 is taking place at three levels. At national level: Member States incorporate the strategy into their National Development Plans. At regional level: Regional Economic Communities (RECs), regional research institutions, networks and partners leverage the strategy in designing and coordinating initiatives. At continental level: The African Union Commission (AUC), New Partnership for Africa's Development-NEPAD Agency (through its Science, Technology and Innovation Hub), and their partners are advocating and creating awareness, mobilising necessary institutional, human and financial resources, tracking progress and monitoring implementation.

At the institutional level, the implementation of the STISA- 2024 is based on the various organs of the AU and its Agencies such as Specialised Technical Committee (STC) in charge of Education, Science and Technology, but also on a variety of bodies under the auspices of the AU Commission, namely: the African Scientific Research and Innovation Council (ASRIC), the African Observatory of Science Technology and Innovation (AOSTI), the Pan African Intellectual Property Organisation (PAIPO), the African Development Bank (ADB) and the Pan-African University (PAU), in addition to Development Partners, Regional and International Research Institutions and the Private Sector.

In this regard, the project of "the Pan African University (PAU)" can be presented as a concrete example of scientific cooperation between African countries contributing to the implementation of this strategy.

The Case of Pan African University (PAU) Project

PAU is an academic network of African institutions operating at the graduate level, it was established by a decision of the Summit of Heads of State and Government of the AU in 2010, with a view to developing institutions of excellence in Science, Technology, Innovation, Social Sciences and Governance, which would constitute the bedrock for an African pool of higher education and research. It strives to stimulate collaborative, internationally competitive and development-oriented research, in areas having a direct bearing on the technical, economic and social development of Africa.

The PAU will greatly boost the population and retention of high-level human resources and quality knowledge outputs and be able to attract the best intellectual capacity from all over the world. This would usher in a new generation of leaders properly trained to take the best advantage

of African human and material resources, imbued with the common vision of a peaceful, prosperous and integrated Africa.

Thematic and Geographic Scope

The PAU comprises five Institutes corresponding to the thematic areas:

PAU Institute	Host country	Host University
Water and Energy (including climate change) -PAUWES	**Algeria** (for North African region)	University of Tlemcen
Life and Earth Sciences (including Health and Agriculture)- PAULESI	**Nigeria** (for Western Africa)	University of Ibadan
Basic Sciences, Technology and Innovation- PAUSTI	**Kenya** (for Eastern Africa)	Jomo Kenyatta University of Agriculture and Technology
Governance, Humanities and Social Sciences- PAUGHSS	**Cameroon** (for Central Africa)	the University of Yaoundé II
Space Sciences- PAUSS (forthcoming)	**South Africa** (for Southern Africa)	the Cape Peninsula University of Technology

Source: African Union, 2019.

Affiliated to each Institute, a network of Centres located on the Continent working on similar thematic areas are identified following a competitive process in order to establish partnerships and contacts with the PAU institutes. To carry out its mandate effectively, the PAU can enter into agreements and contracts with Governments, International Organisations or other relevant partners, for pedagogic, research, management and funding purposes. Hosting Agreements shall be signed between the Commission and the host countries of Institutes and Centres, and Tripartite Agreements between AUC, Host Countries, and Key Thematic Partners.

The PAU is financed through various sources like Settlement of an Endowment Fund, Budgetary resources provided by African Union Council (Scholarships for students, mobility and honorarium for Teaching Staff), Host Countries (Infrastructure and Running Costs. The country can also mobilise this contribution through a Partner), Key Thematic Partners (Support for Equipment, Academic Costs and Research), and self-generated income through teaching and research by Institutes and Centres.

Case of the Pan African University Institute on Water and Energy Sciences

In order to strengthen its cooperation with the African Union as well as with the African countries, Algeria has expressed its willingness to host the Institute on Water and Energy Sciences, including Climate Change of the Pan African University. As a consequence, the Assembly of the African Union in its 17th ordinary session held in Malabo, Equatorial Guinea, from June, 30 to 1st, July 2011, decided to allocate the PAUWES in Algeria, thanks to an agreement reached by the North African region countries. The Abou Bekr Belkaid University of Tlemcen (a city situated in the North West of Algeria, nearly 500 km from Algiers) houses the premises of the PAUWES Institute, and there is a project to construct specific buildings to permit the increasing of its scholar accommodation capacities. The financing of the implementation of the PAUWES Institute required the negotiation and conclusion of a Tripartite Agreement convened for a renewable period of three years. The Agreement was concluded between the Algerian Government, the African Union Commission and the German partner.[1]

For the enactment of this Tripartite Agreement the African Union Commission signed in Addis-Ababa on May 12, 2014, a financing Agreement of 20 million Euro amount with the German Government, which led to its opening on October 27, 2014. (*GIZ, 2019*)

Principal Targets of Scientific Cooperation

PAUWES aims to reach the SDGs' Goal 1: "**End Poverty in All its Forms Everywhere**" through building African human resources capacities in economic growth, implementing social reforms, reconciling development with ecological aspects and social and ensure cultural participation. It aims in strengthening the resources and effectiveness of the African Union Commission and the UPA Rectorate the Pan African University (UPA and setting up the Pan African University Institute for Water, Energy and Climate Change Sciences (PAUWES); capacity building through international PhD and Master's programs and applied research structures at PAUWES; public and private sector alliances and promotion of scientific cooperation

PAUWES Scholarships' Harvests

Since its opening, the PAUWES received three cohorts, which successfully completed two years of intensive training in the areas of Energy Engineering, Energy policy, Water Engineering, and Water policy. While the first cohort included only 27 students from 12 African countries, the third one was composed by 79 students from 25 African countries, of which 14 where women. The second cohort involved 47 students from 21 African countries.

H.E. Prof. Sarah Anyang Agbor, AU Commissioner for Human Resources, Science and Technology, advised the graduates on October 1st, 2018, at the third graduation Ceremony "make each day (their) masterpiece for the development of our mother land, Africa".

Perspectives of the Indo- African cooperation within the PAU project:

The relations between Africa and India are historically very ancient, they were limited to the coordination and the political dialogue, especially within the framework of the Non- Aligned Countries Movement, before being boosted in the 2000's to cover the commercial, economic, cultural and technical domains. They have been further strengthened with the establishment of the Africa-India Forum in 2008, in which the two parties identify the priority sectors of their cooperation and the means of its implementation. (Laflamme, 2018)

At the last Africa-India Summit, held in New Delhi in October 2015, discussions focused on economic and sustainable development, mutual cooperation, education and health, placing the development of technologies, the sharing of skills and education at the centre of the African-Indian cooperation for the few next years. In this context, India pledged to mobilise 10 billion US Dollars in concessional loans to finance projects in Africa and 600 million US Dollars in assistance over the five next years.

India is making its partnership with Africa more visible by becoming its first partner in specific areas, including the science, technology and innovation field. participate in building African scientific capacities and implementing the Science, Technology and Innovation Strategy for Africa (STISA-2024). In this context, the PAU represents the ideal cooperation platform to start this partnership.

Several areas of scientific and technological cooperation between the African Union and India can be defined according to the African priorities and the mission of each of the functional institutes of the PAU, and according to Indian excellency in some scientific fields, which include Biomedical and health devises, medical informatics, renewable energy technologies, water purification, waste water treatment, municipal/ industrial/ biohazardous waste treatment, energy efficiency, industrial processes and green building, automobile engineering, nanotechnology, agricultural-biotechnology, food processing, intelligent transport, wireless sensor network, green mobility, clean technology, etc.

The African- Indian cooperation within PAU's Institutes could be implemented into (*Mitra, 2019*):

Contact building: organising joint workshops/ seminars/ frontiers symposia/ exhibitions, visitations, fellowships and students' internships,

exploratory visits and lectures by eminent Indian and African scientists, fielding young researchers in India and Africa, international meetings between scholars.

Providing support to: joint R&D projects, project-based mobility exchanges, training and advanced schools, access to advanced facilities and participation in mega-science projects.

Facilitating and promoting: joint R&D clusters, virtual R&D networked centers and multi- institutional R&D projects.

Promoting pre-commercial R&D and innovation: Academia- Industry Applied and Industrial R&D projects, innovation and entrepreneurship, facilitating Technology Development, Tech Transfer and joint venture.

Moreover, the Space Sciences Institute (PAUSS) project, offers the possibility of setting up a triangular partnership between South Africa, India and the African Union in the space field, with the aim of making this Institute functional. India's experience in recent years in building and launching satellites, in reducing the costs of space conquest and in recycling costly space equipment, has made this Country a reliable and strategic partner in the space field, including for developed countries. A lot can be shared with Africa in terms of training of African engineers and technicians, providing technical assistance, developing space technologies and technology transfer.

Climate change can be another bearer of Indo-African scientific cooperation. Dr. Malti Goel, Chief Executive and President of the Climate Change Research Institute – CCRI, said in a conference on clean technology, giving in RIS on January 11, 2019: "Alumni of science-policy mechanisms represent a significant international resource of highly qualified, adaptable professionals able to span the science-policy divide and thereby effect solutions for global challenges".

In this respect, a partnership between the CCRI and the PAUWES in the field of climate change and clean technology, may be possible, and partnership between other Indian research Institutes and the five Institutes of the PAU are to be encouraged in the future.

Conclusion

Africa has suffered for a long time, from terrible instability on the security front which has pushed it to put in place a development policy based on a purely security vision. The adoption of the Agenda 2063 is paving way to consider African development from a global and transversal point of view, taking into account all political, economic, environmental, socio-cultural, scientific and technological factors. Indicators suggest that Africa is making gradual progress in developing its capacity for STI, despite numerous challenges. However, African countries have a long way to go in improving capacity development, given that capacity needs are not high on priority.

The challenge for Africa today consists in its ability to adopt long-term approach to human development, improve higher education, foster growth, invest sustainably in building capacities and critical technical skills, and most of all mobilise internal and external human and financial resources in order to implement the STIS-2024. In the near future, Africa's focus shall also be on environmental concerns affecting the planet or many of its regions, including desertification, dwindling water resources, erosion of biodiversity, global warming and pollution in all its forms. In order to achieve the aforementioned agenda, there is a need to develop a science diplomacy plan for partnerships with both developed and developing countries. In the near future, Africa's focus shall also be on environmental concerns affecting the planet or many of its regions, including desertification, dwindling water resources, erosion of biodiversity, global warming and pollution in all its forms.

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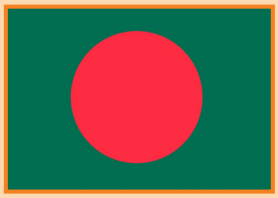
Endnote

1 According to the following breakdown, Algeria covers the costs of infrastructure, salaries of administrative and technical staff locally recruited, basic salaries of academic staff as well as operating costs; the African Union Commission supports International Staff Salaries, local staff bonuses, registration fees and student grants, While the German partner will ensure the establishment of the laboratories, the rehabilitation of amphitheatres and classrooms made available to PAUWES and the subsidy of training cycles abroad.



Introduction of Nuclear Power Plant in Bangladesh –Modern Diplomacy

Nargis Akter Dolly*

Introduction

Science diplomacy is the use of scientific collaborations among nations to address common problems and to build constructive international partnerships. Many experts and groups use a variety of definitions for science diplomacy. However, science diplomacy has become an umbrella term to describe a number of formal or informal technical, research-based, academic or engineering exchanges. (TWAS, 2015)

We know that nations and cultures have long built relationships based on science. Science can support diplomatic efforts, as when researchers provide insight to support a new treaty on protecting oceans. Diplomacy may help play the foundation for a multi-national science projects or scientific cooperation can begin with the explicit intention of improving relations. Countries, which used these innovations and adapted them to their social conditions, changed their levels from developing countries to developed ones. (AAAS, 2018). With this prelude, the paper attempts to elucidate on the case of Nuclear Power Plant in Bangalesh, as a manifestation of Science Diplomacy, emphasising on the importance of Science Diplomacy in Bangladesh.

Role of Science Diplomacy to Ensure Economic Growth in Bangladesh

Bangladesh has emphasized on 'science diplomacy' to ensure economic growth through innovations and knowledge sharing. In the national science and technology policy and the seventh

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five-year plan from 2016 to 2021, focus has been on finding solutions to the emerging problems in agriculture, food, health, environment and climate change through application of science and technology. We have devised science diplomacy to ensure partnership for sustainable economic development through knowledge and learning.

The country is committed to acquiring scientific and technological capability, in order to reach socio-economic goals. Concerted efforts are being made to foster scientific and technical co-operation with developed and developing countries, for building a sound science and technology base in the country. It is asserted that common goals can be effectively addressed by pooling both material and intellectual resources particularly with countries that share common problems. International collaboration (bilateral agreements and MOUs) in science & technology can be deployed for furthering national interest as an important component of foreign policy initiatives. (MoS&T, 2018). Science Diplomacy is the way forward to realize aforementioned goals. Interestingly, the nuclear power plant in Rooppur is one such site, which can be seen as a case of science diplomacy, in practice.

Rooppur Nuclear Power Plant- Blessings of Science Diplomacy

Bangladesh is strongly involved in achieving three consecutive development milestones: (i) a middle income country by 2021 (ii) a zero poverty level nation by 2030 and (iii) to produce at least 11-12% of its electricity generation from nuclear sources by 2041. It aims to secure sufficient supply of electricity to derive the desired level of economic growth for the three targeted socioeconomic development of our nation. Over the last several years, Bangladesh has made a significant progress in the development of the power sector. Government has undertaken various projects to increase the generation of electricity to cope with the rapid increases in the demand to support the economic development. (MoPE&MR, 2016).

Presently, Bangladesh is implementing a master-plan to produce 24,000 MW, 40,000 MW and 60,000 MW in the year 2021, 2030 and 2041, respectively. The Power System Master Plan (PSMP), 2016 aims to ensure supply of electricity to all citizen and economic sectors at affordable costs at all times through a well-balanced power generation environment that maximizes the respective advantages of different types of power generation methods, including nuclear power, thermal power, hydropower generation and power imports from neighbouring countries (MoPE&MR, 2016).

Bangladesh, where only 60% of the population has access to electricity, has a science-diplomacy engagement with Russia. The Prime Minister Sheikh Hasina of Bangladesh visited Russian President Vladimir Putin in Moscow in 2013, and the two countries signed a deal providing a loan to build a nuclear plant in our country. HPM stresses Science Diplomacy for sustainable growth at Vienna conference of the International Atomic energy agency. Russia is also planning to train the Bangladeshi staff and cooperate on the use of its reactors for research. (MoS&T, 2018)

The Early Phase of National Nuclear Power Programme and Rooppur NPP Project

The NPP construction is a complex activity which requires huge preparation and years of preparatory works. It is a highly capital-intensive undertaking and financing for such a huge project is not that easy to manage. The NPP project also requires early selection of NPP technology and the vendor which is one of the big challenges for a newcomer country. The history of nuclear power in Bangladesh dates back to early 1960s. The proposal for introduction of nuclear power plant (NPP) was made in 1961. Among potential twenty sites, the Rooppur NPP site was selected based on the then international practices and the plant was approved in 1963. Rooppur NPP site is located in the People's Republic of Bangladesh, on the eastern (left) side of the river Padma (the local name for the lower reaches of the Ganges River), 160 km north-west of the capital -the city

Dhaka, 21 km north-west from the city of Pabna, at a distance of about 8 km from the center of the sub-district Ishurdi. Site territory is located between 89° 02′ and 89° 03′ East longitude and between 24° 03′ and 24° 04′ North latitude.

Before liberation war and after the independence of Bangladesh, several feasibility studies for implementation of Rooppur NPP project were conducted but none were successful. In 2007, the Bangladesh Atomic Energy Commission (BAEC) proposed two 500 MWe nuclear reactors for Rooppur by 2015. In April 2008, the government reiterated its intention to work with China in building the Rooppur plant and China offered funding for the project. The International Atomic Energy Agency (IAEA) approved a technical assistance project for the Rooppur nuclear power plant to be initiated between 2009 and 2011, it then appeared that a 1100 MWe plant was envisaged.

Russia, China and South Korea had offered financial and technical help to establish nuclear power in the country. In March 2009, Russia made a formal proposal to build a nuclear power plant. In April 2009 the government approved the Russian proposal to build a 1000 MWe AES-92 nuclear plant at Rooppur for about $2 billion and a bilateral nuclear cooperation agreement was signed by the two countries in May 2009. In 2010 an intergovernmental agreement was signed with Russia, providing a legal basis for nuclear cooperation in areas such as siting, design, construction and operation of power and research nuclear reactors, water desalination plants, and elementary particle accelerators (IAEA, 2010). An agreement with Rosatom was signed in February 2011 for two 1000 MWe-class reactors to be built at Rooppur for the Bangladesh Atomic Energy Commission (BAEC). Rooppur is close to a HVDC link with India and on the route of a planned 600 kV HVDC link running up the western side of the country. Another intergovernmental agreement was signed in November 2011 for the project to be built by AtomStroy Export. A nuclear energy bill was introduced into parliament in May 2012, which outlined the establishment of the Bangladesh Atomic Energy Regulatory Authority.

The beginning of construction at Bangladesh's first nuclear power reactor dated on 30 November 2017, marking a significant milestone in the decade-long process to bring the benefits of nuclear energy to the world's eighth most populous country. An intergovernmental agreement for provision of a $500 million Russian loan to finance engineering surveys on the site, project development and personnel training was signed in January 2013. The $500 million loan will be repaid in 12 years with five years' grace period. In June and October 2013, AtomStroyExport signed contracts with BAEC to prepare documentation related to the construction and environmental impact assessment for the Rooppur plant, as well as providing for necessary engineering studies, including site preparation and detailed design documentation. AtomStroyExport said that this represented a transition to long-term cooperation. Site works started in October 2013.

The IAEA has been supporting Bangladesh on its way to becoming the third 'newcomer' country to nuclear power in 30 years, following the United Arab Emirates in 2012 and Belarus in 2013. Bangladesh government has taken a practical step for implementation of nuclear power programme from the beginning of 2009. The early activities included a detailed road map addressing all infrastructure requirements. We adopted the IAEA's Milestones approach and followed the steps required for each of the 19 infrastructure issues to build Rooppur NPP. Bangladesh established its NEPIO (Nuclear Energy Programme Implementing Organization) in 2010 based on the IAEA concept to monitor progress of nuclear power programme and Rooppur NPP project and coordinate all the required activities among the various implementing organizations/ ministries involved in nuclear infrastructure development. Bangladesh started preparatory construction activities of its first NPP, the Rooppur NPP in 2013 which was completed in June 2018. It stepped into the main construction on 30th November 2017, through the First Concrete pouring Ceremony inaugurated by the Hon'ble Prime Minister Sheikh Hasina.

With the financial and technical assistance of the Russian Fedaration, RNNP is going to be built as safe, reliable, cost effective and environmentally friendly power plant which will play a vital role in the socio-economic development of our country. The IAEA has been supporting Bangladesh in developing its nuclear power infrastructure, including in establishing a regulatory framework and developing a radioactive waste-management system. This support has been delivered under the IAEA technical cooperation programme and is partially funded through the Peaceful Uses Initiative.

On the otherhand, an inter-governmental agreement between the Government of the Peoples Republic of Bangladesh and the Government Of the Republic of India on 'Cooperation in the Peaceful Use of Nuclear Energy and a Inter-Agency Agreement between Global Center for Nuclear Energy partnership ,Department of Atomic Energy of the Government of India And Bangladesh Atomic Energy Commission (BAEC) on 'Cooperation Regarding Nuclear power plant projects in Bangladesh was signed on April 08,2017.

Earlier in May 2015 Bangladesh seeked India's help with training its nuclear staff and in April 2017 BAEC announced the appointment of India's Global Centre for Nuclear Energy Partnership (GCNEP) as the consultant for construction and operation of the Rooppur project. GCNEP is a Department of Atomic Energy R&D facility strongly supported by Russia and designed to strengthen India's collaboration internationally. In March 2017, the IAEA agreed to provide staff for the centre and use it for training professionals throughout the region (MoS&T, 2018).

Fuel cycle

All fuel for Rooppur is being provided by Rosatom, and all used fuel is to be repatriated to Russia, in line with standard Russian practice for such countries. A draft agreement on used fuel was signed in March 2017, totaling about 22.5 t/yr from each reactor (42 fuel assemblies, each with 534 kg of fuel). A further agreement for repatriation of used fuel for reprocessing was signed in August (MoS&T, 2018).

Second nuclear power plant

In June 2014 the government and BAEC invited the Japan Atomic Energy Agency to explore the possibility of building a second 2000 MWe nuclear power plant in the south of the country. Site selection focused on several islands in the Bay of Bengal, notably Mazher Char in Barguna, Muhurir Char in Feni, Boyar Char in Noakhali and Gangamati in Patuakhali. Four other potential sites are in Khulna, close to the Sundarbans. In August 2018 it was reported that the site would be in the Rangamati district, near a new deep-water port.China's Dongfang Electric Corporation (DEC) has expressed interest in building the second nuclear power plant.(Financial Express, 2018)

Organisation and Regulation

Bangladesh's development strategy to see the country becoming a middle-income nation by 2021, in large part by emphasis on its science and technology sector to drive economic growth. The ministry of science and technology (MOST) estimated in 2014 that $6.2 billion will be needed in the next decade to achieve the goals of Vision 2021. The Science and Technology Act 2010 is helping to boost this initiative and now allocating over $150 million per year to nuclear technology development as gas reserves become depleted. In February 2012 the MOST signed an agreement with Russia's Rostechnadzor related to regulation and safety and the provision of advisory support to the Bangladesh Atomic Energy Regulatory Authority (BAERA) on regulation, licensing and supervision. The staff will be trained in Russia. In April 2017 BAERA signed an agreement with India's Atomic Energy Regulation Board (AERB) on the exchange of technical information and cooperation in the regulation of nuclear safety and radiation protection. Hopefully, the two units of Rooppur NPP will go into operation by 2023 and 2024, respectively (MoS&T,2018).

Conclusion

Bangladesh is working to diversify its energy supply to enhance energy security, reduce its dependence on imports and on its limited domestic resources also. Nuclear energy these days are safe, reliable and on the content of Bangladesh capable of reducing the gap between demand & production significantly. The 3rd generation pressurized water reactors with automated and it built safely features intake nuclear energy reliable sources of massive electricity production. On basis of present scenario of Bangladesh, the Rooppur Nuclear Power Plant will provide not only a stable base load of electricity, but it will enhance our knowledge and allow us to increase our economic efficiency. The construction of Rooppur NPP is going to accelerate socio-economic development, enhance scientific and technological potential of the country and promote Bangladesh to become a member of the elite Nuclear Club of the countries, which have nuclear technologies for power generation. For long sixty years ,our cherished the dream for building its own NPP.I think it's a gift and benefits of modern science diplomacy. The scientific and technical bilateral relations with Russia and India will reap benefits in enhancing the nuclear energy landscape of Bangladesh.

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High-Tech Agriculture and Climate Change: Case of Tien Giang Province, Viet Nam

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Thanh Minh Thu Vo**

Introduction

Climate change is an unavoidable problem and it has direct and indirect impacts on all of us. According to scientists, Vietnam is one of the countries heavily hit by climate change (Central Vietnam Farmers Association, 2019). In particular, the Mekong Delta is one of the three deltas most heavily affected by climate change in the world. Impacts of climate change have been observed in the Mekong Delta for many years, with increasing levels of intensity. As one of the key agricultural provinces in the Mekong Delta, in the past years, Tien Giang province has been suffering from the impacts of climate change, especially its agricultural sector (APBAC, 2019). The most typical manifestation is the salinity intrusion in dry season, which makes it difficult for agricultural production for the coastal areas in the east. It has also caused riverside and coastal landslides, etc. To proactively respond to climate change, in the past few years, Tien Giang has mobilized various capital sources for implementing many projects to prevent salinity intrusion and effectively control floods, ensuring fresh water sources for irrigation and daily life, production and preventing river bank and coastal erosion (Vietnamese Environment News, 2015). The initial results of these projects have significantly contributed to the protection of production and stabilization of life for people that are under the impact of climate change. However, due to limited local resources, lack of substantive awareness amid population on climate change, especially urban residents - who are less affected by climate change, the response and adaptation to climate change in the agricultural sector in the province, has not been as effective as expected. This paper aims to provide an overview

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of the technology-led on-going initiatives in the province, to mitigate climate change impacts.

Agricultural Landscape of Tien Giang Province Tien Giang is located along the Tien River - a tributary of the Mekong River, which is adjacent to the East Sea. It has 32 km of coastline and a system of intertwined rivers and canals. Climate change has increased the sea level and also caused intense saline intrusion, affecting many areas of Tien Giang, ecologically. It has brought great difficulties for life and agricultural production which is the the main livelihood of a large proportion of local people.Tien Giang has a fairly developed and diversified agriculture, including crop, fisheries and forestry and covers a significant part of the Mekong Delta region. The province is named as the Kingdom of fruits of the country, with an area of over 70.5 thousand hectares of fruit production, providing over 1.3 million tons of fruit to the market every year (Department of Foreign Affairs of Tien Giang province, 2018). Moreover, Tien Giang also has a large production area of vegetables (over 1 million tons / year), having more than 40 types of vegetables to supply to Ho Chi Minh City and Southeast provinces (Department of Foreign Affairs of Tien Giang province, 2018).Fishery is one of the key economic sectors of the province. Its farming area is over 15,500 hectares. In 2018, the annual output of captured and cultured aquatic products reached over 242 thousand tons (aquaculture products reaches nearly 145 thousand tons), including produces such as pangasius, clam, tiger shrimp (Department of Foreign Affairs of Tien Giang province, 2018). Its livestock production is also quite developed, producing over 8.9 million heads of poultry, over 600 thousand pigs and over 88 thousand cows. The quality of animal husbandry is constantly improved thanks to over 410 farms and the application of scientific and technical advances to production (Department of Foreign Affairs of Tien Giang province, 2018).

Impacts of Climate Change

Despite such a well-developed and diversified agriculture, Tien Giang agriculture sector has witnessed many difficulties and challenges due to climate change. The following areas have been impacted:

1. **Plantation**: During dry season of 2016 salinity intrusion was witnessed on the estuaries (Tien and Vam Co rivers). In 2015-16, the salinity was high and penetrated into fields faster than the average, affecting the production of winter-spring rice crop in Go Cong region. On the other hand, salt water also made it difficult for irrigation, affecting rice cultivation model combined with fish farming inside the fields (Nguyen Hong Thuy. 2016).

According to a report in 2015-2016, saline intrusion caused damage of estimated VND72,360 billion to 3,284,446 hectares of winter-spring rice; 15,562 billions dong for 113 hectares of fruit trees (it was observed that 20 hectares of longan couldn't be harvested because of cracking; 93 hectares of custard apple trees became weak due to lack of water); 40 hectares of lemongrass died because of drought, causing damage of estimated VND 1,260 billion (Sebastian et al., 2016). 2. **Livestock feed production:** Climate change led high temperatures, changes in rainfall, increased floods and droughts, has been affecting animal feed production systems (reducing food production), which has caused lack of water supply, imbalance of ecological environment and reduction of pasture productivity. The consequence of this change is to reduce the resistance of livestock, increase the likelihood of outbreaks of diseases, reduce the growth and reproduction productivity of livestock, leading to low production efficiency. Water scarcity pushed up the cost of water supply for livestock production. Climate change has made erratic weather change, affecting tolerance level of some species, thereby creating conditions for some harmful microorganisms to cause diseases for animals (Nguyen Hong Thuy. 2016). In 2010, according to the report of the Steering Committee for Blue Ear Disease Prevention and Control of Tien Giang province, the outbreak in the province was in 127/169 communes and wards in all 10 districts with 33,830 effected pigs, accounting for 6.2% of total pigs in Tien Giang province. It caused a damage of more than

VND 400 billion (Nguyen Hong Thuy. 2016). In such scenarios, the next section proposes some technology-intensive models to be adopted for addressing climate change related challenges. Some of these technologies are in other countries.

Recent Models of High-Tech Agriculture in Tien Giang

1. Planting melon in net houses using Israeli drip irrigation technology Initial cost to build a net house with an area of 500 m^2 and drip irrigation system and accessories is about VND 150 million. With this technique, the melon plant can be grown with 4 crops every year. The yield of each crop would reach to about 1.5 tons/500 m^2, with an average selling price of VND 30,000/ kg, the farmer earns VND 45 million including a profit of 50%, equivalent to VND 22.5 million. So, each hectare of melon has a yield of 30 tons, generating a profit of VND 450 million/crop (Vietnamese News Agency. 2018). With reasonable cost, this model can be applied in eastern areas where there is shortages of water for production in dry seasons. Furthermore, it can also help keep plants away from pest.

2. High-tech chicken farm Use of software to manage chicken farms which includes vaccine management software as well as farm temperature management system that ensures temperature at 27 - 28^{o}C. Also, drinking water treatment and filtration system for chickens, feed management with Cillo automatic spray towers, etc. are helpful ICT enabled systems. A farm in Cho Gao district has adopted software to enhance produce and has witnessed an increase to 330,000 chickens for eggs. The farm has proposed its software to be certified with GLOBALGAP and have its eggs exported to other countries (KFF. 2017).

3. High-tech agricultural zone in the province Tien Giang will invest VND 1,204 billion to build a high-tech agricultural zone covering an area of over 197 hectares. In the immediate future, the province gives special importance to investment and improvement of infrastructure, especially traffic, attracting investment, etc. (Government of Vietnam. 2017). Accordingly, in the first phase (from 2017-2020), the project will be implemented on a scale of 44 hectares, focusing on investment in technical infrastructure, calling for investment from agricultural enterprises using high technologies. Total mobilized capital for the project is about VND 280 billion; 21 billion out of which is the budget capital, the rest is other capital sources (Government of Vietnam. 2017).

In phase II (from 2021-2030), Tien Giang province will have a total investment of VND 924 billion in 153.3 hectares. This investment will be used to complete the technical infrastructure, the administrative center, the research area, the experimental area, the training of human resources and other services, etc. (Government of Vietnam. 2017).

Sugguested Models

According to many forecasts, revolutionary modern science and technology will create completely new technologies that motivate production to develop in depth, reduce the consumption of energy and raw materials, reduce harm to environment, improve the quality of products and services and strongly promote the development of production. In particular, the **industrial revolution 4.0** has impacts on the agricultural sector (Nhan Dan. 2017). Taking advantages of the revolution achievements is what the agriculture sector should do in order to better cope with negative impacts of climate change. The following are some suggested models using high/smart technologies that can be applied in the province in the context of climate change:

1. Rice production with 4.0 technologies

Technologies 4.0 can be used in rice cultivation for a more effective way of production. In fact, many pilot projects have successfully been implemented in some places in Viet Nam. Technology 4.0 in rice cultivation includes intelligent monitoring buoys helping in enhancing the ability to cope with saline intrusion. Alternating dry-flooded rice cultivation with technology 4.0 includes automatic water level sensors, which automatically updates water level information on the internet environment; intelligent water pump system are remotely controlled by mobile phones

and there are also smart slow-flow fertilization systems (BNN. 2018). Applying technologies 4.0 to rice production will help farmers to better control their production, reduce the impacts of CC and generate higher yield.

2. Using Biotechnology Applied Varients

Currently, intial success was achieved in the research and selection program for rice varieties for affected areas, applying biotechnology. Some rice varieties studied by scientists of Mekong Delta Rice Research Institute such as AS996, OM2517, OM5451, OM6677, OM576, OM6976 and others, have been evaluated and tested in areas affected by alum and salinity. These are varieties capable of tolerating alum and salinity (Dang Cong San. 2016). With the current situation of rice production in eastern area of the province, these varieties can been used in seasons with salinity intrusion.

3. Aquaponics model

Aquaponics is a method of creating natural, environmentally friendly food sources and exploiting the best properties of aquaculture and hydroponic vegetable cultivation with re-circulating water.

Aquaponics is a model that saves both fertilizer and human resources costs and creates safe and high-yield vegetables. On average, one hectare can grow 7,000-8,000 vegetables, fish tanks were arranged according to specific models. A 3-month fish tank would harvest approximately between 500 and 1,000 kg. (Khoahoc. 2018).

Conclusion

With available models of high-tech agriculture in the province, the agricultural sector can well adapt to the current situation of climate change and maintain its productivity, which continues to contribute to the economic growth of the province. Provincial authorities should have incentive policies to multiply them in the whole province especially in areas which badly affected by climate change. Also, studying the feasibility of applying the suggested models can resolve problems. Even in such scenarios, incentive policies hold significance for the successful application and multiplication of these models to maintain sustainable livelihood, for a large part of population as well as agricultural contribution to the provincial economy.

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Journey of Federal Republic of Ethiopia from a Middle Income Country to a Climate Resilient Economy

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Introduction

Ethiopia is a Least Developed Country (LDC) located in the North East Africa region, the Horn of Africa. The country is characterized by tremendous diversity of climatic and biophysical settings, ranging from the equatorial rainforest in the south and south-west with high rainfall and humidity. The variation in the biophysical characteristics of Ethiopia ranging from hot, arid desert to mountain ranges accounts for the variation in climate, soil type and cultural practices across the country and reflects the challenges country is facing in addressing the dilemmas of economic growth with green growth and climate resilience pathways.

National Commitment to Climate Resilient Green Economy

Over the last 5 years, the growth of Ethiopia's economy is among the top five fastest growing in the world, and is double the average for Sub-Saharan Africa. Ethiopia's public investment-led development strategy focuses on increased agricultural productivity, industrial output, export revenue, and public infrastructure. The strategy has generated tangible results in terms of economic growth and improved social conditions including significant reductions in rural and urban poverty. Ethiopia's goal to become a middle-income country by 2025 is thus attainable.

To reach middle-income status and sustain the development gains of recent years, Ethiopia will need to continue to implement its transformational growth strategies and address significant climate change threats. The country's ecological and agricultural systems are fragile and vulnerable to rising temperatures and

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changing weather patterns that are likely to impact critical seasonal rainfall levels. This is compounded by population pressure and stretched natural resources, especially the management and utilization of land. Furthermore, Ethiopia ranks 173 out of 187 countries on the UNDP's 2013 Human Development Index (HDI), with food insecurity persistent for roughly two million Ethiopians. In total, the negative impact of climate change on GDP could be 10% or more by 2050.

The Government of Ethiopia (GoE) clearly recognizes the negative consequences of climate in-action to the country's ongoing and future development, and has therefore prioritized climate resilience in its transition towards a green, sustainable growth model. Indeed, building a CRGE is a crosscutting pillar of the GoE's development agenda for poverty eradication through broad-based, accelerated, and sustained economic development.

In August, 2015, in Addis Ababa, two reports that present climate resilience strategies for the agriculture, forestry, water, irrigation and energy sectors in Ethiopia were launched by the Ministry of Environment and Forest (MEF), the Ministry of Agriculture (MoA) and the Ministry of Water, Irrigation and Energy (MoWIE).These strategies aim to support Ethiopia's goal to achieve middle income status by 2025 through the successful integration of the government's Climate Resilient and Green Economy (CRGE) vision into the five year national economic development framework, also known as Phase Two of the Growth and Transformational Plan (GTP II).

Agriculture and Forestry Climate Resilience Strategy, the Government of Ethiopia's (GoE) Agriculture and Forestry Strategy highlights the need to engage in more climate resilient activities in these two vital sectors, which make up 43% of national GDP and employ 80% of the population. The strategies for these sectors focus on agricultural crops, livestock, forestry, food security and disaster prevention, and are designed to move Ethiopia's economy from agricultural dependence to a greater GDP share based on services and industry. GoE projections highlight the importance of moving away from such a climate vulnerable economic model to a more sustainable and inclusive growth model that simultaneously improves livelihoods in the long term.

Water and Energy Climate Resilience Strategy, The Water and Energy Strategy is designed to effectively leverage these important sectors, which are expected to contribute approximately 7.2 billion USD to the projected GDP growth over the GTPII period. According to this strategy, 42% of MtCO2e savings will come from energy and water activities. Ethiopia's hydropower is largely dependent on rainfall, so assessing and combating the challenges related to rainfall variability, for example, will be critical to food security and livelihoods.

NDCs and Global Actions on Climate Change

Ethiopia was the first least-developed country to submit its Intended Nationally Determined Contributions (INDCs) to the UNFCCC, this only demonstrate the commitment of the county to climate change and resolve to safeguard community and natural resources from adversities. Signatories to the Paris Agreement set out what they intend to achieve by way of emissions reductions in their Intended Nationally Determined Contributions (INDCs), which were submitted to the United Nations Framework Convention on Climate Change (UNFCCC). Upon ratification of the Agreement, these became Nationally Determined Contributions (NDCs), in most cases without change.

Governments are now formulating plans for the delivery of NDCs. Collectively, the NDCs fall far short of what will be necessary to achieve the goals of the Paris Agreement. However, the Agreement provides an opportunity for countries to review progress and revise their NDCs every five years, beginning with a facilitative dialogue in 2018. It will be a major challenge for the parties to the UNFCCC to ensure that revised NDCs are as ambitious as possible and include all feasible energy emissions savings.

Ethiopia aims to increase power generation capacity by a considerable amount, mainly

through several large hydropower schemes. The success is in doubt after controversy about sustainability, including the challenge of mitigating the considerable downstream effects on neighbouring countries. Beyond satisfying its own growing demand, Ethiopia aims to become an exporter of electricity, which would require investment in an extensive distribution grid.

Ethiopia's NDC would lead to a reduction of at least 64% below the Ethiopian business-as-usual (BAU) scenario by 2030, when emissions including Land Use, land use change & forestry (LULUCF) are projected to reach 400 Metric Ton CO2e (MtCO2e). The corresponding Greenhouse Gas Emission (GHG) reduction target for 2030, excluding LULUCF, is 40% below BAU, or 185 MtCO2e, which is the emissions level used to rate the emissions reduction target. Full implementation of the NDC is conditional on finance, technology transfer and capacity building support under the framework of Ethiopia's Climate Resilient Green Economy Strategy (CRGE) strategy, which is integrated in its national development plan GTP II (Second Growth and Transformation Plan).

The mitigation efforts will focus primarily on the forestry sector, which is expected to contribute with a reduction of 130MtCO2e. Ethiopia also intends to use international carbon credits to meet its target.

Ethiopia's NDC is based on the Climate Resilient Green Economy Strategy (CRGE) strategy, which is integrated in its national development plan GTP II (Second Growth and Transformation Plan). If policies are successfully implemented, the NDC target could be achieved in 2030. Uncertainty remains on the effectiveness of current policies in place, which is reflected in a range of current policy projections.

Reducing vulnerability and building resilience to safeguard human security and to achieve the SDGs is another key pillar of the NDC. An important component of Ethiopia's contribution includes actions to build resilience and enhance adaptation to the impact of climate change. Given that 80 percent of the population depends on agriculture for their livelihoods increasing the resilience of agriculture is a priority for Ethiopia. This includes addressing the high vulnerability of the sector to droughts and floods. The NDC explicitly refers to co-benefts of mitigation and adaptation actions in regards to forestry and agriculture by maximizing the synergies between adaptation and mitigation. Many of the measures involving forestry and agriculture can provide substantial economic and livelihood benefits to Ethiopians. Respective adaptation needs are further specified in the CRGE and the National Adaptation Programs of Action (NAPA), including the institutional establishment of improved coordination of disaster risk management and adaptation; education and awareness raising on effective adaptation and disaster risk management from the local to the national level; enhanced emergency preparedness and response; enhanced local livelihood and community resilience for all Ethiopians; and an integrated approach to climate-sensitive development planning.

While Ethiopia considers their NDC a full national commitment to be undertaken without pre-conditions, international support for the implementation of both mitigation and adaptation action is critical for success. Altogether, Ethiopia's NDC can be considered an ambitious response to the significant challenges to stay at 1.5°C and to deal with the enormously challenging risks for Ethiopia as a LDC. This is true with respect to the enabling institutional framework described, the inter-ministerial approach and the ambitious targets and priority actions.

The Implementation Modalities for Sustainable Future

Implementation has institutional, procedural and thematic dimensions. At the institutional level, Ethiopia has set up a management framework for the CRGE. The inter-ministerial approach ensures national commitment and alignment across the government. The inter-ministerial management framework is led by the Environmental Council and the Technical Committee, which oversees the implementation of the strategy through six technical committees (Agriculture, Electric power supply, Building and green cities, Transport, Industry, and Health) to meet its ambitious growth

targets while keeping GHG emissions low. This set-up reflects very well Ethiopia's strong commitment and demonstration of climate leadership at the highest levels of the government, including the Office of the Prime Minister and the concerned line ministries.

At the procedural and legal/policy level, legal frameworks and policies need an upgrade to ensure proper NDC implementation, well aligned with the SDG implementation roadmap and the NAPA. This should include the revised NAP and revised guidelines and a checklist to ensure the mainstreaming of the CRGE as well as the full integration of gender and human rights measures into the country's climate strategy. Ethiopia may also benefit from continuous intense cooperation with international partners and services provided by the NDC Partnership. The general objective of the CRGE is to improve and enhance the health and quality of life of all Ethiopians and to promote sustainable social and economic development through the sound management and use of natural, human-made and cultural resources and the environment as a whole so as to meet the needs of the present generation without compromising the ability of future generations to meet their own needs.

At the level of thematic priorities, the CRGE includes the following, which are broadly consistent with the NDC. However, is to further develop these thematic priorities into more specific flagship programmes for action, including related investment plans. It is further recommended to identify lighthouse projects under each of the programmes for action, which demonstrate step-by-step how programmes turn into reality. Each should include clearly visible sustainable development co-benefits and linkages to Ethiopia's GTP II/CRGE. To scale up Enhanced Climate Action in Response to 1.5°C of Global Warming: Scaling Up Nationally Determined Contributions there is need to create more ambitious inclusive green growth development plan with measurable indicators and timeline which are in sync with NDC.

Conclusion: Climate Safe Future for Ethiopia

Due to both its high vulnerability to climate change and its envisioned leadership for ambitious climate action, Ethiopia has a huge potential to provide an enabling policy and legal framework to guide climate action consistent with 1.5°C pathways in alignment with sustainable development planning and disaster risk reduction. Building on existing frameworks, policies and the NDC, it is recommended to develop a number of national flagship programmes and related lighthouse projects, comprehensively addressing the most burning climate risks and impacts in a targeted and inclusive way. More programme to cover food security, water management, climate-resilient livelihoods, renewable energies, and non-economic and economic loss and damage shall be integrated, designed and implemented in a participatory way, creating triple wins of adaptation, GHG mitigation, and sustainable development, and mobilizing international cooperation and support.

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Science Diplomacy and Sustainable Development: Suriname-India Bilateral Relations to Improve Livelihoods of Rural Communities

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Bilateral Relation between Suriname and India

The Republic of Suriname is located in South America was until 1975 part of the Kingdom of the Netherlands, and prior to that a Dutch colony. Suriname is one of the most ethnically diverse countries in the world. Dutch is the official language. Suriname and India started their bilateral ties in 1975, the year Suriname gained its independence. Both states are represented at the highest diplomatic level in each other capital. The most important activities within the bilateral relation of Suriname and India in the past 12 months are:

- Suriname became a member of the International Solar Alliance (ISA) in February 2018. ISA aims to make 'scaling up' a reality in the deployment of solar energy in the 121 countries with strong sunshine situated between the Tropics of Cancer and Capricorn. These countries represent 73% of the world's population.
- The Honourable President of India Shri Ram Nath Kovind and First Lady Smt. Savita Kovind paid a visit to Suriname in June 2018. According to the Embassy of India in Paramaribo (Suriname's capital) a total of five MOU's were signed in the areas of Centre for IT Excellence, cooperation between the electoral authorities, National Archives, cooperation between diplomatic institutes and remunerative employment of

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dependents of the diplomatic personnel of the two countries (Embassy of India-Suriname, 2019).

- Under the Indian Technical & Economic Cooperation Programme (ITEC) the slots reserved for Suriname are 50 during the year 2018 - 2019.

An Agreement to set up a Joint Commission was signed in 1992 and six JC meetings have been held so far (the last being held in June 2017). Other areas of (continuous) cooperation are: economy, education and culture.

Culture has a special place in the bilateral relation between Suriname and India. The main reason is the fact that approximately 30% of the Surinamese population is of Indian descent (Censusstatistieken 2012. Algemeen Bureau voor de Statistiek in Suriname (General Statistics Bureau of Suriname). The Indian Cultural Centre in Suriname (ICCR) was opened in 1978 and it actively pursues soft-power diplomacy initiatives and the whole gamut of ICCR's outreach including, Hindi language, Kathak, Yoga and classical music. India provides yearly grants for promotion of Hindi in Suriname. India and Suriname are look alike in many areas. Apart from the scales there are many similarities.

In this paper the focus is on the existence of relatively poor rural communities scattered over different parts of the country. Their livelihoods need sustainable improvement in several areas. In this paper the disadvantages in the areas of health, water and sanitation, energy, education, and agriculture will be touched upon.

This paper is an appeal to broaden the cooperation between the two countries with the area of rural community development through Sustainable Development Diplomacy and Science Diplomacy. First, the emphasis will be on the rural communities in both countries, followed by Sustainable Development Diplomacy and Science Diplomacy. After exploring possible areas of cooperation the paper will end with some recommendations.

Rural Communities in Suriname and India

Suriname

Rural communities are found in villages along rivers in the tropical Amazon rainforest of Suriname. Unlike in the urban area, coastal many rural areas lack basic resources necessary for a sustainable livelihood. The areas are being inhabited by different indigenous Amerindian tribes and different Maroon groups. The Maroons are descendants of enslaved Africans who escaped slavery and established sustainable self-ruled communities in the forests. Following this, the case of access to drinking water will be used to stretch the need for improvement of living conditions in the rural areas of Suriname.

Although 95% of the overall population is obtaining their drinking water from improved sources, large disparities remain between the urban coastal (98.6%), rural coastal (95.9%) and rural interior populations (70.7%). Of great concern is that less than 10 per cent of households using an unimproved drinking water source use an appropriate method of treatment, meaning that the vast majority of those households are at risk from water-borne diseases. While 91% of the overall population has access to improved sanitation facilities the disparity between urban, rural coastal and rural interior areas is even more striking. In the urban coastal area, 98 per cent of households have improved facilities, and in rural coastal areas 94%. However in rural interior households, just 42% of households have access to improved sanitation. Open defecation is still the main practice of nearly half of all households (49.1%) in the rural interior (UNICEF 2014).

This means that in the rural interior, one third of households don't have access to safe drinking water, and fewer than half of all households has access to improved sanitation. According to its multi-year development plan (2017-2021) the main goal of the government of Suriname is to develop rural areas sustainably whereby the quality of life of those living in these areas would be substantially improved (Government of Suriname, 2017)

India

India has the largest population of poor people (Hedge, 2019) and community development has assumed high priority. The initial programme aimed at upliftment of the rural poor, covered agriculture, animal husbandry, roads, health, education and housing.

Though 30% of rural population lives in a chronic condition of poverty in the last three decades some improvement in the number has been seen because of anti-poverty schemes and migration from rural to urban areas.

Science Diplomacy and Sustainable Development Diplomacy

The practice of science diplomacy could be dated back until the early days of diplomacy. According to Linkov *et al*. (2014) the idea of science diplomacy is itself not new, with the literature pointing out that the US was among the first to make use of a science attaché, having representation in Germany as early as 1898 (Linkov *et al*. 2014, as cited by Masters 2016). This practice could be defined as the use of scientific collaborations among international communities to address common scientific challenges and to build constructive global partnerships and cooperation (Saxena, 2017).

Science diplomacy is not only conducted at the level of states. With a growing divide between the "haves" and "have nots", and the prominence given to the role of science, technology and innovation in addressing issues of human security, non-state actors, including civil society, the private sector, academia and research organisations, have been drawn into international debates and scientific collaboration. In the case of India and Suriname, science could be used to bring together expertise in promoting research and the use of innovation for the benefit of rural communities in both nations. This leads to sustainable development. For countries to achieve sustainable development they need to engage in partnerships to develop best policies and practices. Sustainable development diplomacy needs deeper participation of all relevant stakeholders and could therefore be defined as the engagement of diplomatic and civil society to collaborate on addressing and tackling challenges that avert the creation or preservation of sustainable livelihoods.

Areas of Cooperation

The areas of cooperation are selected based on mutuality. Both countries have the same problems in their rural areas. It will be necessary for both governments to share knowledge, experiences, and technology, by also engaging with NGO's, the private sector, scientists and (all layers of) the rural communities. The current global industrial revolution has an exponential pace of technological change, building on new (mostly) digital technologies and transforms, practices and systems. The both countries could engage in sustainable development diplomacy and science diplomacy to deploy science and technology to enhance livelihoods and thereby guarantee sustainable rural development.

Health

Although rural communities often have access to local healthcare facilities, there are other factors that contribute to how they can access healthcare. Some factors include cost of insurance and specialist services, transport to and from required services, time and confidence in the quality of services. A coordinated approach to healthcare that incorporates technology such as artificial intelligence is an ideal goal for rural communities; for example technologies that can help doctors provide effective video consultation to patients in rural areas (www.orionhealth.com). India and Suriname can pair to tackle healthcare challenges in their rural areas. For example Suriname is very well known in the America's for successfully eliminating malaria within its borders. On the other hand malaria is (according to the World Malaria Report 2017) a main threat for India's health system. In the year 2016, more than half of the population (698 million) was at risk. According to this report, India accounted for 6% of all malaria cases in the world, 6% of the deaths, and 51% of the global *plasmodium vivax* cases. The Report estimates the total cases in India

at 1.31 million and deaths at 23,990. The biggest burden of malaria in India is borne by the most backward, poor and remote parts of the country, with between 90 to 95% of the cases reported from rural areas (WHO, 2017).

Water and Sanitation

Access to clean water and proper sanitation are basic human rights and are critical sustainable development challenges. The causes are in most cases polluting industries, agriculture, households and energy generation. In the rural interior of Suriname, fewer than 15% of households have safe drinking water piped into their households or yards and fewer than half have any improved water source on their premises (UNICEF, 2015). Most villages in the rural interior are built on river systems, and for generations people have used the river for all of their needs, while open defecation is still a common practice. Rural India faces the same problems regarding access to safe water and proper sanitation.

Education

The mission towards ensuring quality of education and promoting lifelong learning demands a range of prerequisites including, primarily, a spirit for knowledge, relevant as well as futuristic curriculum, and well-trained teachers. And, as all these feed each other, they need to be realized in an integrated and holistic way (India CSR, 2018). Both countries could engage in a sustainable cooperation with mutual benefit by sharing knowledge and experience. Both states face the same challenges and technical cooperation in the fields of the development of new curriculum and the use of ICT could play a vital role in improving education in rural areas.

Energy

Energy is central to nearly every major challenge and opportunity the world faces today. Be it for jobs, security, climate change, food production or increasing incomes, access to energy for all is essential. Focusing on universal access to energy, increased energy efficiency and the increased use of renewable energy through new economic and job opportunities is crucial to creating more sustainable and inclusive communities and resilience to environmental issues like climate change (UN, 2019). Sustainable energy is a boost for economic growth and is essential for creating sustainable livelihoods. Furthermore, access to energy creates health benefits and enables people to study or start a business. India and Suriname could pair in the development and use of renewable energy. Scientists agree on the fact that energy from renewable resources as wind, water, solar and biomass is clean. All of these sources are available in both countries.

Agriculture

According to the FAO achieving food security would require an integrated approach that addresses all forms of malnutrition, the productivity and incomes of small-scale food producers, resilience of food systems and the sustainable use of biodiversity and genetic resources (FAO, 2019). Again both governments could work together with scientists, local farmers and multilateral organisations to guarantee food security, nutrition and sustainable agricultural practices for the rural communities. Because of, among others causes, the use of old technology (if technology is being used at all) the communities stick with low-productivity agriculture.

Barefoot College as a successful model

The success of the Barefoot model in India is widely recognized. Barefoot College demonstrates that illiteracy does not have to be a barrier to poor communities developing themselves and that the most sophisticated technologies can be disseminated by poor rural men and women who can barely read and write. As such, thousands of people are trained each year to be teachers, doctors, midwives, dentists, health workers, solar engineers, water drillers and testers, hand pump mechanics, architects, artisans, designers, masons, communicators, computer programmers, and accountants.

The Barefoot College connects rural communities to solar, water, education, professions and advocacy to help communities and individuals take control of their lives and the wellbeing of their communities. In 2016 two

Surinamese women completed the International Solar Training Program of Barefoot College. Currently these two women are skilled enough to share their knowledge and experiences with other local communities in remote villages in the interior of Suriname.

This training program began in 2008 and is being supported by the ITEC Program. According to Barefoot this six-month program, conducted twice a year, is a collaborative effort of Barefoot College, ITEC and the respective Governments and NGO's (ground partners) of the participating countries.

Trainees are often illiterate or semi-literate grandmothers who maintain strong roots in their rural villages and play a major role in community development, bringing sustainable electricity to remote, inaccessible villages (Barefoot College, 2019). Solar electrification reduces CO2 emissions, slow the negative impacts of deforestation and decrease air pollution from burning firewood and kerosene.

Recommendations

Based on the findings of this preliminary study, this paper concludes with the following recommendations:

- Whereas India has developed a policy on science diplomacy, Suriname still needs to engage all stakeholders and develop an inclusive policy on this subject. The Multi-year development does not mention science diplomacy and technological cooperation is ad hoc. The Ministry of Foreign Affairs is yet to install a science diplomacy division.
- Both nations clearly need to do better in engaging with non-state actors who can play a vital role in both Sustainable development diplomacy and Science diplomacy. Improving livelihoods of rural communities requires a broad level of cooperation including (all levels of) government, rural communities, universities and scientists, civil society and private sector.
- Engagement with all layers of the rural communities (including women and youth) in developing this policy is pivotal to ensure sustainability. Both countries can do better in engaging the communities in policy development and priority setting.
- Both nations can do a better job in sharing knowledge, technology and success stories. Improving livelihoods of rural communities has been on the agenda of both states for decades and it is plausible that successful mechanisms or models in different areas have been developed in the course of the years and that those could be shared.
- In many developing states, there are constraints on capacity. This also limits the options for international engagements. Suriname and India have the structure and infrastructure to enhance their partnership. Apart from de presence in both capitals, the Joint Commission is a suitable environment to further engage in this regard. The frequency and output of the Joint Commission meetings need to be increased accordingly.

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Review on S&T Cooperation between Russia and India

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Russian Science and Technology Policy

The state policy of the Russian Federation in the field of science, technology and innovation (STI) has recently undergone changes. A new strategic approach to Russia's modernisation has emerged, with key long-term priorities for the national STI complex as well as a new framework for its governance.

The development of a strategic approach to STI issues and its institutionalisation has been an essential part of the modern STI state policy of the Russian Federation. On December 1st, 2016, the President of the Russian Federation approved the Strategy for the Scientific and Technological Development of the Russian Federation (hereinafter – the Strategy). The Strategy sets out the goal and the main objectives of Russia's scientific and technological development, the principles, priorities and main areas and measures for implementing the state policy in this sphere, as well as the expected results of the Strategy's implementation, namely Russia's sustainable, dynamic and balanced scientific and technological development in the long term (till 2035). It also determines the place and significance of a scientist, engineer, technological entrepreneur in society.

The document sets the following context for implementing the state policy in the sphere most successfully:

I. Introducing the definition of «grand challenges», with science and technologies being important tools to meet those challenges by playing a key role in ensuring both the sustainable

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development of civilization and the assessment of risks and potential hazards for humanity. In terms of the scientific and technological development of the Russian Federation, the following grand challenges may be deemed as the most important[1]:

- Exhaustion of Russia's economic growth opportunities based on extensive exploitation of raw materials, against the backdrop of the development of the digital economy and the emergence of a limited group of the leading countries with new production technologies, which drive towards the use of renewable resources;
- Demographic transition caused by an increase in human life expectancy, changes in the life-styles and related ageing of population, which, taken together, results in new social and medical problems, including the growth of global pandemic threats, higher risks of new infections, and the return of currently extinct infections;
- Health and life hazards resulted from an inefficient use of natural resources and an increase in anthropogenic pressure on the environment to the extent that it poses a threat to the renewal of natural resources;
- A need to ensure food security and independence of Russia, competitive strength of domestic products in the global food markets, and reduction of technological risks in the agro-industrial sector;
- Qualitative changes in the global and local energy systems, a growing importance of the economy's power supply capacity and stepped-up generation of power, its conservation, transmission and use;
- New external security threats (including military threats, threats of losing national and cultural identity of Russian citizens), brought about by the growth of international competition and proneness to conflict, global and regional instability and their growing interconnection with internal threats to national security;
- A need for the efficient development of the space, eliminating disproportions in the social and economic development of the national territory, consolidating Russia's positions in the economic, scientific, and military development of outer and air space, the World ocean, the Arctic and the Antarctic Regions.

II. Transition from branch-wise S&T priorities to societal demand-oriented approach.

The implementation of the priority areas in the development of science, engineering and technologies at the first stage of the state scientific and technological policy (1991-2001) made it possible to obtain results and create competencies necessary for moving to the implementation of new priorities of S&T development of the Russian Federation that address grand challenges[2].

III. R&D Management (modern, «digital», competitive).

Following up on the document the Strategy, in 2017 the Russian government approved the Action Plan for the Implementation of the Scientific and Technological Development Strategy of the Russian Federation in 2017-2019 (hereinafter – the Action Plan). The Action Plan, in particular, provides for the development and approval of the state program «Scientific-technological development of the Russian Federation», which includes a programme of fundamental research and integrated S&T programmes in priority areas defined by the Strategy. The programme will be financed at the expense of other government programmes, development institutions and funds of support of scientific, scientific-technical and innovation activities. Also, it may be said that the Action Plan includes measures for creating opportunities for the successful realization of creative potential of young people in science and innovation, including international technical and scientific cooperation.

The Action Plan consists of 43 actions intended to[3]:

- Form an up-to-date management system & improve investment attractiveness;
- Establish an effective communication system, increase the perceptivity of the society and the economy to innovations, provide conditions for the development of science-driven business;
- Provide conditions for R&D in line with the best Russian and worldwide practices and the recent principles of work organization;

- Create conditions to identify talented youth and enable them to build successful career and develop intellectual potential of the country;
- Establish the model of international S&T cooperation and integration that will help to protect the identity of the Russian science and enhance its effectiveness through mutually beneficial collaboration.

To the key elements of the Strategy also refer the implementation of the National Technological Initiative, the Strategy of "naukograds" (science cities) and development of the Concept of International Science and Technology Cooperation", which is aimed at promotion of the international S&T cooperation and integration into global S&T community.

Russian-Indian R&D collaboration

Legal framework

The Intergovernmental Russian-Indian Agreement on Science and Technical Cooperation, 1994, establishes a legal basis for the development of bilateral cooperation between Russia and India.

The Working Group on Science and Technology (hereinafter – the WG on S&T) functioning under the Intergovernmental Commission on Trade, Economic, Scientific, Technological and Cultural Cooperation, the Integrated Long-Term Programme and the Basic Science Cooperation Programme are the three main institutional mechanisms for bilateral Science and Technology cooperation, while the Science Academies of the two countries promote inter-academy exchanges.

Moreover, there are Memorandums and Agreements on S&T cooperation between the Indian organisations and Russian science foundations (Russian Foundation for Basic research, Russian Science Foundation); universities are being promoted to encourage the growth of bilateral interaction in the field of S&T.

Two Programmes of Cooperation concluded in October 2013 were active mechanisms for cooperation as well. The first was the Programme of Cooperation in the fields of science, technology and innovation between the Department of Science and Technology (DST), Government of the Republic of India, and the Ministry of Education and Science of the Russian Federation (MON) for the period 2014 – 2017. Priority areas of cooperation, set in the Agreement, were environmental sciences; energy (including alternative sources of energy), efficiency and security; information & communication technology; nanotechnology and materials & engineering sciences. The second one was the Programme of cooperation between the Department of Biotechnology of the Ministry of Science and Technology (DBT), Government of the Republic of India, and Ministry of Education and Science of the Russian Federation for the period 2014 – 2017, within life sciences and biotechnology.

Both Programmes supported joint Russian-Indian R&D projects through the mechanism of a joint call for proposals.

Joint working platforms

The general coordination of S&T relations at the interstate level is carried out by the WG on S&T functioning under the Intergovernmental Commission on Trade, Economic, Scientific, Technological and Cultural Cooperation. Last meeting of the WG was held on February 26, 2018, in the Ministry of Science and Higher Education of the Russian Federation.

BRICS STI WGs. Within the BRICS, India oversees such areas as geospatial technologies and their applications for development: the development of information and communication technologies (ICT) and decision-making systems (SPM) based on geospatial technology for managing risks associated with natural disasters and climate change, and for appropriate flexible development planning to ensure a sustainable habitat. Together with Russia, India is responsible for cooperation in the field of materials science and nanotechnology, as well as in the field of photonics. Both India and Russia supports and actively participate in the implementation of BRICS STI Framework Programme aims to support joint research projects in priority areas. The initiative is aimed to facilitate cooperation among researchers and institutions in the framework of consortia that should consist of partners from at least three BRICS countries.

Funding

Support of fundamental research in the Russian Federation is carried out within the framework of the Program of Fundamental Scientific Research in the Russian Federation for the long-term period (2013-2020) and the Program of Fundamental Scientific Research of the State Academies of Sciences for 2013-2020. Russian Foundation for Basic research (RFBR, regularly announces bilateral joint calls, BRICS STI Framework Programme funding organization and Call Secretariat) and Russian Science Foundation (RNF, the second call for Russian-Indian proposals in all research fields, except social sciences and humanities was announced on June 1, 2018) make a significant contribution to the basic research funding. A number of separate initiatives are implemented in order to support research infrastructure, including mega-science projects: Government Decree No. 220 on measures to attract leading scientists to Russian higher education institutions.

The activity of the Russian Foundation for Assistance to Small Innovative Enterprises in Science and Technology (FASIE) is intended to support innovations via funding R&D projects aiming at solving societal problems and creating highly knowledge-intensive products, with focus on small innovative companies.

The main tool for supporting applied research is the Federal target program on research and development for priority areas of the development of S&T complex of Russia 2014-2020 (hereinafter - FTP 2014-2020), managing by the Ministry of Science and Higher Education of the Russian Federation. After studying the it can be summed up that in order to get funding for the international applied research projects under the program there are some obligatory rules, such as:

- The requested amount of funding from the federal budget (subsidy) should be calculated for the duration of the work within the framework of the project, specified in the call conditions (from 1 year to 4 years);
- The requested amount of funding from the federal budget (subsidy) should be fully used by its recipient to recover its research costs;
- The project may provide for extrabudgetary co-financing by the industrial partner;
- The cost of foreign partner in the project should be at least 100% of the amount of the grant requested by the Russian participant for each year of the project (the rule of equal funding);
- Foreign partner's work package are covered at the expense of foreign partner funds (foreign funding agency) and must be expressed by the Russian partner in the national currency (ruble, RUB) at the official exchange rate of the Central Bank of the Russian Federation on the day the decision on the winners is taken (the Protocol is sighed by the respected funding agencies);
- The amount of funding requested from the federal budget for the project implementation should not exceed the limit of the subsidy, including within one financial year, indicated in the call announcement;
- If the requested amount of funding from the federal budget is reduced in relation to the limit of the subsidy, the reduction should be proportional to each fiscal year. The allowable deviation from this requirement should not exceed 5%.

Indian-Russian applied R&D projects implementation

- **Bilateral cooperation in applied research. Challenging issues**

Bilateral cooperation in applied research - statistics

Within the framework of FTP 2014-2020, 15 bilateral Russian-Indian projects have been supported since 2014. Among them, six projects were supported in 2017 within the Programme of Cooperation in the fields of science, technology and innovation between DST and MON for the period 2014 – 2017 (two were dissolved due to the lack of financing from the Indian side); four were supported in 2017 within the Programme of cooperation between DBT and MON for the period 2014 – 2017 (one was dissolved due to the lack of financing from the Indian side).

Table 1: Existing Russian-Indian Partnerships - Examples

S. No.	Funding Organizations	Russian side	Indian Side
1	MON, DST	Federal State Budget Educational Institution of Higher Education "Irkutsk State University"	Indian Institute of Technology Guwahati
2	MON, DST	Federal state autonomous educational institution of higher education "St. Petersburg Polytechnic University of Peter the Great"	Indian Institute of Technology Bombay
3	MON, DST	Federal state autonomous educational institution of higher education "Belgorod State National Research University"	Center for Nanoscience and Technology, Indian Institute of Science, Bangalore, India; Limited Liability Company Megalum
4	MON, DST	Federal State Budgetary Research Institute of Physics and Technology. A.F. Ioffe Russian Academy of Sciences	Indian Institute of Technology (Indian School of Mines), Dhanbad; Technological Institute Motilal Nehru, Neshnel
5	MON, DST	Federal State Budgetary Institute of Science Institute of Problems of Chemical Physics of the Russian Academy of Sciences	University of Sri Venkateshwara
6	MON, DST	Federal State Budgetary Institute of Science Institute of Synthetic Polymer Materials. N.S. Enikolopov of the Russian Academy of Sciences	University of Visva-Bharati, Indian Association for the Advancement of Science
7	MON, DST	Federal State Autonomous Educational Institution of Higher Education "National Research University" Moscow Institute of Electronic Technology	University of Utkal
8	MON, DST	Federal State Institution "Federal Research Center Fundamental Foundations of Biotechnology" of the Russian Academy of Sciences	Center for Advanced Scientific Research Jawaharlal Nehru
9	MON, DST	Federal State Budgetary Institution of Science Institute of Bioorganic Chemistry, Institute of the Russian Academy of Sciences	Tata Memorial Center ACTREC
10	MON, DBT	Federal State Budget Scientific Institution "VN Orekhovich Scientific Research Institute of Biomedical Chemistry	The Council of Scientific & Industrial Research (CSIR) – National Geophysical Research Institute

Source: Data collected from various sources, including Department of Science and Technology and Department of Biotechnology, Government of India

Challenging Issues

The long-term Russian-Indian collaboration in science and technology provided the basis for identifying some bottlenecks in this cooperation. The challenging issues that should be taken into consideration are the following:

- The volume of funding within the framework of supported applied projects should be provided under the terms of equal co-financing, in accordance with the terms and conditions of national regulations and the call documentation.

- In India, there is a two-stage procedure of supporting and funding joint projects, while in Russia the procedure is one-stage. It means that after the joint decision is taken on what projects to support and it is fixed in the Protocol signed by both Indian and Russian funding agencies, the Indian side submits the chosen projects for the second round of internal approval. During this second stage some conditions, such as amounts of budget requested for the projects or projects implementation period or others, can sometimes be changed on a unilateral basis. This can cause inconvenience in terms of whole projects' changing and additional agreements undertaking between the project partners, and therefore between the Russian partner and the Russian funding agency.
- Multilateral cooperation in applied research - statistics. BRICS STI Framework Programme

Within BRICS STI Framework Programme two coordinated multilateral calls have been launched since 2015, with the participation of all BRICS countries: Brazil, Russia, India, China and South Africa. From the Russian side two funding agencies take part: Russian Foundation for Basic Research (performs the functions of the Call Secretariat as well as supports fundamental research projects) and the Russian Ministry of Science and Higher Education (MON, supports applied research projects). In 2017 within the pilot BRICS coordinated call MON supported for funding seven projects, five of them with Indian participation. In 2018 the second BRICS coordinated call was launched, MON supported six projects, four of them with Indian participation

The table 1 provides several examples on the existing partnerships between Russian and Indian research organisations.

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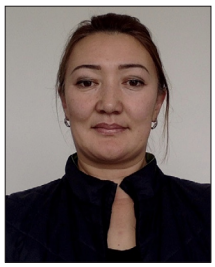
Note: Most of the points in "Russian-Indian R&D cooperation", "Indian-Russian applied R&D projects implementation" are narratives derived from my professional experience.

Science Diplomacy and Sustainable Development Goals (SDGs): Case of Kyrgyz Republic



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Introduction

The 2030 Agenda for Sustainable Development, adopted by all United Nations Member States in 2015, provides a shared blueprint for peace and prosperity for people and the planet, now and into the future. At its heart are the 17 Sustainable Development Goals (SDGs), which are an urgent call for action by all countries - developed and developing - in a global partnership. They recognize that ending poverty and other deprivations must go hand-in-hand with strategies that improve health and education, reduce inequality, and spur economic growth – all while tackling climate change and working to preserve our oceans and forests. (United Nations 2015)

Science Diplomacy and Sustainable Development Goals

According to Raymond Saner, " Implementing the SDGs at global level requires ingenuity and willingness to cooperate on all sides of the multiple global divides: be that-rich/poor, developed/developing, northern/southern hemisphere, state-led/market-led economies, democracies/non-democracies, and high science-technology/low technology/science countries." (Saner 2015)

Countries are embarking on a laudable and difficult journey. Sustainability – consisting of social, economic and environmental sustainable development- is expected to be implemented as a policy package. Successful implementation inevitably means aiming for

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maximum efficiency and effectiveness of current social and physical infrastructure conditions as well as searching for new technologies to make these ambitious but absolutely needed goals a reality for the benefit of global survival and constructive future global development.

Poor and under-developed countries will need transfer of technology from highly developed industrialised developed countries and all countries will be in need of new technologies to make the SDGs become a sustained reality on a global level. Sharing technology for the benefit of humanity can be achieved through science diplomacy.

Science Diplomacy should be considered as a means to reduce the many imbalances and as a vehicle to lift humanity up towards sustainable growth and development. Saner has given examples for applying Science Diplomacy and suggestions for using it creatively in achieving SDGs. While he has suggested measures that are not country specific , it is possible to develop country specific plans for harnessing Science Diplomacy for achieving SDGs.

SDGs and Kyrgyzstan

Kyrgyzstan works closely with UNDP (United Nations Development Program) in its efforts to "focus on developing capacity of institutions and communities using analytical tools (NHDRs and MDG reports), human rights-, gender equality- and youth-based approaches".

The Kyrgyz national development agenda recognizes the significance of water issues. It states that access to safe water and adequate sanitation largely influences the effectiveness of healthcare. Much attention is given to water supply, sanitation, and hygiene issues, which are vital for the entire population of Kyrgyzstan, especially for children. The Government defines its policy on these issues, especially in the regions, water availability is necessary for the development of agriculture. Consequently, SDG on clean water and sanitation and all its targets are significant for the sustainable development agenda of Kyrgyzstan.

Kyrgyzstan's "green economy" strategy considers all natural assets as factors of production and provides for a transition to a resource-efficient and low-carbon development based on the rational use of natural resources and promotion of low-waste or no-waste methods of production and consumption. This is complemented by growing use of renewable energy sources: solar, wind, water, geothermal sources, and biofuel. Since sustainable development planning implies taking environmental threats and risks into consideration, adaptation to climate change is becoming increasingly relevant.

The Government approved a draft law on the State strategic planning system, which is currently under consideration by Parliament (Zhogorku Kenesh or Supreme Council). This bill aims at harmonizing all matters related to the initiation, development, review, approval, implementation, monitoring, evaluation, and adjustment of public policy instruments at all levels. It sets out the organization and basic principles of strategic planning, the system of public strategic planning documents and the responsibilities of those involved in the strategic planning process.

Within the State's forecasting system, methodologies were adopted for strategic planning on sustainable development and for assessing and cataloguing public policy instruments, in line with the strategic planning framework.

The agenda of achieving SDG 7 on affordable and clean energy in Kyrgyzstan overlaps with other SDGs and their targets, as the country is striving to build a "green economy" (SDG 8), thus promoting responsible consumption and production (SDG 12), addressing climate change (SDG 13) and life on land (SDG 15) issues. The energy sector is one of the most important in the Kyrgyz economy, accounting for roughly 3.9 percent of GDP and 16 percent of industrial production. In contrast to neighbouring countries, Kyrgyzstan has small amounts of natural reserves of fossil fuels, but enjoys large amounts of water resources and an abundant supply of hydropower. This is recognized as one of development opportunities for the country, already reflected

in the Government's development strategy for the energy sector for 2012–2015.

In terms of infrastructure and sustainable transport development (SDG 9, target 9.1), similarly to Kazakhstan, Kyrgyzstan's strategic objective is to become a regional transit-hub, reflecting the geographical position of the Central Asian countries. The national development strategy contains specific infrastructure measures to turn Kyrgyzstan from a "transport deadlock" into a "transit" country. Planned construction of railways is going to give impetus to the development of regional economies, and addresses the problem of access to mineral deposits. All this will increase employment and improve economic well-being of the population, providing additional transport links between the North and the South of the country. An important priority for Kyrgyzstan is the development of the tourism industry and aspiring the status of a major regional centre of tourism and recreation, meeting modern requirements. All this involves building transboundary infrastructure to promote and deepen trade relationships with the SPECA countries, and improve the economic conditions in the country and the subregion (target 9.1).

The high dependence of the Kyrgyz Republic on foreign economic relations is primarily due to the small size of the domestic market and the relative lack of resources and capital goods. At the same time, the high degree of openness of Kyrgyzstan's economy makes it very vulnerable to global price fluctuations. The tightening of the external borders of the Eurasian Economic Union may exacerbate the situation.

Consequently, in pursuing the SDG agenda, Kyrgyzstan has aligned its priorities with SDG 8 on decent work and economic growth, reduced inequalities on interstate levels (SDG 10) as well as SDG 17 on partnerships for achieving the goals. These SDGs prove their relevance in terms of targets 8.a on providing aid and support in terms of sustainable trade development for the developing countries and targets 17.10, 17.11, 17.12 increasing the integration of the country in the world trading system.

SDG 9 on industry, innovation, and infrastructure is given priority. Specifically, the targets on enhancing scientific research and encouraging innovation (9.5) and assisting the diversification of industry and providing policies for such development (9.b) are relevant for Kyrgyzstan's sustainable development priorities. These are expected to affect the achievement of the environmental agenda of the country (notably SDG 13).

Due to increased migration, traditional family ties have weakened. Women increasingly choose education that leads then to taking lower-paying jobs. Salaries in traditionally "female" occupations are usually 2.5 times lower than those in traditionally "male" ones. Men also experience the consequences of stereotypes, notably that they should be the "bread-winners". Kyrgyzstan became the first country in Central Asia to adopt its own National Plan on the implementation of UN Security Council Resolution 1325 on Women, Peace, and Security. It is piloting the UN's 7- Point Action Plan on women's equal participation in decision-making bodies and their role in peacebuilding, conflict prevention and resolution, as well as the protection of women and girls from violence. Both correspond to the National Gender Equality Strategy (2012-2020) and the subsequent Action plan.37 In this sense, providing quality education (SDG 4) is the cornerstone of achieving gender equality (SDG 5), improving the economic conditions of all groups and reducing inequalities (SDG 10).2 (UNECE 2017)

Kyrgyzstan's Transitions to Green Economy

According to UNPEI "Kyrgyzstan, where the mountains cover over 65% of the territory, has been called the Switzerland of Asia. Independence from the Soviet rule and the transition from the former command economy to a free market economy in the 1990s had severely disrupted agriculture and increased rural poverty, which today comprises three-quarters of the country's poor. The Agricultural sector, which produces abundant cotton, tobacco, wool, and meat, remains the backbone of the economy that is

slowly recovering. Poverty is highly concentrated with 30% of the population living below the national poverty rate. The poor of necessity rely on natural resources to feed themselves and thrive, placing an increasing burden on the land. Decades of ecological mismanagement has left the 7% of arable land strained due to inefficient use and pollution of water resources, land degradation and improper agricultural practices. An estimated 60% of Kyrgyzstan´s land is affected by topsoil loss mainly because of man´s impact of excessive logging for fuel wood and house building.." (UNPEI 2015)

Eradicating poverty remains a challenge. While the Millennium Development Goals helped to lift more than one billion people out of extreme poverty, the Sustainable Development Goals aim to keep them out of poverty. To reduce poverty development needs to be both socially and environmentally sustainable. The United Nations Development Programme (UNDP) is ambitious to help countries like Kyrgyzstan to build their capacity to integrate environmental considerations into development plans and strategies, including sustainable use of natural resources, and to ensure that natural wealth is used to improve people´s lives.

The introduction of a Green economy is leading a new trajectory of sustainable development to ensure the balanced approach to its three components: economic, environment and social. The initiative of "green" is based on three main principles: highlighting natural ecosystem services, providing "green" jobs and policies to people, and achieving sustainable development through market mechanisms.

With the joint UNDP-UN Environment Poverty Environment Initiative, the Kyrgyz Republic have been steered to a path of better natural resource use, poverty reduction, promotion of environmental sustainability and addressing the intertwined challenges of the Sustainable Development Goals.Green economy creates jobs and generates incomes for the most vulnerable and gives them an opportunity to take an active role in local economic activities. In UNDP´s "Green village" initiative in Ugut and Ak-Muz villages of Naryn oblast practical "Do it yourself" trainings and "green" agricultural technologies were provided to local communities, enabling 1,400 residents to raise greenhouse crops and produce fresh vegetables year-round. The initiative further oversaw installation of solar water heating systems and energy-efficient LED streetlights.

In this fashion, Kyrgyzstan has demonstrated its potential to use alternative energy sources and thrive in the transition to "green" economic growth of resource-effectiveness and low-carbon development, which will complement economic, social and environmental policies.

Green economy is an important tool for achieving Kyrgyzstan's sustainable development. The Sustainable Development Goals represent the priorities for the economy and catalyze what markets should be delivering for people and societies. This will engender a better-managed system, where all levels of society are striving toward achieving the common goals set by the Government. (UNPEI 2015)

Conclusion

According to UNESCO "Science, due to its international and universal nature, has the power to cross borders and connect different peoples, communities, and societies. Science diplomacy builds on this power of science, using science as a tool to achieve foreign policy objectives where, not only the research outcomes, but also science itself as a process and way of communicating, may serve to promote peace and sustainable development.". (UNESCO 2016) . It is hoped that Science Diplomacy will enable Kyrgyzstan to achieve SDGs and make further progress.

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Universities as Centers of Science Diplomacy: Case of Volgograd State Technical University

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Introduction

Special attention is paid to science diplomacy in Russian academic circles. Science diplomacy was discussed during a whole series of international events, which were held with an assistance of the Russian Foundation for Basic Research (RFBR) that is a self-governing nonprofit public organization in the form of a federal organization which main goal is to provide assistance to activities in all areas of basic research, including qualification upgrade programs for scientists, and financial support for international scientific cooperation in the field of basic research. The Fund is financed through funds from the federal budget. First of all, it is the International Seminar «Scientific Publication: Where, Why, and How» and first «Russia-Korea Science and Technology Day»(June 5-6, 2017).

University as Core of Science Diplomacy

Universities, especially regional ones, should be at the core of science diplomacy, in our opinion. Universities nowadays, primarily engineering and technical ones, are the main source of innovation and advanced scientific and technical developments. In addition, universities are centers of cultural and sports activity for youth. Higher education institutions are complex institutions that have a diverse influence on the development of the territories of their location.

With a developed scientific, leisure and entertainment, social and information infrastructure, universities can become

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not only a factor in the effective innovation development of regions, but also become drivers of their positioning in international markets by attracting stakeholders (students, academics, business communities, public figures, athletes, representatives of creative specialties, etc.) from another regions and countries. As E.V. Saburova rightly notes, "universities are able to bring popularity to a city, region, and can easily contribute to developing the image of a place, but only if a program of joint marketing development is developed, and if the city and the university exist as a whole and support each other's capabilities" [3, p. 144]. In this regard, it is necessary to talk about the importance of collaboration between university administrations and representatives of regional authorities in developing institutional mechanisms for the formation and transmission (positioning) of territories from the standpoint of the availability of a scientific and educational resource.

Volgograd State Technical University (VSTU) is the largest scientific and educational center in the South of Russia and a leading regional university. VSTU differs from other regional universities in having a wide range of educational services, both technical and humanitarian, and active cooperation with enterprises and organizations of the region. The university is registered in 5 ratings, national and international:

- Times Higher Education (one of 35 Russian universities);
- IC Superjob technical universities of Russia in 2017 (19th place);
- Webometrics Ranking of World Universities (52th place);
- National ranking of universities (66th-67th place);
- ratings of the analytical center "Expert", directions "computer science" (28-30 place), "engineering science" (45 place), "economy" (19-21 place), "inventive activity" (46-49 place).

The main characteristics of the activity of VSTU (data as of 01/01/2018)

Educational activity	
The total number of students enrolled in undergraduate, specialist, graduate programs	19912 people
including: full-time education part-time (evening) form of education correspondence courses	 7753 people 879 people 8815 people
The total number of international students enrolled in undergraduate, graduate and postgraduate programs	714 people
Number of educational centres	68
Scientific activity	
Articles in Russian magazines	2210
Foreign publications Publications in BD Scopus	639 339
Security documents received from the Russian Federation	257
Staff capacity	
The total Staffing Levels	1132 people
including: Doctors of Science / Professors candidates of sciences / associate professors Academicians Corr. RAS and other state academies	 191 people 698 people 7 people

Source: VSTU, 2017.

VSTU is an important actor in the socio-economic development of the region. The University acts as a communication platform for the implementation of constructive interaction with representatives of business, government, science, education, the public, being the initiator of holding negotiations, meetings, conferences, conventions, symposia, etc. Thus, in 2018, a representative Volgograd delegation headed by the Governor of the Volgograd Region paid a working visit to the province of Mazandaran of the Islamic Republic of Iran. It included representatives of the regional administration, chambers of commerce and industry of Volgograd and Volzhsky, business community, tourist industry, heads of Volgograd universities, among them the rector of VSTU. The trip resulted in the signing of a Memorandum of Cooperation between the Volgograd region and the Iranian province of Mazandaran. The document defines the development of international and foreign

economic relations in the trade and economic, innovation-technological and socio-cultural spheres.

In addition, Volgograd is the center of public diplomacy in Russia. The Center for Public Diplomacy began its work in Volgograd in 2015 with the support of the Minister of Foreign Affairs of Russia and the Governor of the Volgograd Region. At the center of the site is carried out exchange of experience of specialists in various spheres of international projects. Experts in various spheres have opportunity to exchange of experience and realize joint projects. Permanently acting Public Diplomacy Forum "Dialogue on the Volga: peace and understanding in the XXI century." The delegates of foreign countries, representatives of authorities, public and scientific organizations of Volgograd discuss global world agenda, the prospects for cooperation in the economic, social, humanitarian and scientific spheres.

As the scientists of the Faculty of Economics and Management of VSTU rightly point out, "under the conditions of the active development of Volgograd State Technical University and the formation of a supporting regional university on its platform, the mission expands towards increasing the influence of the university's performance on the regional stakeholder environment, education, innovation, social and cultural development of the region ". [4, p. 130]

The University has many channels of communication and information distribution into the external multi stakeholder environment for its positioning and promotion of the region:

- non-residents and foreign students (attracting talented youth; activating the socio-economic life of the territory);
- scientists and representatives of the expert community (development of cooperation ties; formation of innovative potential);
- figures of culture and art (formation of creative space; informational background);
- public figures (social initiatives; significant events);
- representatives of the business community (attracting investment; forming the entrepreneurial climate);
- officials of the region, country and foreign countries (institutional support for transformations), etc.

The scientists of Volgograd State Technical University annually participate in international internships (DAAD, Fulbright, Open World, the National Scholarship Program of the Slovak Republic, etc.) and participate in the implementation of European scientific projects under the Erasmus + line. VSTU has a close partnerships with several international universities, such as Hanoi University of Science and Technology (Vietnam), University of Anbar (Iran), Waseda University (Japan), Matej Bel University (Slovakia), The Catholic University of Eichstätt-Ingolstadt (Germany) and others.

Universities are places with a unique atmosphere and the logic of building internal space, ensuring an effective process of generating and transmitting new ideas and innovations. However, in itself, the presence of universities in the region does not provide any advantages without a scientifically based and systematic strategy of positioning external opportunities for the target audience that regional universities can provide to the territory's stakeholders.

Conclusion

Based on the analysis, a number of conclusions and practical recommendations can be formulated:

- on the basis of international and domestic experience, it seems very promising to use universities as centers of science diplomacy for positioning the region in terms of creativity and openness to the outside world;
- to multiply the number of significant events organized and held on the territory of universities (scientific conferences and workshops, business forums, industrial exhibitions and fairs, socio-cultural and sports events, etc.), which will contribute to the formation of a positive information field and will allow presenting the potential of the university and the region;

- positioning is advisable to build on the principle of "ambassadors of the territory" (place ambassadorship), which will contribute to the formation of a positive image from external stakeholders. "Ambassadors of the territory" can be non-resident and foreign students, representatives of the scientific community, entrepreneurs and businessmen, public organizations and the media who, one way or another, interacted with the territory through universities;
- the positioning of the region must be accompanied by qualitative changes in the structure of the regional economy and infrastructure development. The promoted image of the territory must coincide with its real content. The discrepancy between the expectations of consumers of the territory and reality, can level all efforts of stakeholders to form a loyal attitude to the territory.

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Indonesia–South Korea Science Diplomacy through Marine and Coastal Cooperation

Nicolaus Naibaho*

Budhi Gunadharma Gautama**

Introduction

In 2014, the new Indonesia government under President Joko Widodo proclaimed one of his visions is to make Indonesia as world's epicentre of maritime. In order to implement this vision, he created a Coordinating Ministry of Maritime Affairs (CMMA) and encouraging the Ministry of Marine Affairs and Fisheries (MMAF) to take a role in developing Indonesia's coastal and marine (Kementerian Koordinator Bidang Kemaritiman, 2018). Expanding the network in international relations by cooperating with other countries is one of the steps that been taken, for example is with South Korea. Indonesia and South Korea have long history in cooperation, while the two countries sharing a common vision, values and the will to contribute to the international community as middle powers, both countries are members of G-20 and APEC.

Indonesia and South Korea officially established diplomatic relations on 17 September 1973. Trade between the two countries amounted to more than US$17 billion in 2017, having increased nearly 20 per cent since 2016 and targeted to reach US$30 billion by 2022 (Sheany, 2018). During their last summit in Jakarta, they agreed to upgrade their countries' bilateral relationship to a "special strategic partnership" aimed at accelerating industrialisation in Indonesia, increasing economic and trade ties and people-to-people exchange. That marked by signing several Memorandum of Understandings (MOU), including the cooperation on Immigration, Security, the Fourth Industrial

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Revolution and Maritime. There are three concepts of Science Diplomacy (SD) i.e Diplomacy for science, Science in Diplomacy and Science for Diplomacy (Turekian, Macindoe, Copeland, Davis, Patman, & Pozza, 2014). In particular the SD between Indonesia and South Korea can be categorized as Science for Diplomacy since it implementing a particular international science cooperation activity (e.g., capacity-building, joint research projects, science student fellowships, scientific conferences, faculty exchanges with developing country universities). This article aim is to share the experience of practical SD between Indonesia and South Korea through the Marine and Coastal cooperation. In maritime cooperation, the formal cooperation was initially started by the signing of MOU between Coordinating Ministry of Maritime Affairs as representative the Government of the Republic of Indonesia and the Government of the Republic of Korea on Maritime Cooperation', which is signed in Seoul on the 16th of May, 2016 (Surbakti, 2018).

However, in the term of technical and research cooperation, especially on marine and coastal area, the collaboration has been started back in 2014 where representative of Korean Maritime and Ocean University Consortium (KMOUC) came to Indonesia and met Director of Marine Research Centre (MRC), a research centre under MMAF. In this meeting, both parties talked about possibility of cooperation and came to agreement on cooperation in the field of offshore, marine and fisheries scientific and technical cooperation in the form of research and development project (Ministry of Marine and Fisheries of Indonesia and Korea Maritime and Ocean University Consortium, 2015). Following the first meeting both parties then signing the Letter of Intent declaring that both parties agree to work together in the field of offshore, marine and fisheries scientific and technical cooperation in the form of research and development project. After signing the Letter of Intent, both parties then proceed to discuss about the joint cooperation research by developing Korea – Indonesia Offshore Cooperation Center (KIOCC) (Ministry of Marine and Fisheries of Indonesia and Korea Maritime and Ocean University Consortium, 2015).

Stakeholder Engagement and Institutional Collaborations

In the case of SD relation between South Korea and Indonesia, KMOUC and MRC were appointed as the representative both countries, where both centre has capability and qualification to carry on the project. S&T capacity in this relation must be broadened, deepened, and must be created when it does not existed. However, in doing this project, the MRC needs to coordinate and cooperate with other institutions in Indonesia that work in the field of offshores activities, like Ministry of Energy and Minerals, Ministry of Environment and Forestry, Ministry of Finance and Ministry of Transportation, also some Province and Local Governments. In the relation between Indonesia and South Korea need the injection of more and better expert scientific advice directly on the policy development and decision making with the goal is to create a safe system of bureaucratic process (Copeland, 2016).

Since this project will be related with oil and gas activities, which the duties and functions wherein MRC did not have authority upon the oil platform. Therefore, MRC also need to coordinate with Special Task Force for Upstream Oil and Gas B usiness Activities (SKK Migas) as the one with authority to manage the oil and gas business activities in Indonesia. This institution aim is purposely to exploit the state's oil and gas natural resources that will be able to generate maximum benefits and revenue to the state for the greatest welfare of the people.

Beside SKK Migas, MRC also engaging the other stakeholders like, companies and universities. In order to leverage the S&T cooperation, institutional linkages and public-private partnership between government, corporations, R&D institutions, and universities need to be encouraged. With enhancement on planning and closer coordination, research institution, science academies and intergovernmental science networks could play a larger role to in pursuing the objectives (Copeland, 2016). Named few of them are PT. Pertamina, a state owned company that work on oil and gas, also Institut Teknologi Bandung and Institut Teknologi

Sepuluh November. On the other hand, the South Korea side also involving few companies and government institution, among others:

- Ministry of Ocean and Fisheries
- Korea Maritime and Ocean University
- Korea Research Institute Of ships and Ocean Engineering
- Hyundai Heavy Industry
- KHAN
- Samsung Heavy Industry
- Daewoo Shipbuilding and Marine Engineering
- Haemirae Offshore Farm Co. Ltd.
- Noah Offshore Farm Co. Ltd.

Related to the institutional development of KIOCC, Indonesia and South Korea vision is to create a joint center with the purpose of promoting development and cooperation on offshore science and technology, advancing offshore and marine scientific research and contributing to the protection of marine environment as well as the sustainable use of marine resources. While the objectives of this joint centre are:

To conduct joint research on the decommissioning abandoned oil and gas platform and its re-utilization options for marine and fisheries sectors that can encourage participation of research institutions/industries/universities in both countries;

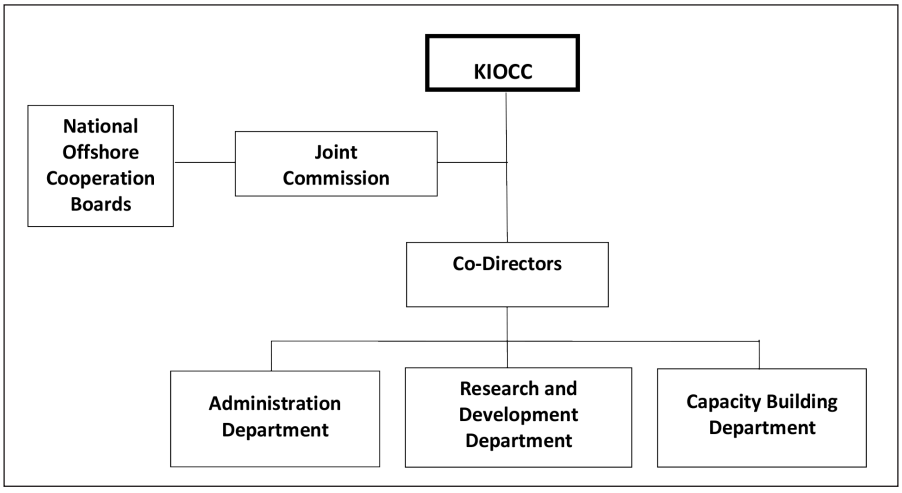
- Collaborative support for offshore plant sector (support participation in demonstration projects, establishment of joint venture, technology cooperation, etc.);
- Build a network between Korean and Indonesian companies (support to hold a forum, workshop about the technology in offshore plant sector, related company introduction etc.).
- To facilitate the research working by the two parties, the the KIOCC organization will be designated into like diagram below.

Marine and Coastal Science Cooperation

Challenges and Opportunities

One of the problems that are faced by Indonesia right now on offshore context is the oil and gas installation. There are about 630 offshore platforms in Indonesia which show active oil & gas development compared with their surrounding counties. Over 70% of the offshore oil and gas platform in Indonesia have finally reach their maximum capacity and no longer operated (Ministry of Marine and Fisheries of Indonesia and Korea Maritime and Ocean University Consortium, 2017). These oil and gas platforms

Figure 1. KIOCC Organizational Structure



are already closed and abandoned, and soon to be decommissioned. This situation shows that Indonesia's oil rig decommissioning market is very huge and unavoidable issue at some point in the future. This condition is very suitable for KIOCC to proposed the research on re-utilisation of abandoned platform as their pilot project

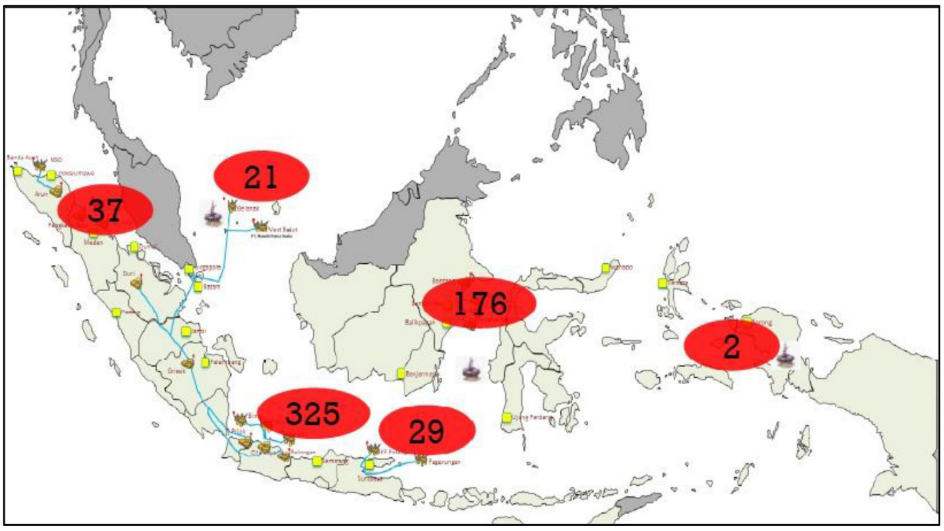
There are several challenges that KIOCC face in starting this project, among other are the institutional authority, as mentioned before that MRC did not have authority upon the oil platform. This means the KIOCC need to be established as soon as possible. The other challenges is that the cost of dismantling offshore oil and gas platforms are very expensive up to million dollars per rig and will be a burden of the state budget (APBN) (Ministry of Marine and Fisheries of Indonesia and Korea Maritime and Ocean University Consortium, 2017). However this situation also create opportunities for KIOCC to implement its project, since there have been no platforms dismantled and removed before in Indonesia since the installation of the first platforms for almost half of century. Therefore, the Dismantlement, Repair and Engineering (DRE) process in Indonesia is an important issue and it will be a benchmark on next DRE project in the future.

Moreover, the dismantling process can be seen an opportunity to obtain greater a profit from the investments by converting the idle platforms to other uses that have economic value or scientific benefits. A new initiative of decommissioning has been proposed and implemented by several countries to not only reducing the dismantling costs but also gain added values from the disused structures. Numbers of alternative re-utilization for marine and fisheries sectors have been proposed for both partial and complete removal of decommissioned offshore oil and gas platforms, such as:

- Rigs-to-Reefs (R2R)
- Offshore aquaculture
- Research and ocean monitoring stations
- Rescue and military base
- Renewable energy hub derived from wind, waves or currents
- Diving or fishing Location or hotel resort

For this initial project, the KMOUC and MRC saw that the R2R alternative is the suitable option to implement. This is because R2R is a successful strategy to undertake the offshore activity in an environmentally effective, efficient and equitable safe manner not only for the operator and regulatory but for the physical and biological surroundings. In addition, the R2R creates new habitat as well as restore the damage habitat of coral.

Figure 2. Offshore Platforms Mapping in Indonesia



Rig to Reef Programme

In order to start the R2R project, the KMOUC and MRC do a feasibility study on seven targeted abandoned platforms located in the ATTAKA and Yakin filed, East Kalimantan that ready to be converted into decommissioning (Ministry of Marine and Fisheries of Indonesia and Korea Maritime and Ocean University Consortium, 2017). These seven platforms are belonging to Chevron Indonesia Company (CICo) that at the end of 2016 has submitted a plan to dismantle both of the platforms (Ministry of Marine and Fisheries of Indonesia and Korea Maritime and Ocean University Consortium, 2017). The objective of this feasibility study is to outline options of decommissioning to effectively dismantle or re-use abandoned platforms in Indonesia. There are some options to reutilize the platforms in Indonesia considering the needs of marine and fisheries. Options to be selected will take into consideration likely environmental impact, the safety of personnel and other users of the sea, economics and financial implications. Other thing to be considered is the regional fisheries and economic development (Ministry of Marine and Fisheries of Indonesia and Korea Maritime and Ocean University Consortium, 2017). Moreover, the feasibility study require consideration of a number of factors including regulatory requirements, technical feasibility, health, safety, socio-economic, environmental impacts, economics and strategies implemented by oil and gas Operators (Ministry of Marine and Fisheries of Indonesia and Korea Maritime and Ocean University Consortium, 2017). The feasibility study will use as a guideline on decommissioning and re-utilization over 600 platforms installed in Indonesia by reducing the cost of dismantling (Ministry of Marine and Fisheries of Indonesia and Korea Maritime and Ocean University Consortium, 2017).

Capacity Building

Beside the R2R project, the KIOCC project component that will be implement is the capacity building. The fastest way to build capacity is through program of training and professional training and exchanges. This is because Indonesia is facing problem of decommissioning in the near future. None of the oil and gas operators in Indonesia has experiences in Decommissioning process, more over in R2R. This means that there is currently limited structural sharing (technical, budget, technology), which hinders learning from decommissioning experiences. The building of Indonesian expertise in the field decommissioning and R2R process is a main goal of Offshore Research Partnership.

The development of this partnership provides a unique opportunity to educate and train a critical mass of oceanographers, engineers and system operators that will further develop, operate and maintain R2R project in Indonesia on the long term. Experience sharing among the stakeholders, both local and international best practice in decommissioning and R2R to shape the Indonesian master plan The building of a national capacity through student exchanges (conducting to the PhD and master diplomas), allowing the Indonesian experts to continue developing, planning and operating the decommissioning and R2R process after the end of the partnership.

Conclusion and Perspectives

The bilateral cooperation between Indonesia and South Korea in the Marine and Coastal is one of application of successful SD that can be used as lesson learned to other development country. SD is a win-win solution as the first step in this SD the two countries respective is focusing on the technology to support Dismantle, Re-utilization and Engineering of an Abandoned Oil and Gas Platform in Indonesia. This SD involved public-private partnership between government, corporations, R&D institutions and universities. To improve the science and diplomacy and international S&T would require benchmarking, monitoring and evaluation. After having process of benchmarking, monitoring and evaluation this SD cooperation could be broadened in other areas related to the Marine and Coastal development.

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Role of Scientific Community in International Discussions: The Case of World Drug Problem

Eduardo Betancourt Key*

Introduction

There is evidence that the use of psychoactive substances between humans comes from ancient times making it almost a natural behavior for humans to look for substances that make them feel physically or mentally better when they face particular situations in their daily life.

In those times, the most common psychoactive substances came from the poppy, cannabis and coca plants cultivated in Asia the first two and in the American continent the third one and they were mostly used for medical purposes the first one and for religious rites the rest of them. Unfortunately, with the years their usage had a deviation to a recreational use that extended rapidly through legal and illegal channels and made an enormous profitable market that benefited not only to merchants but also to governments itself until it became a huge health problem, specially in China, where, by the XVIII century, the recreative use of opium had become part of the culture and economically beneficial to a wide range of the Chinese society while general population was involved in an endless cycle of addiction called the opium chinese epidemic which also led to some armed conflicts (UNODC, 2008).

But it not only affected China, countries like India and many others east and south east asian countries were affected by the illegal cultivation, production and trafficking in opium.

That conjuncture, specially in China, made it necessary for the international community to pose an international agreement about how to address this problem that could have become a general

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worldwide issue affecting negatively to the whole humanity.

World Drug Problem at International Fora

At the beginning of the XX century, many countries affected by the illicit trade of opium had agreed bilateral or limited multilateral agreements to address their particular issues on the subject but it was in February of 1909 when took place the first international conference about drugs, the Opium Commission, in Shanghai after years of discussions and demonstration of pressure from the society, specially from international religious groups, against the illicit opium trade; the involvement of the United States of America after taking control of the Philippines as a colony from the Spanish kingdom (1898) including its high levels of opium consumption and the possibility to export that type of use of the substance to the American territory, and also to the old British government's concern about its links with the greatest opium cultivation country at the moment, colonial India (UNODC, 2008).

The International Opium Commission of Shanghai laid the groundwork for the first international drug control treaty, the International Opium Convention of The Hague in 1912 which stayed inalterable until 1925 when it was upgraded to include cannabis in its scope.

There were other changes and inclusions of the international instruments related to drugs over the next years but it was in 1961 when the international community adopted, in the framework of the United Nations Organisation, the "Single Convention on Narcotics Drugs", which merged the existing drug control agreements and listed some substances to be under international control since then.

Ten years later, the United Nations also adopted the "Convention on Psychotropic Substances" as a response to the increased use of these drugs in several countries and in 1988 the "United Nations Convention against Illicit Traffic in Narcotic Drugs and Psychotropic Substances" was adopted to attend the security threats posed by drug trafficking in many countries (UNODC, 2008).

The framework of the current international drug control regime was completed with the adoption of these three above mentioned treaties, totally based in the scientific evidence available at that moment respecting to the harmful effects of these drugs on people's health (UNODC, 2008).

It is also important to say that the relevance of addressing the world drug problem have reach such a high level that almost in every international political agreement organisation or integration initiative there is an instance referring to this subject. For instance, in Latin America, a region affected mainly by the production and traffic of cocaine, countries like Venezuela are covered at different levels by instances from the global system, represented by the United Nations Drug Control System mentioned before, to a regional level, represented by the Interamerican Drug Abuse Control Commission of the Organisation of American States; the South American Council on the World Drug Problem of the Union of South American Nations; as well as other spaces in the Mercosur and CELAC infrastructures.

Scientific Evidence-based Approach in Addressing the World Drug Problem

It was in 1893, that the British government formed a Royal Commission on Opium to inquire whether the cultivation of poppy plants should be prohibited in british India or not, being this initiative one of the first ones where an advanced scientific study was held to contribute to the understanding and assessment of the world drug problem and the search or evaluation of their possible solutions (UNODC, 2008). Although the results of this Commission could be considerated as disgraceful nowadays, to say the less, because it gave a bigger priority to avoid the big economical cost that could have meant, for both the british crown and the indian society, the prohibition of the cultivation of poppy plants in India and for denying the moral and physical degradation experienced by its population as a consequence of

this practice instead of to the search of a solution to the health problem of the affected population (UNODC, 2008).

However, as time went forward, the illicit cultivation of opium poppy decreased considerably in India while it increased in Afghanistan to the point that currently that last mentioned country concentrates almost 90% of the global cultivation of opium poppy while India moved out of that record and became one of the principal producers of synthetic drugs, which demonstrate that countries are facing a very dynamic, challenging and evolving phenomenon that must be tackle with wide, specific and specialized information for a better and effective understanding of it.

That is why it would be impossible to address this problem without the essential and invaluable inputs that scientifics and specialized professionals bring to the international community in this regard.

For instance, in accordance to the 1961 convention, the International Narcotics Control Board was established as a monitoring body with the mandate of following the implementation of the international drug control conventions and it is mandatory that at least 23% of its members come from the international scientific community through their respective nomination by the World Health Organisation taking in mind their expertise in medical, pharmacological or pharmaceutical sectors (UN, 1961). Also, the World Health Organisation has a principal role on the scheduling process of substances as it is the first instance, as same as States, that could have the initiative to propone the amendment of any of the list, being this the movement of a substance from one list to the other or the inclusion of a new one in any of the lists, based on the scientific evidence provided by its scientific experts about the harmful effects of the substance under examination in respect to human health. Regarding to the substances scheduling under the 1988 Convention, the principal role is assumed by the International Narcotics Control Board, which also makes an exhaustive scientific research about the risks of a potential or current illicit use of a substance in the process of manufacturing narcotics and psychotropic substances as well as many other useful reports.

Without any of both specialized opinions provided by the World Health Organisation or the International Narcotics Control Board, depending of the case, there is no possibility that a substance could be subjected to the international drug control system, demonstrating also that scientifics' opinions are highly valuable between politics and negotiators when discussing about the world drug problem.

The above could be considered as a good example of how science diplomacy works on finding consensus between scientifics and diplomats, as long as both of them recognize the results and positive skills of the other and use them on their way to achieve a unique and common goal, which in this case is to promote the health and welfare of all humanity.

Another example referred to the effect that the scientific society have had when the international community addresses the world drug problem, understood as a global phenomenon, is the one related to the affectation it has on internal and citizen security.

There have been dramatic cases that stained the conception of the world drug problem as an international security issue that should be addressed mainly by security dedicated entities, like the conflictive situations in Afghanistan and Colombia, the two main countries in illicit cultivation and production of opium and cocaine respectively, where that situation gave a good excuse to particular actors to carry out international interventions that have resulted on the increase of unnecessary violence and deaths in both countries. Fortunately, the insistence of diplomats, negotiators and the scientific community has stopped those pretensions by the moment and had made clear that the world drug problem is a public health issue and that it must be treated in a balanced manner with security ones.

This change on the vision states are looking at the world drug problem has been called "the new approach" in various international discussion at

global and regional levels (OAS, 2013) and have made significant changes around the world, not only because now the abuser of drugs is seen as a sick person rather than an offender, which have made significant changes about the perception of the problem in general society, but also because there have been new experiments around the globe to look for innovative options to reduce the illicit markets of drugs and to reduce the negative effects of their consumption in humans; for example, we see initiatives to legalize the recreational use of cannabis in some states like Uruguay and the Netherlands and some controversial harm reduction measures which have and still require intensive and impartial studies from the scientific society to clear out the effectiveness of those and other non repressive nor violent proposals.

After all the written above, this author considers that it is demonstrated that the scientific community has a determinant role in the framework of the international drug control system with its responsibility (through the work of the specialists of the World Health Organisation as well as the International Narcotics Control Board) to provide precise and grounded reports and information respecting to the proposition of amendments of the lists included in the international drug control conventions but also for their annual reports about the evolution of the world drug problem as well as the one published by the United Nations Office on Drugs and Crime.

Those outputs supply politicians, diplomats and policy makers with invaluable information for their respective work to address this issue and reach consensus in the different scenarios where discussions are held. But its influence is not only limited to the global system.

As it was said before, there are different instances in regional bodies dedicated exclusively to address the consequences of the world drug problem in their respective scope and it is evident how the delegates of the different countries agree on the importance of a scientific evidence based approach when addressing the world drug problem in these scenarios.

For instance, after the negotiations made by technical experts and diplomats to complete the Hemispheric Plan of Action on Drugs 2016-2020, held in the framework of the Interamerican Drug Abuse Control Commission of the Organisation of American States, references about the role of scientific community are mentioned in four of its five parts highlighting the necessity of collaborative relations between scientific community and policy makers and executors, the fostering of the scientific research in this subject, the proper medical attention of abusers as well as the best way to ensure that illicit supply reduction measures do not interfere with medical and scientific use of controlled substances.

Recommendations and Conclusion

The world drug problem has demonstrated to be an evolving and convulsive issue that, after centuries of existence and more than one hundred years of international control seems to remain almost unalterably. It emerged through the production of traditional drugs obtained from natural plants to use them in religious rites to the current emergence of new psychoactive substances that can be manufactured using regular modern technologies in any small apartment in any city of the world, what represent a renewed and urgent challenge to address for governments (UNODC, 2018).

The role of scientific community in this regard have been crucial to aboard the problem in a scientific manner, as a world health issue more than a security one. It can not be denied that it has different aspects than should be attended with specific and distinguish actions and that some of them are related to citizen security and illicit financial flows but looking at the problem with a general view, it is mainly and clearly related to the health aspects of humanity.

This year 2019 is the target date to the implementation of the "Political Declaration and Plan of Action on International Cooperation towards an Integrated and Balanced Strategy to Counter the World Drug Problem", adopted by the Commission on Narcotic Drugs in 2009 which

aimed to eliminate or reduces significantly and measurable some aspects of the problem that today look like inalterable. So, this is a proper date to boost the participation of scientific community not only to assess the achievement but most important to identify the challenges that still remain and look for an intelligent, effective and satisfying response to the global society as a whole.

So it could be said that without the participation of the scientific community in the international discussions about the world drug problem the perception we have about it could be a very different than the one we have now and could have involved more dramatic consequences to society than the ones it has had to the current moment. That is why it is recommended that scientific community keeps having an active participant role in the discussions made in the international arena because of its important inputs to understand, analyze, assess and respond efficiently to this sensible matter.

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A Case of India-South Sudan Cooperation in Education and Science and Technology in South Sudan

Johnson Kol Bol Makol*

Introduction

South Sudan, the newest nation in the world enjoys a very cordial relationship with India and this relationship has a long history. India recognized the formation of South Sudan and extended diplomatic relationship within a short period after formation of South Sudan and upgraded the Consulate in Juba to the Embassy level within eight months. The bi-lateral co-operation is now restricted to few areas but there is scope to expand and diversify it. In this paper I argue that India can play a key role in improving the educational system in South Sudan, particularly in higher education and also help in strengthening the fledging S&T infrastructure. It is pointed out that despite the fact that South Sudan gets external aid and assistance in cash and kind in educational sector, there is enough scope for India to contribute in this sector. This paper thus suggests steps and measures that have to be taken by both countries to facilitate bi-lateral collaboration in education and S&T. This is more an expiatory piece than a strategic plan backed by data and analysis.

Educational System in South Sudan

South Sudan's educational system is being revamped and expanded. Higher education at South Sudan refers to the education offered at post secondary level and this comes under Ministry for Higher Education and Science and Technology (MoHEST). MoHEST was established in 2010. It oversees development of higher education. The educational system suffers from many problems, most of which can be traced to the protracted civil

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war and underdevelopment of South Sudan. Nevertheless, with active support from aid agencies, civil society, foreign governments efforts are being made to enhance literacy, enrol more girl children in the education system, build capacity at all levels and expand considerably the secondary and tertiary education. Even if financial resources are available the question is where are the teachers and trainers and institutions that will develop human resources in education and work consistently over long term in making education system responsive to the needs and aspirations of the society. The data available indicates the daunting tasks. The enrolment rates are low and the number of institutions in higher education are very limited. Understanding the need for greater involvement of aid agencies and others, the government had formed various bodies to develop, implement and oversee the educational sector.

According to USAID, the enrolment has increased to more than a million but drop out rates are high and only 18% of those who are enrolled continue till class 8th. As South Sudan lags behind in female literacy with only 10% of the females are literate, it has an impact on education of girl children right from primary classes. Only 13% of primary school teachers and 10% of secondary school teachers are women. In terms of qualification, most teachers are educated up to primary and secondary school level and teachers with graduate or higher qualifications are less than 15%. Besides infrastructure problems, the low level of enrolment at primary school level itself poses many challenges. How to reach out to those who want to attend and get educated but have no access when the formal school system is underequipped. When the number of children enrolled and those outside the education system are almost the same, the limitations to formal school system in providing education are obvious. The enrolment has increased from 3,00,000 in 2000 to 1.3 million or so by now. But the number of children in secondary schools is less than a lakh. The statistics regarding university education indicates that despite problems and constraints progress is being made. With demand increasing, the number of private universities have increased.

Perspectives from World Bank

"Basic education outcomes remain low. The adult literacy rate was 27 percent in 2009, below that of other fragile and conflict-affected states when they emerged from conflict (see Table 3.2 and Table 3.3). In 2000, 20 percent of students completed primary school. By 2011, the completion rate had increased to 37 percent (compared to 69 percent for SSA on average). In 2009, 48 percent of primary-aged children were enrolled in school, declining to 42 percent by 2012, and the rate is assumed to have declined further since then due to the conflict. Data on the number of secondary school graduates in South Sudan are limited.

According to the Ministry of Higher Education (MoHE), the gross enrolment ratio in 2015 was 9.3 percent, far below the average for SSA and countries with fragile and conflict-affected situations (FCS) (see Table 3.3). Those who can afford it send their children for secondary school outside the country, typically to Kenya or Uganda. However, there are no data tracking the enrollment or completion rates for this group, nor is there good information regarding the numberof graduates who return to South Sudan or seek employment in the public sector. With regard to higher education, there are five operational state/public universities: the University of Juba (founded in 1977), University of Upper Nile at Malakal (1992), University of Western Bahr el Ghazal at Wau (1990), Rumbek University (2009), and Dr. John Garang University of Science and Technology in Bor (2010). The University of Juba has about 6,000 students in active learning and has graduated about 6,500 students since 2006. According to MoHE data, in 2015 there were 721 professors and lecturers serving in South Sudan's 13 universities (more than half at universities in Juba); all 13 had a library and generators; none had dormitory facilities and one-quarter did not have safe drinking water."

(World Bank 2017 P 42)

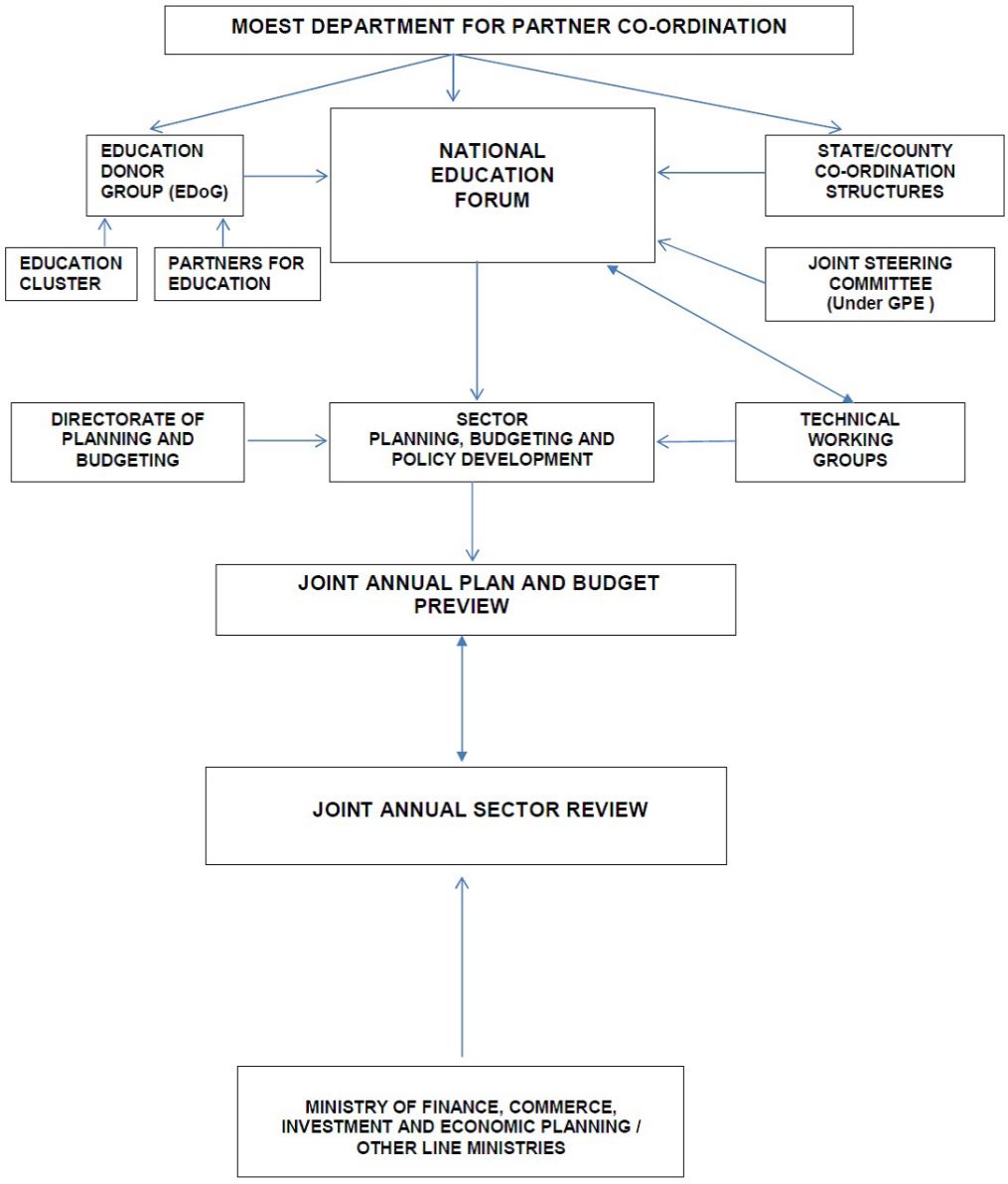
World Bank also points out that even if a quarter of the students enrolled which was 11,419 in 2015 were to graduate the number of new graduates will be less than three thousand. This is too small a number for a country that

needs significant number of graduates and other qualified personnel to rebuild and take the country forward. While the number of Universities is on the increase, concerns about the quality of faculty have been raised. According to **Kuyok**

" Moreover, the system is dominated by unqualified faculty. For example, in terms of academic qualifications, only 86 of all academics held a PhD in 2012. Furthermore, staff profiles, compiled the same year, revealed that only 36 faculty were full professors, while 62 were associate professors, 76 assistant professors, 242 lecturers, and 262 teaching assistants. To run the academic programs, universities recruit part-time tutors. Thus, 31 percent and 60 percent of Juba and Bahr el Ghazal lecturers, respectively, were part-timers in late 2016. The staff situation at the other three universities is equally alarming." Kuyok 2017, 16)

The author points out some positive developments including collaborations with universities abroad and the dedication and commitment shown by faculty in the universities. However these alone will not be sufficient.In the recent years South Sudan has received bi-lateral

DIAGRAM OF EDUCATION SECTOR CO-ORDINATION IN SOUTH SUDAN



Source :Education Sector Coordination Manual, Ministry of Education, Science and Technology P3 (2015)

assistance from many countries and global institutions like World Bank. The bi-lateral aid and aid from NGOs have helped the government to utilize their capabilities in the educational sector. USAID is a major donor and supporter while NGOs have been supporting education for women and girl children. In case of higher education, Realizing the need for effective co-ordination and execution the Government of South Sudan has set up many fora on education as in the diagram below

In the recent years South Sudan has signed Memorandum of Undertaking with Turkey in higher education sector. Similarly South Sudan and Botswana signed a MoU in May 2018 so as to facilitate students from South Sudan to join in universities in Botswana. In fact many students from South Sudan are pursuing education at universities in other countries in Africa but the details are not fully available. A notable initiative to promote engineering education among women an exclusive STEM (Science, Technology, Engineering and Mathematics) center has been started at the University of Juba in November 2017 in partnership with IsraAID and STEM Synergy, and with the support of the Mark Gelfand Family Charitable Trust. Thus slowly but steadily efforts are being made to promote education and to make it accessible. However as pointed out, the challenge is huge and the tasks are daunting.

India-South Sudan Cooperation

While both countries enjoy a stable relationship, economic and commercial relations are limited, given the potential. Fellowships are available for candidates from South Sudan in programs offered under ITEC and by Indian Council for Cultural Relations. There is an urgent need to increase the number of fellowships and also provide fellowships in other programs. While there are many initiatives from India, there is hardly anything on higher education or capacity building in the sector on a long term basis. (MEA 2018) From the above brief it is clear that although 10 fellowships were offered by ICCR only 7 were utilized. On the other hand under the Indian Technical and Economic Cooperation (ITEC) Training Slots, 200 have been allotted for 2018-19. The number should be increased . But more important is to develop a comprehensive plan for bi-lateral co-operation between Sudan and India in education and S&T.

India has rich experience in education sector and has made impressive progress in education and S&T. More important is the fact that it used traditional methods, non traditional methods such as literacy campaigns, and, developed multiple schemes in education to meet the needs of different groups. South Sudan needs multiple schemes that cater to different needs, particularly the needs of girl children and women. Similarly India adopted innovative policies and programs in education to make it more accessible, affordable and relevant. In S&T, it adopted schemes to promote excellence, diversity and inclusion. South Sudan in fact cannot be served by an approach that fails to acknowledge the diversity in needs and the constraints. With its experience in education and S&T India can help South Sudan to develop a comprehensive action plan in education and S&T. India can help in all dimensions in education, ranging from infrastructure development to promoting excellence in higher education. The same is true of S&T in which South Sudan lags behind many countries in Africa.

Conclusion

This brief paper suggests that India and South Sudan should co-operate in education and S&T. It is worth pointing out that this will strengthen bi-lateral ties. It will be an opportunity for both countries to show to the world a country could begin almost afresh in education and S&T and still achieve considerable progress.

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Science Diplomacy for Strengthening the Medicines Regulatory Systems in the Americas: A Regional Experience

Lisette Elda Perez Ojeda*

Introduction

Science diplomacy is the use of scientific collaborations among nations to address the common problems facing 21st century humanity and to build constructive international partnerships (Fedoroff, 2009) this also applies in the field of the health regulations and regulatory science.

Good Health and Well Being is the objective 3 of the Sustainable Development Goals, the aim is to achieve universal health coverage, and provide access to safe and affordable medicines and vaccines for all (United Nation, 2015). Supporting research and development for vaccines is an essential part of this process as well (United Nation, 2015). Regulatory systems play a key role in assuring the quality, safety, and efficacy of medical products. Effective regulatory systems are an essential component of health systems and contribute to desired public health outcomes and innovation. The National Regulatory Authorities (NRA) are the government entities responsible for ensuring the safety, efficacy and quality of medicines and play a vital role in the health care system by providing regulatory oversight of all medical products.

During the last decades, a growing number of networks and initiatives have been developed to strengthen medicines regulatory systems. The region of the Americas, developed an initiative to strengthen health regulatory systems through an evaluation and certification process that allows the appointment of Regional Reference Regulatory Authorities of medicines and biological products (NRAr). The NRAr work jointly, through

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cooperation mechanism, on capacity building in other countries of the region that allow the strengthening of their regulatory systems and act as a group with consensual positions in the different international forums.

Strengthening Regulatory Systems in the Americas

National Regulatory Authorities play a vital role in the health care system by providing regulatory oversight of all medical products such as medicines, vaccines, blood products, traditional or herbal medicines and medical devices. They perform their mandate based on a legal framework and a set of recommended regulatory functions that span the medical product lifecycle including clinical trial oversight, marketing authorization and registration, licensing and inspection of premises, market surveillance and enforcement activities when required.

The Americas is a region of deep asymmetries where inequalities in access in poor and vulnerable populations persist, and there is still fragmentation and segmentation in systems that guarantee access to health technologies. In the particular case of the national regulatory authorities, there are large differences in the structure and autonomy of the regulatory bodies, the financing systems and their regulatory capacity to ensure effective compliance with its functions (Ojeda, 2016).

In the last two decades a group of global and regional initiatives have been developed aimed at strengthening the NRA capacities based on the population right to access to quality medicines according to the science and technology advances. One of these initiatives is the evaluation and certification of Regional Reference Regulatory Authorities process in the Americas,

In 2006 a group of five regulatory authorities from Latin America (Argentina, Brazil, Chile, Cuba and Mexico) met in Oaxaca, Mexico, with the proposal to build a common agenda that would consolidate mutual trust in regulatory matters for the benefit of the economic well-being and public health of the inhabitants of the region(1). As a result arose the proposal of an NRA evaluation process as a regional mechanism of certification of the drugs regulatory authorities focused on evaluating its performance in the fulfillment of its functions and also served as a capacity building mechanism in the regulation of medicinal products field. The evaluation process concludes with the rating of the authority assessed, according to its results, in one of four levels; a Regional Reference Authority is that which reaches the level IV, this describes an authority that is competent and efficient in fulfilling the functions recommended by PAHO/WHO to ensure the efficacy, safety and quality of medicines. The Pan American Health Organization (PAHO) acts as a facilitator of the process, leads the evaluations and gives the certification of Regional Reference Regulatory Authority for medicinal products and biologists to those NRA that reached the level IV.

To date, 8 national regulatory authorities have been recognized by PAHO/WHO as National Regulatory Authorities of Regional Reference: Argentina's National Administration of Drugs, Food and Medical Technology (ANMAT), Brazil's National Health Surveillance Agency (ANVISA), the Center for State Control of Drug and Medical Devices of Cuba (CECMED), the National Institute of Food and Drug Monitory of Colombia (INVIMA), the Federal Commission for Protection against Sanitary Risks of the United Mexican States (COFEPRlS), Canada's Health Canada, US Food and Drug Administration and Chile's Institute of Public Health (PAHO, 2018)

A significant milestone was the discussion of this initiative at the 50th PAHO Directing Council meeting, carried out in September 2010, and the approval of the CD50. R9 resolution: "Strengthening National Regulatory Authorities for Medicines and Biologicals". In this resolution PAHO Member States are urged to: strengthen and evaluate their regulatory capabilities with respect to the functions characteristic of a regulatory and oversight agency for medicines and biologicals, through an examination of the performance of their essential functions; to use the results of the qualification activity and the designation of the regulatory authorities of regional reference

to strengthen their performance in terms of the steering role of the health authority; and support national regulatory authorities so they can benefit from the processes and information from national regulatory authorities of reference. (PAHO, 2010)

The regional reference authorities works as a network, which together with PAHO are committed to to support efforts to strengthen other regulatory agencies, based on its own experience, by promoting exchange and cooperation among countries, and by actively participating in regulatory harmonization efforts within the framework of the Pan American Network for Drug Regulatory Harmonization (PANDRH). In this sense they develop a wide range of cooperation activities for capacity building in other NRA. From 2010 to date, more than 30 courses have been carried out in several countries of the region, also bilateral consultancies and internships in the ARNr (2). They also lead the different regional projects on pharmaceutical regulation approved by PANDRH. (PAHO, 2016)

On the other hand these reference authorities working in build trust among them and share information on their best practices, also exchange technical information in order to achieve mutual recognition of they regulatory decisions to faster the drugs approval processes allowing better access.. Regulatory collaboration, as inter-agency work and data-sharing help strengthen the regulatory capacity of all partners by promoting sustainable exchange of technical knowledge. In these sense is important to highlight the inspection final report exchange, considering the large number of pharmaceutical companies, and the cost of in situ inspections, some bilateral agreements have been established to establish mutual recognition of Good Manufacturing Practices Compliance

Regional Reference Authorities in Multilateral Forums

In the year 2011 the group of ARNr was created, this group carries out two annual meetings, in the first semester of the year review the results of the work of the previous year and define the strategies and working plan for the the new year. (3) ; in the second semester they held a meeting with PAHO to evaluate the progress of their jointly work to strengthen regulatory systems in the region.

Of the regional work done we can highlight

The Regional Working Group on Medical Device Regulation: Established during he "1st Regional Meeting of the Regulatory Authorities for the Strengthening of Regulatory Capacity on Medical Devices in the Americas Region" held in La Habana, Cuba s currently comprised of 16 NRAs; countries join the Working Group voluntarily, with the commitment to advance towards achieving the strengthening the Regulatory Capacity on Medical Devices through Regional exchange of information joint projects and training strategies towards the harmonization of regulatory requirements. This group mislead by CECMED, the cuban NRA (PAHO, 2018b)

Specialist from regional reference authorities are Convocation of experts in NRA acting as PAHO advisory experts of the system for evaluation of national reference regulatory authorities; 26 ARN have already been evaluated.

Center for the State Control of Drugs and Medical Devices (CECMED) and Medical Devices is working with PAHO and the Ministry of Health to strengthen the Nicaraguan national regulatory Authority of Drugs as part of the technology transfer project for the production of biological and inmuno-biological, that takes place between the governments of Russia and Nicaragua. (PAHO,2018a)

The regional reference NRA group is coordinated by one of its members who exercises coordination for a two years period. In these meetings they also review the different international forums and meetings that will take place during the year, the most current topics that are being discussed and the initiatives in which they participate and what are their criteria, concerns and position about it. After a discussion process they try to adopt joint positions that respond to regional interests .

These actions were of particular importance during the international consultation process

on the strengthening of the regulatory systems developed by WHO since October 2014 aimed to reach a Global Benchmarking Tool (GBT) for the evaluation of national regulatory system of medical products. The World Health Organization began assessing regulatory systems in 1997 using a set of indicators designed to evaluate the regulatory programes for vaccines. Since that time, a number of tools and revisions were introduced. In 2014 work began on the development of a unified tool for evaluation medicines and vaccines regulatory programs following a mapping of existing tools in use within and external to WHO. (WHO 2018)

Recently WHO published a new documents (Revision VI) that takes into consideration input received from two international consultations with Member States in 2015, a public consultation in early 2018 and a series of meetings involving experts from regulatory authorities from different parts of the world, in which the work of the Americas region, represented by PAHO, was significant, particularly as a region that already had a tool and an evaluation process with 8 years of experience that has given important achievement.(WHO, 2018) This last document contains a large part of the recommendations and criteria made by the NRAr and incorporate indicators and measures criteria of the evaluation tool used in the process developed in the Americas. This document will be use to evaluate and publicly designate WHO-listed authorities (WLAs) that have been objectively documented to perform at high maturity levels in 2019

Conclusion

2019 is 9 years of the establishment of the process of evaluation and certification of Regional Reference National Regulatory Authorities in the Americas.Throughout these years, the initiative has succeeded in build capacities in the drug regulatory agency in the region strengthening their medicines regulatory systems. The jointly work of the regional reference authorities could be an example of real implementation of science diplomacy, based on the international collaboration in health in order to assure safety, efficacy and quality of medicines. Effective regulatory systems are an essential component of health systems and contribute to desired public health outcomes.

Endnotes

1 The meeting reports and commitment of the meetings between the regulatory authorities are not always public domain, they are working documents between them. For further information are available presentation of Dr Jose Pena Ruz p.e https://www.redeami.net/docs/docs/encuentros/ix_encuentro/7.1-Proceso_evaluacion_OPS-Jose_Pena.pdf

2 Capacity building activities could be found on each National Regulatory web site.

3 Press release and information on Regional Reference NRA anual meeting are available on the RNA websites that have hosted the meetings. (CECMED, ANMAT, COFREPRIS, INVIMA, HEALTH CANADA AND CHILE ISP.

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Iran's Science Diplomacy: A Holistic View

Mostafa Safdari Ranjbar*

Introduction

Nowadays it is widely acknowledged that science, technology, and international affairs affect one another, bearing pervasive mutual influences. It goes without saying that globalization has considerably enhanced and extended the importance of science and technology (S&T) for and in international relations (IR) beyond their traditional domains. National policy-making, for instance, today can no longer afford to ignore S&T developments and activities abroad, especially not those of rival countries. At the same time, S&T issues underpin many concurrent global challenges while scientific collaboration clearly bears upon social capital and trust-building badly needed to nourish civil relations between different and above all adversarial countries or cultures (Flink and Schreiterer, 2010).

The term 'science diplomacy' is a relatively new one and reflects the fusion of two previously distinct elements: science and diplomacy. Science is an evidence-based form of knowledge acquisition. Also, Diplomacy is a non-violent approach to the management of international relations characterized by dialogue, negotiation, and compromise. Science diplomacy, therefore, is the process by which states represent themselves and their interests in the international arena when it comes to areas of knowledge acquired by the scientific method. Science diplomacy is increasingly critical to addressing many of the planet's most urgent challenges such as management of the global commons, faltering public health systems, and the threat of collapsing ecosystems (Turekian et al., 2014).

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Science diplomacy's direct relationship with national interests and objectives distinguishes it from other forms of international scientific co-operation, which are sometimes commercially oriented and often occur without direct state participation. Thus, international science cooperation and science diplomacy are overlapping endeavors: they are related, yet analytically separate. International science cooperation is mainly concerned with the advancement of scientific discovery, while the central purpose of science diplomacy is often to use science to promote a state's foreign policy goals or inter-state interests. In other words, international science cooperation tends to be driven by individuals and groups, whereas science diplomacy, while it may derive from the efforts of individuals, often involves a state-led initiative in the area of scientific collaboration (Turekian et al., 2014).

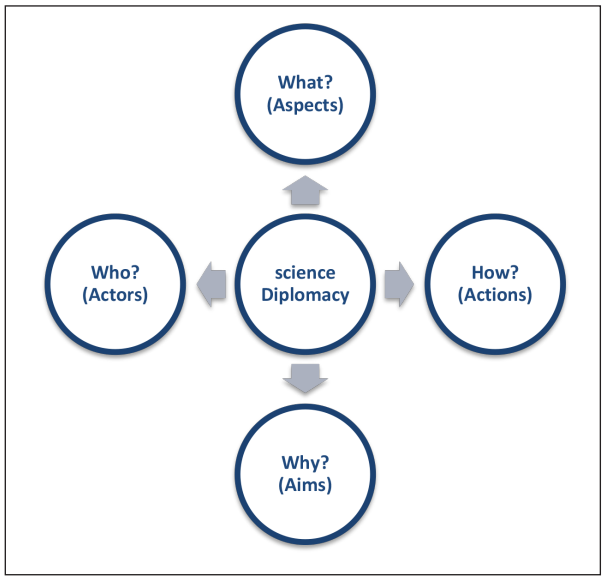
Governments are well aware that S&T cut across national politics and feel confident they can be engaged to tackle and hopefully solve these global problems. However, the degree to which their international S&T policy is guided by one or the other strand of reasoning, by offensive or defensive objectives or by a blend of all these varies considerably. Also, the great variety of approaches, both in goals and means, suggests it is futile to look for a one-size-fits-all model to deal with international S&T and science diplomacy. Instead, different institutional settings and political trajectories, interests and governance modes entail different approaches that are still difficult to clearly tell apart (Flink and Schreiterer, 2010).

Not only there are not plenty of literatures about science diplomacy, but also it is relatively difficult to find some previous work that proposed a holistic view of science diplomacy. Some of them focused on goals and objectives (Nye, 1990; Flink and Schreiterer, 2010), while the others highlighted initiatives and activities (Leach, 2015; Gluckman et al., 2017). Therefore this paper aims at proposing a comprehensive model about science diplomacy that consists of four key components including aspects, aims, actions, and actors through reviewing the current literature and body of knowledge of science diplomacy. These components respectively refer to what, why, how and who questions regarding science diplomacy. After that, this paper intends to shed light on Iran's science diplomacy regarding these four components. The remainder of this paper is organized as follow: in session 2 the proposed model was introduced and explained; in session 3 some evidence and examples about Iran's science diplomacy were presented, and session 4 includes a summary and some concluding remarks.

Literature Review and Conceptual Model

As mentioned before there are two shortcomings in science diplomacy literature. Firstly, since science diplomacy body of knowledge is very thin, there are few previous studies in this area in terms of journal articles and books in comparison to some other areas such as science, technology and innovation policy (STIP). Secondly, most of the existing works focused on some components of science diplomacy like science diplomacy goals and objectives (Nye, 1990; Flink and Schreiterer, 2010) or initiatives and activities(Leach, 2015; Gluckman et al., 2017) and they didn't develop and proposed a comprehensive model. To address above-mentioned shortcomings, this paper aims at proposing a big picture or holistic view of science diplomacy that consists of four components including aspects, aims, actions, and actors through reviewing the current literature and body of knowledge of science diplomacy. The above-mentioned components respectively refer to four question regarding science diplomacy: what, why, how and who?. The proposed model for science diplomacy is displayed in Figure 1. By applying this model not only we can analyze and investigate science diplomacy in individual countries, but also we can do some comparative case studies about different countries experiences. Moreover, through employing this model we will be able to recognize the deficiencies and weaknesses of science diplomacy in different countries and propose some policy, program and initiatives for strengthening one country's science

diplomacy. The components of the model are introduced below.



What (aspects)

Science diplomacy consists of three aspects as follow diplomacy for science, science in diplomacy and science for diplomacy.

Diplomacy for Science

This aspect of science diplomacy seeks to facilitate international scientific cooperation in both top-down strategic priorities for research and bottom-up collaboration between individual scientists and researchers' (The Royal Society, 2010)

Science in Diplomacy

Many of the major challenges facing states are increasingly global in nature and scale, and have science and technology in the fingerprint of their cause or cure. Science in diplomacy describes the role of science and technology in providing advice to inform and support foreign policy objectives. The function of science in diplomacy should be to ensure the effective uptake of high-quality scientific advice by policy makers (National Research Council, 2002). Nowadays it is essential for diplomats and foreign affairs policy makers to know about key trends in some areas such as nuclear energy, new and renewable energies, climate change, ICT revolution, nanotechnology, biotechnology, industry 4.0 and etc.

Science for Diplomacy

Science for diplomacy is the use of science to help build and improve international relations, especially where there may be strain or tension in the official relationship. Science for diplomacy primarily draws on the 'soft power' of science: its attractiveness and influence both as a national asset and as a universal activity that transcends national or partisan interests. Perhaps the real promise of science for diplomacy, however, lies in its ability to develop stronger links between countries in which the political environment is tense and official relationships are strained or limited (Lord and Turekin, 2007).

Why (aims)

We can divide the aims of science diplomacy activities into two levels including national and international level.

National-level

Accessing to researchers, research findings and research facilities, natural resources and capital is one of the national-level aims of science diplomacy. Here, the thrust is to improve national innovation capacity and competitiveness by way of benchmarking international R&D trends and policies; spotting new technologies, scientific discoveries and research potentials; seizing new markets, knowledge and key technologies; and attracting foreign talents and investments. Also, promotion of a country's achievements in R&D is another national-level aim of science diplomacy. As part of a nation's global marketing efforts, SD and collaboration in S&T are geared to attract the world's best students, researchers, and companies. Getting them interested in its R&D may help raise the country's academic capacities, reputation and performance, stir innovations or enhance its innovative capacities, and lay grounds for sustainable international partnerships of mutual benefits (Flink and Schreiterer, 2010).

International-level

Apart from strengthening a nation's knowledge and innovation base, international scientific cooperation comes to be seen as an effective agent to manage conflicts, improve global

understanding, lay grounds for mutual respect and contribute to capacity-building in deprived world regions. All in all, it has become subject to policy initiatives around the world, though its scope and objectives, instruments and intensity differ widely (Flink and Schreiterer, 2010). The ongoing de-nationalization of scientific research (Wagner and Leydesdorff, 2005), economic globalization, and growing international competition on all markets for goods and services keep extending the playing fields of international relations. Science and Technology have gained an important and ever-increasing role in the competitive quarrel for market shares, power, and influence (Skolnikoff, 1993; Wagner, 2002).

The more a nation's prosperity and economic success hinge on its ability to tap into global resources and to attract talent, capital, support and admiration, the better it is advised to look for strategies to use its R&D assets most effectively to secure competitive advantages. At the same time, global phenomena such as climate change, infectious diseases, famines, migration, nuclear non-proliferation or terrorism call for international collaboration in S&T to tackle, or at least to ease, the many multi-faceted problems they raise or entail (Flink and Schreiterer, 2010).

Access-driven initiatives also carry opportunities for value-driven or merely instrumental activities to ease tensions between states, build trust, and manage or prevent conflicts which may or may not be made explicit goals. Furthermore, access is crucial for extremely expensive 'big science' projects that no country can afford to run alone, such as the International Thermonuclear Experimental Reactor or the International Space Station. Often times, even if not always, collaborative projects and programs of such a size are pitched under multilateral international S&T umbrella agreements (ISTA) (Flink and Schreiterer, 2010).

How (actions)

In general, science diplomacy actions are designed to meet some local needs, to address cross-border interests and to solve some global challenges.

Actions designed to directly advance a country's national needs

Science diplomacy can be enlisted to meet a range of national domestic needs, from exercising soft power to serving economic interests to promoting innovation (Gluckman et al., 2017).

- Exercising soft power: The concept of "science for diplomacy" emerged originally to describe the aspiration by larger countries to project their culture and influence beyond their boundaries. More recently, smaller countries have discovered the value of science in asserting themselves on a global stage and increasing their relevance to international policy discussions.
- National security and emergency response: National security needs are dominated by science, on a number of levels. Establishing and maintaining the confidence needed for many arms control treaties depends on scientific verification.
- Economic dimensions: In the twenty-first century, trade and diplomacy are intimately linked and, in many countries, organizationally linked within the same ministries. Correspondingly, trade in advanced technologies and technology-based services is on the rise. Given the global value chain encompassing intellectual property, data, and manufacturing, multiple countries are often involved in developing a single product. In turn, innovative countries seek out one another to achieve synergy toward optimizing such products. At the same time, countries look for advantages regarding the sale and protection of products with a high intellectual component. Thus, recent trade negotiations have been heavily invested in debate and negotiation about intellectual property, copyright, software, and advanced biologics. Scientific input into such negotiations is critical to protect national positions.

Actions designed to address cross-border interests

In addition to engaging in the actions described above, a country can serve its national interests

by using science to address specific bilateral or cross-boundary issues. One obvious case involves the management of ecosystems and resources that span jurisdictional borders. Clearly, matters relating to trans-border shared resources such as gas fields, fish stocks, rivers, and watersheds all have large scientific components, meaning that diplomatic efforts without adequate science can be ill-directed (Gluckman et al., 2017).

Actions primarily designed to meet global needs and challenges

In expanding the scope beyond national interests, one encounters truly global problems such as climate change, ozone depletion, global biodiversity, and marine pollution. On these topics, there is often greater focus on the perceived immediate interest versus longer-term implications that expand beyond traditional political timescales (Gluckman et al., 2017). Some examples of science diplomacy actions at different levels are presented in Table 1.

In addition, several science diplomacy actions are proposed regarding three main aspects of science diplomacy (Diplomacy for Science, Science in Diplomacy and Science for Diplomacy) in table 2.

Who: actors

To be successful in doing SD by any measure, a country has to be very clear about both its overall strategy and who should be in charge to carry it out. Often times, potential partners abroad do not know what is being offered to them and to whom they can turn with questions, project proposals, or grant applications. Regardless of which goals come first, which strategy looks most promising, and up to which department or agency it is to carry them out, 'leadership' becomes crucial in what has become a global war for talents and opportunities. Many of the obvious shortcomings, ambiguities, and inefficiencies in the ways to do science diplomacy can be associated with a lack of leadership, starting at the level of agenda-setting up to the 'machinery of government'. Yet this does not mean that any compelling SD has to start with convening top-ranking committees to elaborate strategic guidelines that then need be pushed down the throats of the executive branch for successful delivery. Rather, the challenge lies in an effective, recurrent and sustainable combination of bottom-up interest aggregation with strategic decision-making (Flink and Schreiterer, 2010). Nowadays plenty of actors including governmental actors (e.g. Ministries of Science and Technology, Ministries

Table 1. Science diplomacy actions in different levels (Gluckman et al., 2017)

	Actions
National needs	• Influence, soft power, and reputation: bilateral relations; projections and development assistance • Security: crisis, emergencies, disasters, and threats • Economic: trade, innovation, standards, and definitions • National needs and capabilities: technical capabilities, access to know-how and development of domestic STI
Common interests across national boundaries	• Trans-boundary and regional issues • Standards and definitions • Shared technical services • Crisis and disaster management • Social licensing for new technologies • Big science
Global interests	• Shared challenges across borders • Ungoverned spaces

of Foreign Affairs, Universities and GRIs) and non-governmental actors (e.g. Think Thanks, Private research institutes, and companies) are active in science and technology diplomacy activities in terms of policy-making, programming and implementing strategies).

Iran's science diplomacy

This session encompasses some information and evidence about Iran's science diplomacy in terms of aspects, aims, actions, and actors.

Aspects and Actions

In this session some actions are presented in terms of diplomacy for science, science for diplomacy and science in diplomacy (Table 3).

Aims

The general aim of Iran's science diplomacy is creating a co-operation between diplomacy and science and technology through the expansion of interactions between governments, institutions and specialists in order to use the diplomacy capacities to develop the country's science, technology and innovation, and mutually to use the country's scientific and technological capacities and capabilities to advance foreign policy goals. Also, Iran's science diplomacy seeks for some International aims including the use of scientific and technological capabilities to advance political goals and use diplomatic capacities to advance scientific and technological goals in order to facilitate and facilitate bilateral or multilateral relations between countries, both to meet the interests of the countries involved and to solve

Table 2. Science diplomacy aspects and actions (Leach, 2015)

Aspects/ Actions	Professional Science Communication	Popularization of Science	Science Communication Policy
Diplomacy for Science	Researchers communicating to establish large-scale, international cooperation in science	Public relations and journalism activities raising awareness of outcomes of large-scale international projects	National attempts to give researchers skills in organizational communication, negotiation, and intellectual property issues
Science in Diplomacy	Initiatives by research bodies to communicate the potential of research to solve policy problems, to open dialogue, and give advice about the regulation of science and technology.	Targeting policy-makers as a key audience for research results and outcomes	National attempts to encourage researchers to communicate with policy makers and embed research in governmental processes
Science for Diplomacy	Researchers communicate with collaborators across national divides and despite restrictions	Popularization encouraging high levels of general scientific literacy, awareness, and dialogue about science and technology	National encouragement and support for international research through communication skills, cultural programs, and language programs to increase capacity for international collaboration as well as facilitate international dialogue about contested science and technology.

Table 3. Some science diplomacy actions in Iran

Aspects	Actions
Diplomacy for science	• To follow up of international cooperation projects for the development of education (inviting foreign professors to teach in the country) and an international cooperation plan for the development of applied research (conducting bilateral or multilateral research) • Membership in international assemblies (e.g. CERN) • To Identify overseas elites and to facilitate their cooperation with Iranian researchers • To Identify internal capabilities and to Introduce these capabilities and opportunities to international scientific assemblies • To facilitate studying abroad for Iranian researchers and students
Science for diplomacy	• To expand the Persian language in international scientific society • International collaborations (human resource exchanges), holding workshops and regional/international conferences, supporting conferences and workshops) • To attract, train and send people to different countries • Networking with other scientific centers, concluding scientific agreements • To attract foreign professors, researchers and students • Training and introduction of science and technology affiliates • Supporting and holding international conferences and workshops (e.g. Inotex, participation in the meeting of ministers of science in non-aligned countries, etc.) • Conducting consultative studies on other countries, providing technology donations to host delegations • To hold and support global, regional and Islamic events • Educational interactions and human resource exchanges • Networking among people
Science in diplomacy	• Networking, membership, and communications with international professional organizations • Conducting study and research activities • To provide human resources empowerment services at the state department • Education (Faculty of International Relations), providing advice on required political issues (Bureau of Political and International Studies of the Ministry of Foreign Affairs) • To educate and to introduce science and technology affiliates, conduct advisory studies on other countries • Bilateral cooperation (design and creation of the High Commission for Technology Cooperation with Russia, China Silk Road Science • To facilitate interaction with China, joint programs with countries such as Indonesia, Singapore, etc.), • To facilitate communication mechanisms among key actors (State, Financial, and ...)

international challenges. Moreover, Iran's science diplomacy aim in national-level is maintaining and enhancing the country's scientific and technological assets while trying to influence decision-making levels of other countries to strengthen the national authority and increase international influence by combining scientific and technological capacities and diplomatic capabilities.

Actors

We can divide Iran's science diplomacy actors into three levels including:

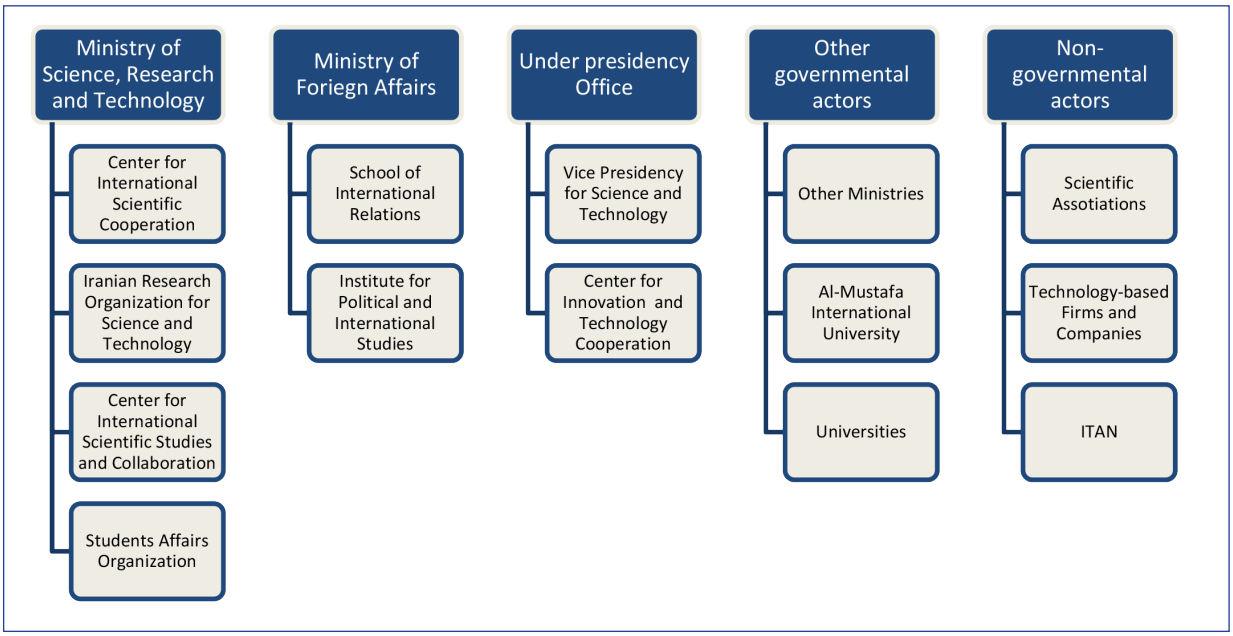
- High-level performers: Vice Presidency for Science & Technology, Ministry of Foreign Affairs, Ministry of Science, Research and Technology.
- Intermediate actors: Center for Innovation and Technology Cooperation, Center for International Scientific Cooperation, Center for International Scientific Studies and Collaboration, Iranian Research Organization for Science and Technology, Institute for Political and International Studies, Students Affairs Organization, universities, other ministries
- Actors at lower levels: Scientific Associations, School of International Relations, Technology-based Firms and Companies and non-state actors.

Different actors of Iran's science diplomacy are introduced in Figure 2.

Summary and Conclusion

Science diplomacy should be a serious part of every nation's tool kit, whether the country is large or small, developing or wealthy. But it cannot be instituted capriciously. Science diplomacy requires a structure that must encompass not only the promotion of international science, as covered by many science agencies, but also explicit attention to issues on the national, regional, and global levels. Technical ministries and foreign ministries thus have compelling reasons to work more closely, and with greater coordination, and to recognize the need for specific expertise for the good of the planet and

Figure 2. Different Actors of Iran's Science Diplomacy



the reduction of transnational conflict (Gluckman et al., 2017). It current paper, in order to enhance our understanding of science diplomacy, a comprehensive model was proposed that consists of four main components including science diplomacy aspects, aims, actions, and actors. After that, this model was employed to shed light on Iran's science diplomacy. Some key findings regarding Iran's science diplomacy are presented below:

- The role of governmental actors in the field of science and technology diplomacy in Iran is a significant role, as many actions are also carried out by these actors. In Iran, non-governmental and academic actors (universities, associations, and think thanks) mainly carry out purely technological and non-political activities, and their potential capacity in the field of science and technology diplomacy has not become the actual capacity. In other words, both scientific and political activities are mostly carried out by governmental actors.
- A large share of science diplomacy actors in Iran is related to the Ministry of Science, Research and Technology (MSRT). Also, the variety of actions taken by the Ministry of Science, Research and Technology in the field of science diplomacy is so high that it covers all three aspects of science diplomacy.
- The Ministry of Foreign Affairs actions are limited to science in diplomacy and merely the empowerment of human resources. Although these dimensions are very important for the nature of Ministry of Foreign Affairs as the main actor in the field of science and technology diplomacy, it has not taken other actions on other issues, except for certain issues (such as nuclear negotiations).
- The Vice Presidency of Science and Technology has been pursuing diplomacy in two aspects of science for diplomacy and science in diplomacy, but it can be said that, these actions should be expanded to a greater degree in diplomacy for science and science in diplomacy.
- It seems that the actions of each group of actors are largely parallel to other actors and there is a lack of inter-organizational mechanisms that help to integrate and coordinate these actions to cover all three dimensions of science diplomacy.
- In the structure of Iran's science and technology diplomacy, there is no specific organization for planning and setting short and long-term targets in this field (similar to the CSTI in Japan). So, various actors, based on their interests, benefits and organizational goals are working on this topic.
- Due to the lack of purpose and division of labor in this area, actors do not know their roles and do not create the required capacities and capabilities to play role in their specific positions. As a result, the scene of science and technology diplomacy, without a coordinator organization, various actors work individually and outputs are not tangible and inclusive. In addition, the resources and mechanisms for funding such activities are not enough and proper.

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Transferring Indian Technology to Sudan for Agricultural Development: A Case of Science Diplomacy

Okasha Eldow Elmahi*

Introduction

Science diplomacy can be defined as the technique of maximization of the benefit of scientific collaboration between the states or nations to solve common problems or to achieve common goals. India is the fastest growing developing country in the last years and the challenges that has been facing this great nation couldn't stop her from reaching this level. Meanwhile so many efforts has been made by the Indian governments since independence, starting by sending their most brilliant scientist to the developed countries to make use of their very good school of diplomacy ,so they can learn the latest technologies in each and every sector , Dr. Ashok Jain was the first Indian scientist attaché in Japan during 1963-65 (Krishna 2001) and he did contribute and been part of transferring Japanese automobile technology (SUZUKI) to India.

The engagement of India with the countries like USA, UK and France also made it easier to bring their best technologies to India and there comes the Indian revolution and this been clear to the world that this country is writing its name again to become a powerful country although it had to deal with sanctions and obstacles from not getting the nuclear technology and the refuse to transfer the technology to India. Thus, by end of nineteenth century, India became a nuclear power, using it both for military and civilian use. India continues to surprise the world again by its space technology; the ISRO (Indian Space Research Organization) launched Mangalyaan or the Mars Orbiter Mission in September 2014.

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Historical Review

Sudan is a country located northeast of Africa, with a population of 40 million and area of 1.860.000 square kilometers. It got its independence from Anglo-Egyptian colonization in 1956. According to the relationship journal of the Sudan-India relationship started very long time ago historically there was relations between India and the Fung (Sinnar) sultanate gold, silver and steel also some other materials shaped that relationship to be a sort of economic relationship between the two nations and it was even in the culture of this sultanate in their poems they use to say:

Hey soldiers of Mohammed Ali don't you know Sinnar has been protected by an Indian swords and arrows (referring to its quality).

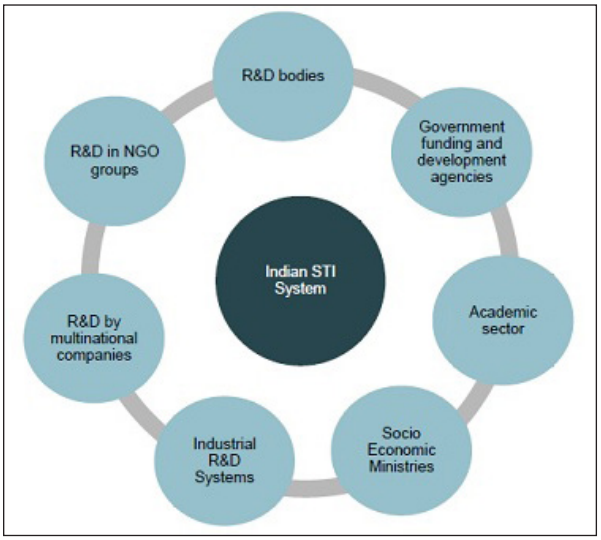
Sudan has imported two steel bridges from India, one located in the capital Khartoum and the other in city of Atbara. Mahatma Gandhi visited Sudan once in 1935 when he was going to England and Jawaharlal Nehru visited Sudan also 1938 on his way to United Kingdom. Sudan and its people would never forget Bandung conference 1955 when the Sudanese delegate the country had no flag on that time, Prime minister of India Jawaharlal Nehru wrote "Sudan" on his handkerchief and this represented Sudan at Bandung. (India Sudan Relations 2016)

STI in India

Science technology and innovation in India to look what performance has been achieved in these fields first we should understand Indian science and technology system earlier of 2000s the policy was to invest in R&D to address the national problems by bringing STI together, on the last five years launching of different initiatives like SWAYAM (Webs of Active-Learning for Young Aspiring Minds), Innovation of Science Pursuit for Inspire Research (INSPIRE), Science, Technology, Innovation and Creation of Knowledge (STICK), all these played a big role in STI policy in India (IBEF 2015-16).

India has increased R&D investments from 76.9 billion USD 2017 to 83.3 billion USD 2018this posts India to be the sixth country in the world. The R&D open up the opportunities in different sectors Pharmaceuticals India targeting to be the 3rd market in the world in manufacturing technologies targeting making 100 million job by 2025 so many international companies targeting India's skilled manpower and scientist (IBEF 2018).

Figure 2.1: Indian ST system



STI in Sudan

Sudan has many opportunities in Human Recourses, Tourism, Fishing, agriculture, minerals recourse and livestock but the main challenge is the US sanctions to Sudan which stopped Sudan from growing as there is no any access to any technologies from outside. Also, the bigger problem of financing these kinds of projects which require huge funds; the sanctions leave no funding resources available to Sudan., This situation has resulted in the problem of brain drain in Sudan, resulting in serious lack of skilled manpower, the lack of new technologies and huge unemployment are another problem that the country is grappling with. Dr. Sara Satti Noor in her paper Science technology and Innovation policy in Sudan reveals the various challenges in R&D in the field of STI, some of them being lack of finance from the public as well as private sectors, low human resource pool mostly because

of the brain drain and lack of proper co-ordination between universities and research centres. She has suggested measures for improving economy of Sudan and emphasized on the need for improving public and private sector finance on research and development in the country.

Science diplomacy is going to play big role and can be the golden key to Sudan and Sudanese people in transfer of scientific knowledges from countries like India, Russia, China and Brazil, where Sudan holds friendly diplomatic relations. India, being the fastest growing economy of the world is of particular interest to Sudan because of the revolutionary work it has been doing in the field of science and technology. Indian products are recognized around the world for their competitive quality and reasonable prices. The country is also playing a big role in transferring and sharing its technology with other countries of the south, giving new meaning to the diplomatic relations and south-south cooperation.

Science Diplomacy to improve agriculture in Sudan

The agriculture and livestock sectors in Sudan contribute 30-35% to Sudan's GDP and also about 80% of non-oil exports. 24 million of Sudan's total population of 40 million depends on agriculture for their living (World Bank 2016)[1]. Science diplomacy can play a major role in boosting the Sudan economy by transferring suitable agricultural technologies such as hybrid seeds. The table below shows how much percentage of hybrid seeds are used by different crops in India (Nain and Kumar 2012).

Table 3.1 Percentage of hybrid seeds use

Crops	%Hybrid seeds used
Cotton	80
Maize	55
Bajra	80
Sunflower	100

The above table shows the huge need of the seeds as the production is not covering and the real need of the internalization of seed production in order to develop agricultural production and seeds production.

SWOT Analysis

This part contains the SWOT analysis of the agriculture sector of Sudan.

Strengths

- Huge agricultural lands
- Water resources (River Blue Nile, River White Nile, River Nile, River Atbara and huge reservoirs of underground water).

Table 3.2 Annual seeds production and coverage

Crop	Annual Seeds Requirements (MT)	Average Annual Seeds Production (MT)	Estimated coverage of certified seeds %
Sorghum	66,162	15095.64	22.82
Wheat	29,900	13887	46.44
Millet	11,670	1465.62	12.56
Sesame	6,339	2555.9	40.32
Cotton	1,070		100.00
Groundnut	192,120	1823.67	0.95
Sunflower	454		100.00
Maize	688	733.71	100.00
Cowpea	1,020	49.62	4.86
Total	309,423	35611.16	11.51

Source: AFSTA 2011.

Table 3.3 Estimated annual seeds requirements

Crop	(05/2006-09/2010)		(2010-2011)		(2010/2011)	
	Average Area (000Fed)	Annual Seeds Requirements (000MT)	Average Area (000Fed)	Annual Seeds Requirements (000MT)	Estimated Value of the seed in SDG	Estimated Value of the seed in USD
Sorghum	21,323	64	22,054	66	59,545,800	20,966,831
Wheat	690	35	598	30	71,880,000	25,309,859
Millet	8,427	13	7,780	12	18,672,000	6,574,648
Sesame	4,178	6	4,226	6	25,915,950	9,125,335
Cotton	333	3	107	1	6,955,000	2,448,944
Groundnut	2,701	108	4,803	192	345,816,000	121,766,197
Sunflower	310	1	227	0	11,350,000	3,996,479
Maize	133	1	86	1	1,238,400	436,056
Cowpea	43	1	85	1	3,060,000	1,077,465
Total	38,138	231	39,966	309	544,433,150	191,701,813

- Livestock resources approximately (140 million).
- Human Resource
- Political willingness for sustainable development
- Unique location of Sudan

Weaknesses

- Poor technology use (low percentages used of hybrid seeds, poor agro-mechanism, poor processing and poor storing methods)
- Low livestock production.
- Lack of quality and safety control measures
- Minimal R&D funds and a smaller number of agricultural scientists due to Brain drain
- Poor Cooperation among different stakeholders.
- Lack of industrial technology to meet the need of agricultural equipment.

Opportunities

- General willingness and awareness among the public about importance of agriculture sector for Sudan's economy.
- Rapid growth in producing Gold, Oil and other resources to finance infrastructure and industrial sector.
- Water harvesting proving to be successful.
- Potential for the utilisation of huge water
- Possibility of Sudan being a major exporter of agricultural products to Africa and the Arab region.

Threats

- Low skilled manpower
- Lack of capacity building projects and the poor technical institution facilities.
- High risk of plants and animal diseases.
- Limited markets for Sudanese products
- High migration from neighbouring countries, like Egypt and Ethiopia into
- Sanctions of technology transfer from US and EU
- High cost of importing fertilisers and agricultural equipment.
- Low cooperation with partner countries regarding technology transfer to Sudan

The above SWOT analysis shows the huge opportunities in Sudan where Indian public and private sector can play a big role. The Sudan India bilateral corporation can result into a win-win situation for both countries.

Possible Technologies to Transfer

- There are so many possible technologies which it can be transferred to Sudan from India
- Transferring farming equipment and machinery.
- Transferring technology of processing organic food in order to maintain Sudanese exports.
- Transferring of livestock reprocessing technology (Sudan has approximately 110 million.
- Transfer Solar energy for agriculture and green technology.
- Transferring forest development in order to face dissertation.
- Transferring fisheries in order to maximize the user of Sudan resources of Rivers and the red sea.
- Transfer India Seeds development.
- Transfer India agro-processing technology and drying technologies
- Transfer India technology of livestock and Animal health services Vaccinations, Disease surveillance and quarantine.
- Harmonization of rules and regulations of lands and also quality control of agriculture and livestock products in Sudan to meet up the international market regulations.

Sudan has so many different sectors to engage with India in order to develop its agricultural sector and Agro-industrial sector.

Conclusion

This paper shown how much India making huge efforts in research and development in Science and technology and also the huge need of Sudan to develop it is agricultural sector which it will going to improve Sudanese Agro-products to inter the world markets. The SWOT analysis of Sudan can open the way to Indian public and private sector to invest in Sudan and the engagement between research centers in Sudan and its counterpart from India can make all this possible and make use of India's previous technology transfer experience either transfer to India or outside India and Sudan has the chance to maximize the benefits of the capacity building programs, scholarship and cultural relations program that offered by Indian government to all developing countries.

This paper also shows how science diplomacy can play a big role in transferring the Indian technology in Agricultural sector which it can be a first step forward to an ultimate Sudan-India collaboration, initiatives and joint R&D could be an excellent start up to fulfill above possible technologies to be transferred in order to develop Sudanese Agricultural sector. and the bilateral relation looking forward to the 9th inter-ministerial committee between the two respective countries that it will be in Khartoum next December.

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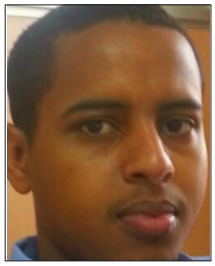
Advancing Food Security in Kenya through International Scientific Cooperation



Abdirahman Omar Ali*

Introduction

According to Food and Agriculture Organization of the United Nations (FAO), Food security exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food which meets their dietary needs and food preferences for an active and healthy life". It is usually framed in four dimensions; food availability, access to food, food use/ utilization and food stability (FAO, 2016a)[1]. Providing sufficient, safe and nutritious food to all people is one of the major global concerns historically and in the twenty-first century.

Kenya has the largest, most diversified economy in East Africa with agriculture being the backbone of the economy and also central to the country's development strategy. More than 75% of Kenyans make some part of their living in agriculture, and the sector accounts for more than a fourth of Kenya's gross domestic product (GDP).

Given the climatic differences among Kenyan regions, while some of them have yield abundant surpluses, the whole productivity in the country is rather low. This is mainly due to semi-arid and arid land which covers most of the country where rainfall is less and less predictable. Irrigated land represents a marginal part of arable land, i.e. in 2013 irrigated agriculture accounted for only 2.4%of the cultivated area according to FAO (2016b)[2]. In addition, innovative inputs are still lagging behind, so that most farmers cannot reap the benefit of modern seeds, adequate fertilizers and other technologies. As a result, the country is prone to frequent food shortages.

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However, agricultural productivity has gradually stagnated in recent years, despite continuous population growth. Moreover, only about 20 percent of Kenyan land is suitable for farming, and in these areas maximum yields have not been achieved, leaving considerable potential for increases in productivity.

In order to overcome these challenges facing the agricultural sector, Kenya is partnering with countries to promote cooperation in the areas of science, research and innovation. In December 13, 2018 Kenya's education ministry and China's top scientific think-tank signed a memorandum of understanding (MOU) in Nairobi. Under the MOU, Ministry of Education, Science and Technology of Kenya and Chinese Academy of Sciences will support a variety of science, technology, innovation and higher education cooperative activities between China and Africa in the areas of ecosystem and environment protection, biodiversity conservation and sustainable development, agriculture, health, the development and demonstration of adaptable technologies via the Sino-Africa Joint Research Center (SAJOREC).In line with this, SAJOREC partnered with Jomo Kenyatta University of Agriculture and Technology and the Chinese Academy of Sciences. These partnerships mainly focus on research on modern agricultural techniques (China-Kenya MOU 2018).USAID is implementing activities that are focused on increasing agricultural productivity and incomes for smallholder farmers; building more resilient communities; improving access to clean water and energy; and increasing access to affordable financing for farmers, entrepreneurs and businesses.

In 2015, USAID supported more than 1.5 million households to embrace new ideas and farming practices as part of the Feed the Future initiativeFeed the Future investments are focused in 27 target counties, and in four main value chains including dairy, livestock, horticulture, and staple foods such as maize, millet and sorghum. Feed the Future activities also link producers to markets, improve input supply, increase access to financial and business development services; promote innovative, private sector solutions; and facilitate more efficient business practices and farmer-friendly policies that contribute to a growing national economy.

Through this scientific cooperation with countries and international organizations, the country is doing tremendous work to change the current status of food production through introduction of science and technology in the field of agriculture to boost sustainable production to end hunger for the poor and also increase the rate of food export.

Input Policy Issues

In June 2008, the government launched the Kenya Vision 2030 as the new long-term development blueprint for the state. Agriculture as one of the key sectors of Vision 2030 and is to deliver a10% annual economic growth rate envisaged under the economic pillar. Agricultural sectorbenefits from anew strategy document, the Agricultural Sector Development Strategy (ASDS), which sets the vision to achieve an average growth rate of 7% per year(ACGE Analysis 2016).

Thisnew strategy has also taken into account regional and international initiatives such as the Comprehensive AfricanAgricultural Development Programme(CAADP) which recognizes agriculture's contribution to accelerated economic growth in African countries and the Millennium Development Goals (MDGs) in which the United Nations member countries pledged to reduce extreme hunger and poverty by 2030. The development of the sector is pursued through strategic objectiveswhich are increasing productivity, commercialization and competitiveness of agricultural commodities and firms, developing and managing key factors of production.ASDS individuated several key constraints and challenges for the agricultural sector, the lack of public resource devoted to the sector by the government being critical. In 2003 under the Maputo Declaration, African Heads of State committed to allocate 10% of annual budgets to the agricultural sector. Kenya has not yet achieved this target. Indeed, thissector was receiving 4.5%of the budget in 2008. This insufficient allocation has reduced human

resources and delivered services by public institutions(Government of Kenya, 2010)[3]. The list of additional constraints remains substantial. Among them, the most important are reduced effectiveness of extension services, low absorption of modern technology and high cost of inputs, limited capital and access to affordable credit, losses due to pests and diseases, low and declining soil fertility.

In order to transform agricultural system intoa dynamic, innovative, responsive and well-coordinated system driven by a common vision and goal, the government of Kenya embarked on developing the National Agricultural Research System Policy (NARS policy) in 2012 to inform the process of establishing an effective and efficient national agricultural research system in crops, livestock, genetic resources and biotechnology. The overall objective of the NARS Policy was to create an enabling environment for a vibrant agricultural research system that contributes effectively to national development. It also aimed at streamliningand enhancing coordination of agricultural research so that the sector can effectively contribute to the goal of attaining 10% annual economic growth envisaged under the economic pillar of Vision 2030 (KALRO Strategic Plan 2017-2021). This led to the formation of Kenya Agricultural and Research Organization (KALRO) with the aim of promoting, streamlining, coordinating research in crops livestock, genetic resources and biotechnology in Kenya through international collaborations. It was also mandated to expedite equitable access to research information, resources and technology and promote the application of research findings and technology in the field of agriculture.

Science and Technology in Food Production

A multitude of approaches and technologies have the potential to contribute to achieving the long-term goal of sustainable food security. In this respect, the government of Kenya has revolutionalised agricultural sector through KALRO with a central mandate of generating technologies, knowledge, information and innovations in crops, livestock and natural resources that are required to enhance productivity and competitiveness of the agricultural sector to meet the local demand for quality food and agro-products for industries and also to take advantage of opportunities in the regional and international markets (KALRO Strategic Plan 2017-2021). Recently, experts from the organization have come up with an integrated soil management technology meant to improve soil productivity in the Mt. Kenya region.

Kenya also has comparatively large number of higher education agencies involved in agricultural research. For example, The University of Nairobi's Faculty of Agriculture and Faculty of Veterinary Medicine, Egerton University's Faculty of Agriculture and the Jomo Kenyatta University of Agriculture and Technology (JKUAT) all are undertaking numerous agricultural research projects. Private sectors like Oserian Development Company, Kenya Seeds Company and Del Monte are also undertaking local research programmes to improve productivity. For example Del Monte is undertaking a local project to enhance quality of pineapples.

Numerous success stories have also been drawn from work done under the East African Agricultural Productivity Program (EAAPP) financed by the World Bank and partners. The overarching goal of the EAAPP is to increase agricultural productivity and growth in eastern Africa, focusing on priority commodities such as cassava, rice, wheat and smallholder dairy production. The project is implemented by ASARECA, the Association for Strengthening Agricultural Research in Eastern and Central Africa and supports the objectives set by African countries through the Comprehensive Africa Agriculture Development Programme(CAADP) (The World Bank, IRBD-IDA 2014).

For example, in meeting surging demand for milk, Kenyan government through initiative of the Ministry of Agriculture, Livestock and Fisheries has come up with an advanced new insemination techniques and improved fodder quality that combines protein-rich crop residues

and this technique have tended to increase the quality and productivity of livestock (The World Bank, 2014).

International Scientific Cooperation on Food Security

Acquiring and adapting new technologies to the local agro ecological system, either from abroad or from local sources like universities is a key part of any serious strategy for achieving food security. Selection of technologies appropriate to the conditions within the host food system is crucial in producing high yields.

Therefore, through international cooperation countries have made excellent changes throughout their economies through partnership. Successful adoption and mastery of new technologies by smallholders requires adequate absorptive capacity on their part. Successful technology transfer is not necessarily easy to achieve and entails some cost on the part of the farmer to learn the technology. Still, the returns from successful technology transfer can be very large. For example the crucial goal for AGRF (African Green Revolution Forum) 2018 that was held in Kigali, Rwanda was to secure greater investments for African farmers and agriculture businesses.

Food production as part of Millennium Development Goals (SDG's) key agenda, Kenya and other African countries have signed series of partnership agreements with India to enhance the supply of agricultural machinery, credit advancement to farmers and scientific cooperation.

On building institutional and human resource capacity USAID partnered with the Indian Ministry of Agriculture's premier National Institute of Agricultural Extension Management (MANAGE) to train 1,500 agricultural practitioners (farmers, processors, extension workers, and policymakers) from 11 African and six Asian countries in specialized farming practices to improve food productivity and income. The trained professionals are now applying their new knowledge and techniques in their respective organizations to contribute in their existing agricultural development and food and nutrition security programmes.

In order to achieve and even gain more in the field of agriculture, India and Kenya have signed a Memorandum of Understanding on Cooperation in the agriculture sector and allied sector and Line of Credit for USD100 million for agricultural mechanization. The Prime minister of India, Modiemphasised on the importance of broad-based and noted that, wide-ranging cooperation in agriculture and food security as a shared priority. He also added that, the two sides were collaborating to raise agricultural productivity in Kenya (The Indian Express 2018).

During his recent visit to Kenya in July 2016, the Prime Minister Narendra Modi and Kenyan President Uhuru Kenyatta held delegation level talks and praised the strength of the re-invigorated partnership between the two countries on issues of agricultural mechanization. This cooperation will help Kenya to gain significantly from India's agricultural scientific innovations that have not only made India self-sufficient but also the exporting food country.

Irish Potato Group Limited (IPM) and Kenya Plant Health Inspectorate service (KEPHIS) are working together to share seed technology and develop higher-yield Kenyan potato seed. The Irish Embassy in Kenya have developed an Ireland-Kenya Agri-Food Strategy which was launched on November 8,2017 brings together development cooperation with trade promotion and the development of institutional linkages for the mutual benefit of our two countries. Ireland is keen to develop partnerships between the Irish agri-food sector and Kenya to support sustainable growth of the local food industry, build markets for local produce and support mutual trade between Ireland and Kenya and the broader East African region and continent (Standard Digital 2017).

On August 29, 2016, the Kenya Agricultural and Livestock Research Organization (KALRO) and the International Livestock Research Institute signed a memorandum of agreement that will pave way for deepening their collaboration in agricultural research for development in particular livestock research, capacity development initiatives and staff exchange programmes. ILRI and KALRO

have previously worked in smallholder dairy development and East Coast fever vaccines development among other projects (KALRO-ILRI Agreement 2016).

The Chinese government has affirmed its commitment to help Kenya to develop an efficient irrigation system as well as to improve its grain storage facilities in an effort to tackle the country's increasing food insecurity. According to Chinese Ambassador to Kenya Liu Xianfa, Kenya can significantly realize food security if it modernizes its agricultural system. He says China has made great progress in agricultural modernization and is ready to share its know-how with Kenya by helping them develop modern agriculture, upgrade their anti-disaster facilities and build their capacity.

Food security being one of the four (4) pillars of President Uhuru Kenyatta, the government is doing everything possible to achieve the dream of reducing poverty rate and increase food production before 2022. To realize this, the government has set on a program to import subsidized fertilizers for the small-scale farmers, buy agricultural produce like maize at a better price, abolished duties on all imported agricultural machineries, increase infrastructural development in the rural areas and invested in Agricultural institutions.

Conclusion

In order to advance food security in Kenya, the government needs to invest and support farmers to increase agricultural and livestock productivity through development and application of new technologies gained through international scientific cooperation, educate farmers on the uses of such technologies and production methods and Invest adequately in agricultural institutions for scientific innovation, put into use productive idle lands, help farmers to mitigate the high cost of production that often leads to high food prices, provide subsidized fertilizers to small scale farmers, support policies on sustainable agro-ecological organic farming. Put a system that would replace unnatural chemical application with better, less expensive practices that nourish the soil, raise healthier animals and facilitate use of readily available compost and livestock manure and most importantly fight corruption in the agricultural sector.

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Science Diplomacy and Regional Integration: The Eastern and Southern African Experience

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Introduction

Science diplomacy two highly significant words in simple terms mean the use of science to build bridges among countries and promote scientific cooperation as part of foreign policy. The enhanced application of science, technology and innovation is imperative for growth expansion as they are the key drivers of Socio-economic Development. They are instrumental in the development and competitiveness of regional economies, which leads to wealth creation and the improvement of living standards. It is, therefore, essential that adequate consideration be given to Science Diplomacy for a sustainable and healthy economic development be it at national, regional, continental or international level. Science Diplomacy has to be at the heart of economic agenda and regional integration which stimulates growth in all key economic sectors in this competitive era as we approach the end of this decade.

The global competitiveness calls for a dynamic and competitive economy endowed with innovative human resources equipped with the required tools to produce high quality products for national, regional and world markets in the process enhancing job creation, skills development and entrepreneurship taking on board the youth and women.

At regional level, in particular, in the Eastern and Southern African region, Science Diplomacy is imperative to deepen regional integration and reach consensus on common programmes for achieving the set regional targets and thereby the Sustainable Development Goals. These programmes relate to Science and

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Technology, centres of excellence as well as the ocean economy and fisheries sector. To this end, the different activities/projects, as well as initiatives which are being implemented or which are being envisaged at the Eastern and Southern African region, are being highlighted below for possible technical or financial assistance from India: It is to be noted that a wide array of science and technology projects are currently being implemented in the region such as agriculture, health, pharmaceuticals, climate change, disaster reduction, renewable energy, water, and so on. However, for the sake of this paper, the analysis has been limited to a few areas.

SADC level

The SADC region has been targeting the overall development and application of systems of innovation that drive sustained socio-economic development and rapid achievement of the goals of the SADC Common Agenda. The areas under focus are:

- Strengthening of regional cooperation;
- Development and harmonisation of policies; and
- Intra- and inter-regional cooperation.

The development of research capacity in key areas; to promote technology development, transfer and diffusion; and to support public understanding of science and technology is also of importance.

The implementation of a Protocol on Science, Technology and Innovation bears testimony to the importance given to the sector by the region since one decade ago. The Protocol outlines the framework of cooperation between Member States regarding science and technology within the region. The aim of the Protocol is to promote development and harmonisation of science, technology, and innovation policies, advocating investment in research and development and promoting public awareness of science and technology.

Implementation Framework to Support Climate Change Response

Climate change is an urgent issue facing the SADC region – one where science, technology, and innovation can play an important role in adaptation by people, business, and Industry. The SADC Science, Technology and Innovation Implementation Framework to Support Climate Change Response was adopted by the region's Science Ministers in May 2011. This document describes activities in four areas where Science, Technology and Innovation is crucial to tackling climate change:

- Observation and monitoring;
- Impacts, vulnerability and risks;
- Adaptation; and
- Mitigation.

The Plan also focuses on identifying sectors vulnerable to the impacts of climate change and producing a Vulnerability Atlas, highlighting areas at increased risk of flooding or drought. The adaptation strategy includes developing a portfolio of green technology projects, as well as research into disease-resistant and stress-tolerant crops.

An Implementation Plan is now being worked out. Funding and necessary expertise will be required for the implementation phase. The possibility that India brings in its expertise and possible financial resources can be explored.

Centres of Excellence

Industrialisation is one of the SADC priorities. An Industrialisation Strategy and Roadmap was developed followed by an Action to ensure its sound implementation. Skills development is one of the prerequisites to facilitate the industrialization of the region. However, one of the constraints the industrialisation process of the region is the lack of adequate professionally and technically qualified and experienced personnel as well as the lack of adequate scientific and technological base. One of the strategies to address this constraint is the establishment of Centres of Specialisation and Centres of

Excellence as vehicles for capacity building and knowledge generation for development of human capital to drive socio-economic development and industrialisation in the Region as per Article 4(g) of the Protocol on Science, Technology and Innovation 2008.

There are many institutions that have been designated as Regional Centres of Specialisation by various bodies in the region. However, they have not been sustainable due to lack of funding as they were designated with external funding through projects and lack of a common regional framework for the management and operations of these centres to ensure maximum utilization by the region in its development agenda. To this end, a draft regional framework and guidelines for establishing regional Centres of Specialisation, and Centres of Excellence has been developed. The regional framework is still being finalised.

The Framework and Guidelines highlight the following:

- Objectives of Centres of Specialisation and Centres of Excellence
- Key activities and Services of the Centres
- Key Performance Areas for Centres of Specialisation and Centres of Excellence
- Centres of Excellence selection procedure and selection criteria
- Life Span of the Centres of Excellence and Centres of Specialisation
- funding and financial sustainability of the Centre
- Success Factors of the Centres of Specialisation and Centres of Excellence (Management and Governance, relevance, impact, funding, monitoring and evaluation); Specific consideration (Institutional commitment);

The Framework will also address the linkages between the Centres of Excellence and the industrialization strategy including the development of value chains, and there should be engagement of stakeholders between Industry and education sectors on the SADC Industrialization Strategy.

India, being one of the World Economic Leaders, could be one of the potential International Cooperation Agencies to provide expertise in assisting the revamp of Centres of Excellence and in assisting in their sustainability plan. Areas of critical importance to India for potential investment could be, inter alia, in assisting the SADC Member States in building up capacity in Science, Technology and Innovation to address the shortage of required skills to fill up the gaps for meeting up the goals in the industrialisation process of the region.

Challenges

SADC has, over the years, experienced an increase in its membership, areas of cooperation and in the size of its Programme of Action. This growth has brought with it new challenges to the integration process, given the different levels of development among Member States. SADC Member States also differ substantially in terms of population size, natural resource endowment, annual economic growth rates, *per capita* income, levels of debt burden, infrastructure development and level of industrialisation. Integrating the economies of such a diverse group of states presents new challenges, which SADC has to effectively manage. Unfortunately, the progress in the implementation of Science and Technology projects and programmes have not been smooth. This is a cause for concern. The amount of funds allocated to Research and Development in African countries as compared to Asian countries is very low. The percentage of R&D over GDP as well the Global Innovation Index gives a clear indication that the African countries do not promote Science and Technology sufficiently. At this pace, the growth momentum will not be sustainable.

Country	Research and Development Expenditure (% of GDP) in 2015	Global Innovation Index 2018	
		Score	Rank
Mozambique	0.34	23.06	115th
Malaysia	1.30	43.16	35th
Lesotho	0.05	-	-
Thailand	0.63	44.49	52nd
Egypt	0.72	32.69	102nd

Source: UNESCO Institute for Statistics; Dutta, Lanvin, and Wunsch-Vincent, 2018.

Further, Mauritius with a score of 31.31 ranked 75th for the Global Innovation Index 2018[1] and comes out as the second-best African country after South Africa. Indeed, South Africa is the best ranked African country as 58th with a score of 35.13 just after India (with a figure of 35.18 - ranked 57th). No African countries are found in the first fifty highest ranked countries. With these disappointing figures, the need is felt to accelerate implementation of S&T projects and further promote Science and Technology within the region.

Proposed SADC/India Cooperation

A Memorandum of Understanding between SADC and India was signed in 1997 to provide a framework for promoting technical cooperation in all fields of economic activity. The cooperation graduated from MOU to Forum level in 2006. The Forum agreed on six priority areas of cooperation, namely, aagriculture, small and medium enterprises, health, human resources development, water resources management; and Information, Communications Technology (ICT). The Forum agreed to meet annually at both Ministerial and Officials levels at mutually agreed date and place. Experts from both sides would work out specific project proposals in the above six areas of cooperation. However, since 2006, there have been no formal meetings of the Forum neither at Ministerial level nor at Officials level. Through this SADC India Forum, cooperation in the field of Science, Technology and Innovation could be further enhanced. The support of India, in terms of funding and capacity-building, could be garnered for the promotion of Science and Technology for a healthy and sustainable SADC region.

COMESA

Science and Technology initiatives

A Biopolymer workshop was held in May 2013, in Mauritius, which constituted one of the first steps towards implementing the COMESA Science, Technology and Innovation strategic priority Further, the Centre for Biomedical and Biomaterials Research (CBBR) of the University of Mauritius has been proclaimed COMESA Centre of Excellence in Biomedical Research in 2013. The COMESA Innovation Council has been set up with the aim of providing advice to Member States relating to existing and new knowledge and innovation, as well as best ways of applying this in the Member states. To celebrate the Year of Pan-Africanism and the African Renaissance, COMESA has launched the COMESA Innovation Awards Scheme to recognize and celebrate individuals and institutions of Member States that have used science, technology and innovation to further the regional integration agenda

Development of the Blue/Ocean Economy

Since fish is the only affordable source of dietary animal protein in the region, the COMESA Member countries have thus given overwhelming importance to the sustainable management of fisheries resources and development of sustainable aquaculture.

However, it should also be noted that challenges with fish diseases, high costs of feeds, unavailability of seeds and degradation of aquatic environments and lack of capacity to effectively manage fish stocks continue to affect the growth of aquaculture in the region.

So far there is no policy framework and strategy on Blue/Ocean economy for the Eastern and Southern African region. The COMESA intends to come up with a framework with main focus on areas such as fishing, shipping and maritime transport, coastal tourism, marine energy (fossil and renewable), pharmaceutical and cosmetic industries, genetic resources and general sea-based products and blue carbon trading opportunities.

One of the nine strategic objectives of the COMESA Blueprint - Medium Term Strategic Plan (MTSP)- is "**strengthening the blue economy"**. Under this strategy, COMESA envisions transformation by unlocking investments and the generation of jobs to citizens through rebranding the use of the water bodies to realize the potential for economic advancement and tapping into new areas of economic actions. The thrust of the Blue/

Ocean economy is to place value addition to water bodies as an area of development space and in support of the SDGs specifically SDG 14. The following initiatives are being envisaged:

- Put in place appropriate frameworks for exploration and exploitation of hydro-carbon and mineral resources including management of the EEZs;
- Exploring deep ocean water applications such as for cooling of buildings and generation of renewable energy;
- Establish and/or strengthen marine services such as vessel registration, marine finance, ICT and marine tourism;
- Development of seaport related activities such as extension and strengthening of the port facilities to allow for larger and more vessels including tourist cruise ships, dredging works of the navigation channel and associated land reclamation, develop master plans and undertake studies to consider new opportunities offered by activities related to the ocean economy and address the land use requirements for future port development projects such as making a hub for bunkering, trans-shipment, cruise and a full-fledged marina;
- Ocean knowledge: identify areas for research, science, technology and innovation in Member states. Engage universities and high level research councils to produce knowledge and a critical mass of people knowledgeable in the area of ocean and blue economy;
- Formulation of a policy for maritime security and safety and ocean economy development;
- Development and adherence to COMESA wide applicable environmental safeguards including for climate risks;
- Develop and follow up on Blue economy Strategies and National Plans (related policy frameworks);
- Development of marine spatial planning to make informed and coordinated decisions on sustainable use of marine resources;
- Ensuring effective ocean management and governance for the sustainability of marine resources;
- Development of disaster risk reduction policy; and
- Develop a monitoring protocol for the coastal and ocean region.

India signed an MOU for long-term economic and technical cooperation with the COMESA in February 2003. An Action plan was developed primarily in the area of capacity building including deputation of experts under ITEC to COMESA Secretariat in the areas of industrial development, Drugs and Pharmaceuticals, ICT and energy. The Action Plan also envisages cooperation in trade, SMEs, science & technology and agriculture. Progress has been made in the implementation of the Action Plan. For instance, Indian experts have been deputed to COMESA Secretariat to assist in the development of the COMESA Integrated Energy Planning Strategy.

Within the context of this MOU, COMESA would welcome Indian expertise to foster the development of the ocean economy within the region and assist in the implementation of the initiatives listed above as well as promoting Science and Technology in the region.

Any form of cooperation with India will be a deeper form of Science Diplomacy with Eastern and Southern African Regional Groups. With such forms of cooperation, India would consolidate further its relations with the nations in a wide range of areas. It will build new ties with SADC and COMESA countries on Science related fields.

Conclusion

Science and Technology are now essential tools for the economic uplifting of any country and any region in the world. Countries failing to keep abreast with innovative production techniques and sources of revenue are facing difficulties to meet up challenges of globalization. The Eastern and Southern African region is no exception. In spite of huge contributions by Member States and International Development Partners, on-going negotiations on trade tariffs and barriers, the intra-SADC and intra-COMESA trade still remain low with a stagnate growth rate and weak economic outlook.

The time has come for innovative ideas to bring up new areas for the diversification of the economic base of the countries and use of Science and Technology for value added production. Unfortunately, investment in Science and Technology has been very little in the Eastern and Southern African region. The project ideas are there to promote the centres of excellence, development of Blue/Ocean Economy and Science and Technology at large. However, the region is constrained financially. It calls for assistance from world powers - resource rich - which could offer its technical knowhow and expertise for engaging in science and technology intensive projects. The region would welcome any form of assistance from India in this respect. The more so, as India already has existing forms of cooperation with both SADC and COMESA. With an intensified form of cooperation, India would consolidate further its relations with the nations in a wide range of areas. It will build up new ties with SADC and COMESA countries and further strengthen partnerships in building capacity in climate change, developing the blue/ocean economy and giving a new impetus to the centres of excellence.

Through an appropriate assistance from India, the region would be able to address climate change adaptation and mitigation problems, accelerate the development of the blue/ocean economy thereby ensuring food security and further, with the application of innovative Science Technology tools, shift gradually to renewable sources of energy and at large achieve sustainability in the long run. At this juncture, the technical and financial assistance of India in promoting Science and Technology in the Eastern and Southern African region would be an opportunity to revamp the SADC-India Forum and COMESA MOU through a Science and Technology oriented framework of cooperation.

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Role of Science Diplomacy in Alleviating Impact of Climate Change on Agriculture: Way Forward for Sustainable Agriculture

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Introduction

There is sufficient capacity in the world to produce enough food to feed everyone correctly; nevertheless, in spite of progress made over the last two decades, 870 million people still suffer from hunger. In addition, the world's population is predicted to increase to 9 billion people by 2050. The most effective means of reducing poverty and achieving food security is to make agriculture more productive and sustainable. The Mediterranean region has a completely unique ecosystem, a type of micro-planet that contains a richness and diversity like no other.

Climate change is dramatically affecting agriculture in the Mediterranean region and solutions need to be found to adapt agricultural practices to rising temperatures, drought and soil salinity, and increasing occurrence of extreme events. Mediterranean agriculture is globally less and less able to provide sufficient food for its population; considering the climate change effects, the scarcity of resources, degradation of arable lands, desertification, loss of biodiversity and pollution. In order to achieve the sustainable development goals, the Mediterranean agriculture must change to meet the rising demand, to contribute more effectively to reduce the poverty and malnutrition, and to become ecologically more sustainable. Adaptation to climate change is become a matter of concern of the agricultural sector in Mediterranean region.Sustainable agriculture puts these conditions at the heart of transformational change in

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agriculture by concurrently pursuing increased productivity and resilience for food security while fostering mitigation where possible.Climate-smart agriculture, a concept developed by FAO, is an approach to developing the technical, policy and investment conditions to achieve sustainable agricultural development for food security under climate change.

Strategies to be adopted go beyond sectorial policies and must propose a global and integrated vision on a global scale. The Paris agreement integrates mitigation issues by reducing greenhouse gas emissions and adaptation by strengthening countries capacity to cope with climate impacts and establishes a system of transparency and global balance and recognizes the need for financial support to finance mitigation or adaptation projects.Mobilization and concrete initiatives of national and international civil societysuch as thescientific community andThe NGOs: contribute to the success of this agreement and to the increase in the fight against climate change.

This paper reports howscience diplomacy contributesto mitigate climate change and to alleviate its impact on agriculture.

Common Threats, Common Solutions

Agriculture is the main source of livelihood for 1.3 billion smallholder farmers worldwide (WB, 2008) and is highly vulnerable to climate change (Salingeret al., 2005). Climate change-induced increases in temperatures, rainfall variation and the frequency and intensity of extreme weather events (Marcott et al. 2013; Steffen et al. 2016; NOAA 2017b).

The changing climate is also contributing to resource problems beyond food security, such as water scarcity, pollution and soil degradation. Agriculture must undergo a transformation in order to meet the intertwined challenges of achieving food security, reducing poverty and responding to climate change. Strategies to be adopted go beyond sectorial policies and must propose a global and integrated vision on a global scale. For a transition to sustainable agriculture, national strategies seek to reinforce the pedagogy and support of the various actors in the sector to help them to structure and amplify their approaches in favour of this ecological. At farm level, in order to solve issues caused by conventional agriculture, several agricultural models have been developed at the level of farmers such as reasoned agriculture and organic farming; these models do not always reconcile the economic, social, and environmental objectives that constitute the pillars of sustainable agriculture. Consequently, the durability of these models is compromised.

Figure 1: Levels of decision making that impact the success of transition to sustainable agriculture

A Successful Climate Regime: Synergies between National and International Action

The Paris Agreement integrates mitigation issues by reducing greenhouse gas emissions and adaptation by strengthening countries capacity to cope with climate impacts and establishes a system of transparency and global balance and recognizes the need for financial support to finance mitigation or adaptation projects. It was adopted in 2015 and was ratified by enough countries for it to enter into force less than a year later – a record in international law. This historic agreement set in place a durable and dynamic

framework requiring all Parties to take climate action.

Under the Paris Agreement, countries have agreed:

- A global goal to limit average temperature increase to well below 2°C above pre-industrial levels and pursue efforts to keep warming below 1.5°C
- All countries will make nationally determined contributions to reduce emissions, and review their efforts every five years, to build ambition over time
- Robust transparency and accountability rules will provide confidence in countries' actions and track progress towards targets
- The importance of adaptation and resilience to climate impacts
- Developing countries will receive financial, technological and capacity building support.

No country can control the climate risk it faces on its own. Climate change is more challenging than many other global issues because it is a race against time, delaying action makes lower climate risk levels unattainable. It also requires profound choices that impact broad national interest debates such as development, energy, urbanisation and consumption.

International cooperation plays a relevant role to address common issues and to build bridges between countries.Diplomacy is the art of influence. It attempts to forge agreement but also to move political boundaries, expanding the realm of the politically possible. The practice of climate diplomacy requires three core capabilities, know yourself, know the other and the capacity of influence. Know yourself isthe capability to develop and action a clear national position based on an objective understanding of how climate change influences and impacts core national interests. As in all other areas of policy, the process of forming the national interest is politically contested, may be dominated by unrepresentative and narrow interest groups, and often depends on less than perfect information. Know the other is the capability to gather and analyse intelligence5 on the interests, constraints and capacities of other actors and how they perceive your own actions and positions. Capacity to Influence is the capability to effectively integrate national priorities into political and diplomatic channels. The command of basic tools of diplomacy and the capability to create a clear influencing strategy and to implement it through multiple venues, building alliancs and strategic confidence, and framing and driving debates through private and public messaging.

Climate diplomacy is the interface between national interest debates and international cooperation. Climate diplomacy ensures the accurate assessment of other countries' interests and intentions and finds the space for agreement. The role of climate diplomacy is to deliver the timely construction of the complex international regime, ensure its effective operation, and shape its evolution to address climate change mitigation.

Science Diplomacy and Climate Change Mitigation: Case of Water Management

Agriculture is the main land use, user of water, and key activity for rural population over large areas in the Mediterranean. Water resources are essential to maintain a stable agricultural production, but also essential to supply to growing cities. In this region, it is likely that the stress imposed by climate change to agriculture is by means of reducing water availability (Iglesias et al. 2010a). Adaptation is a key factor that will shape the future severity of climate change impacts on food production (Lobell et al. 2008; Iglesias et al. 2010b).

Collaboration on water resources needs to be established across national borders in order to make progress towards sustainability. Science diplomacy can be a great vehicle to obtain improved water security.

International collaboration is often a stronger, and obviously, a preferable mechanism to sustainably manage scare water resources than conflict (Lundqvist, 2010).Collaborations may be able to find enduring solutions for the benefit of all partners involved. In any case, adaptive

and preferably collaborative action is needed to reduce the likelihood of conflict and increase water security (OECD, 2011).

In 2005, the Contracting Parties to the Barcelona Convention adopted the Mediterranean Strategy for Sustainable Development (MSSD) in view to set-up a dynamic action plan for a better management related to the natural resources. The first priority of action during the process of the Barcelona Euro-Mediterranean Summit was accepted as integrated water resources (IWRM) and demand management as a more equitable and efficient management approach (Burak and Margat, 2016)

Conclusion

Climate change is a global challenge that does not respect national borders. Emissions anywhere affect people everywhere. Therefore, this requires solutions that need to be coordinated at the international level through international cooperation. In order to ensure the transition for sustainable agricultural and cope sustainable development goals, scientific cooperation are needed to build bridges and address concern. Since 2009, climate diplomacy has suffered stagnation. Diplomatic capacity will always be limited and countriesin the Mediterranean region are already making hard choices where to focus their climate diplomacy in order to deliver the most impact. Similarly, while scientists have worked hard to publicize the predictable damage of global warming, policy makers to date have not taken radical decisions to reverse this trend.

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International Cooperation in Science, Technology and Innovation: The Case of India, Argentina and Guatemala

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Introduction

Diplomatic ties between India and Latin America have been fostered. Unlike other regions in the world, India's relation with Latin America 'has been remarkable for its lack of hype and its low profile' (Badri-Maharaj,2017).

As an international society, our most urgent issue is to utilize the scientific and technological innovations in developing countries, in a way that can contribute to their growth and the eradication of those common issues. In this paper, we will concentrate on the international cooperation and partnership between India-Argentina and India-Guatemala. A background will be given in order to have a better understanding on the context. Similarly, several approaches concerning a reciprocal cooperation in the fields of science, technology and innovation will be presented. Finally, conclusions shall be drawn in light of the theoretical elements discussed previously.

Indo-Argentina Cooperation

India and Argentina's relationship comes a long way. This year marks the 70th year anniversary of their international cooperation. Both nations share common values such as democracy, plurality, family and spirituality. Those common values made the relationship stronger throughout the years, and more importantly shape both countries' intention to develop and collaborate together regarding their issues in science and technology. Science technology and

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innovation are important elements that allow nations not only to grow and solve long-term pressing issues, but also have helped nations around the world to share their innovations in order to achieve common goals.

Both countries are members of the G20 Forum, which is a platform that gathers the world's most powerful nations, the last summit took place in Buenos Aires, Argentina in November 2018, and the theme of the Summit was '*Building Consensus for Fair and Sustainable Development*'. [1] The countries that participated in this summit agreed on sharing common goals, both India and Argentina strengthened their relationship thanks to an official trip by the Prime Minister of India, Narendra Modi, which will be followed by another official trip to India from Mauricio Macri, the President of Argentina. This is proof of both countries' commitment to improve their relationship. The agreements that may be reached as a result of the alliance present relevant topics such as satellite development for internet and scientific exploration, climate change, agriculture, fishing, mining and renewable energy.

Common Approaches between India and Argentina in STI

In the case of India and Argentina, their intention to reach some common goals regarding science and technology to solve shared problems with today's scientific innovations and mutual cooperation is praise-worthy. Food and energy security are a few problems that both countries shared and can be solved in a long-term cooperation, by way of sharing of eresources, exchange of scientists and promotion of science education in both the nations teaching the next generations the importance of science to the advancement of the society. The Government of Argentina created, at a National level the *Programme of Robotics and Technology for Education*[2] , a programme of the Federal Council of Science and Technology, with the purpose of implementing robotics at some local schools of different provinces in the country, in order to foster the use of robotics at the classrooms and the tools to achieve a global and a more technology-related education.

Notwithstanding this, Argentina is a big country and only a few schools are not going to be enough to make this improvement work, but it is a first step to help society achieve common goals and also make the civil society be a part of the scientific innovations and more importantly to train future scientists. Both nations' common achievement is the improvement of life for their citizens regarding food and energy security through their partnership

Some local schools from the City of Buenos Aires in Argentina implemented robotics, and science technology to their curriculum for students from the first grades of primary school.

Argentina has been achieving some agricultural developments in through the use of efficient as machinery, advances in molecular biology and genetic engineering, and by generating efficient integration in the global value chains. Both nations are primarily agricultural economies and working together can prove mutually beneficial, resulting in crop development and profitable product distribution. For example, the way the crops are stored through the application of an efficient technological system can prevent the loss of harvest in a big way.

Regarding energy security Argentina has been developing an important project called "Vaca Muerta" with aims at creating 503.000 jobs by 2050 being implemented in the Argentina's Vaca Muerta field which is the world's second-largest shale gas deposit. This project will be the key for the future of Argentina- India energy security mutual development. Additionally, there are also opportunities for India to invest in the vastly present resources of copper and lithium in Argentina, which in turn can lead to mutual development..[3]

Another project Argentina is developing is with the INVAP company which develops advanced technological inventions such as nuclear energy and airspace radars, this company also has a plant in Mumbai. [4] With this kind cooperation in science and technology fields, Argentina is trying

to not only create more jobs and opportunities for Argentinian scientists through the Minister of Science and Technology but also promoting international scientific cooperation of scientists of Argentina with their colleagues abroad in the mutual interests for the development of science exchange information, knowledge and research. This kind of cooperation is implemented by the creation of research projects, events, bi-national centres, and scholarships for foreign scientists. [5] Likewise, this type of cooperation is essential for countries to be able to achieve concrete goals and reduce their citizens problems, working together as an international society and community has proved to be essential in creating good outcomes. These outcomes always come with good results because sharing knowledge of national's scientist, lawyers, researcher's and other professionals enriches the spectrum of knowledge and brings more opportunities to finally improve people lives

Finally, both countries goals are to eradicate poverty and create better water-food-energy systems for them to be available for all the population and also to reduce the effects of climate change. Also, the creation of jobs and opportunity for more people, science and technology developments are going to help both countries achieve these goals and contribute to the environment to reduce and eradicate climate change.

The Case of India and Guatemala

India and Guatemala established diplomatic relations in 1972, after the Minister of State for External Affairs, Shri Anand Sharma, visited Guatemala for the first time. Subsequently, the Embassy of India in Guatemala opened its doors in 2009; likewise, Guatemala inaugurated its diplomatic mission in New Delhi in 2014.[6]

Unlike other partnerships with major Latin American countries such as Argentina, Brazil, Chile and Mexico, the India-Guatemala relations have been less dynamic, although that is changing due to globalization and a keen interest from both parties to foster ties of cooperation with each other.

Bilateral agreements between both countries have been signed in the past. For instance, in 1981, an agreement on Trade and Economic Cooperation is reached and, in 2015, an agreement for visa exemption for diplomatic and official passport holders is signed. Similarly, from 2007 to 2015, several bilateral visits have been paid by diplomats and other public servants with the aim of establishing a more concrete reciprocal cooperation.

It is worth mentioning that there has been a more proactive exchange of cooperation in the past, in the field of trade. Pharmaceutical products, articles of iron & steel, cotton, machinery & mechanical appliances are just a few products that have been imported/exported through a more economic partnership (Op.Cit).

In 2006, a technological center at the School of Engineering at the University of San Carlos of Guatemala was inaugurated, by the Government of India. This center for technology, within a two-year period, trained more than 1,599 public servants and employees of the private sector of Guatemala. Finally, in 2008, the aforementioned center was given to the University of San Carlos of Guatemala, so it would administer it under its own procedures and policies.

In terms of human capital training in India, within the Central American Integration System (SICA), the Government of External of Affaires of India offered to increase the number of scholarships to Guatemala from 100 to 200, through the Technical and Economic Cooperation Program of India (ITEC), which has benefited hundreds of Guatemalans over the years.[7]. Currently, the ITEC program covers several areas of knowledge such as Humanities, Health, Social Sciences and Science, Technology and Innovation. So far, the programme has been very successful and is getting more attention and interest amongst Guatemalans.

Concrete and Reciprocal Collaboration between India and Guatemala in STI

Thus far, the cooperation and partnership between Guatemala and India in the fields of Science, Technology and Innovation, has been active and

it shall gain more momentum in the years to come. It is in the best interest of Guatemala to strengthen the ties of cooperation with India, whereby both countries would benefit from an alliance in order to face common issues and, at the same time, bring more opportunities.

For instance, Barefoot College (based in India) has worked on a bilateral project that is being undertaken with former scholar recipients from Guatemala. This project focuses on energy through solar panels that would provide energy to more than 200 families in rural Guatemala. It is foreseen that the aforementioned project would be put in practice in its totality once the funds are available. It is worth mentioning that Guatemala is working with the private sector to obtain the necessary funds to complete the project. Indeed, this project would not have been undertaken without the mutual cooperation of both countries; hence the importance of the alliance.[8]

Currently, there is not an actual framework agreement on cooperation between both nations and there have been bilateral talks recently, to make this happen[9] True, there has been a mutual cooperation; however, there has to be a more structured agreement that would set the parameters and goals of such cooperation. The reciprocal cooperation, through a framework agreement on cooperation, would cover the following areas of cooperation:

- Exchange of scholars and scientists, from both India and Guatemala, in order to exchange knowledge at universities and other academic institutions.
- The establishment of postgraduate studies in both countries through inter-institutional agreements with universities.
- The establishment of a department of Science Diplomacy at the respective embassies (Guatemala and New Delhi), with the aim of seeking opportunities and mutual cooperation of both countries, which would result in a more dynamic cooperation in the fields Science, Technology and Innovation.

Furthermore, the creation of a Center for Science and Technology and Innovation in Guatemala would be an asset in its efforts to promote Science, Technology and Innovation. Indeed, the National Secretariat for Science and Technology of Guatemala is interested in having an actual Center for Science and Technology and Innovation, given that there is not such center. Likewise, a technological park in Guatemala would open many opportunities for both India and Guatemala, given that it would position Guatemala as the leading country in Central America in the fields of Science, Technology and Innovation. Similarly, India would position itself as a major regional player and its influence in the regional would be very beneficial in its quest of seeking an important place in today's world.

The cooperation to be established between both countries would have to be reciprocal. This is a situation in which both parties can cooperate to strengthen more those ties of cooperation.

Conclusion

Argentina has a lot of potential between the nation resources such as scientists. Projects such as ¨Vaca Muerta¨ and other projects can contribute to reduce Argentina´s current economic crisis can reduce the unemployment numbers, give a major boost to small businesses and also prevent the fall of the Argentinian currency against other countries' currencies.

The partnership Argentina has with India not only allows cooperation, exchange of knowledge of its professionals, but also encourages private companies of both countries to invest in these avenues. This results the investments to grow in both the countries and create bigger opportunities for their people..

Guatemala and India started having a more diplomatic approach through visits of public servants and businesses men. The cooperation had a more economical approach in its beginnings and, currently, it has covered other areas such as education, training of human capital, scholarships, donations and technological-oriented projects, which is a dynamic cooperation.

It is in the best interest of Guatemala to have a more bilateral and reciprocal cooperation with India in the fields of Science, Technology and

Innovation. True, Guatemala does not have as many economical resources as its emerging partner. However, it can prioritize resources and projects through its own budget. Both countries share similar challenges and have opportunities that can be taken. India constitutes a model of a developing nation that is looking at a brighter future for its economy and people. Guatemala can also follow its partner's steps in replicating a similar model. Hence, both parties win momentum and an important position.

Endnotes

1 The Summit G20 2018 was the first time Argentina host the biggest leaders of the world in just one summit.

2 The Federal Council of Science and Technology of the Government of Argentina, created the programme to foster the inclusion of robotics and science and technology at some local schools of different programmes of Argentina, so that these students can benefit from it.

3 Vaca Muerta is one of Argentina biggest projects regarding Science and Technology.

4 INVAP is an Argentina Company based in Bariloche, the South of Argentina and provides design, integration, construction and delivery of equipment, plants and devices. The company operates in North America, Europe, Asia Pacific, Latin America, the Middle East and Africa, and delivers projects for nuclear, aerospace, chemical, medical, petroleum and governmental sectors.

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Current Status of Science Diplomacy in the Republic of Armenia

Meri Martirosyan*

Introduction

Armenia has a long tradition of excellence in science, technology, and education. During the Soviet era, Armenian capabilities were oriented to a significant degree toward supporting the Soviet military-industrial complex. Research activities, particularly in physics, were well financed. Education in science and engineering received strong support. A number of industrial facilities operated throughout the country, providing goods for local consumption and for more distant markets within the Soviet Union. With the disintegration of the Soviet Union, Armenia became isolated from many of its markets, and exports rapidly declined. The budget for research and education plummeted and the technical talent, skilled professionals began to leave Armenia. Although many research and education institutions remained, their capabilities had eroded considerably. Funds to cover costs of experimental work were too little, and the funds that were available were not always directed to activities with high potential to build research capacity and lead to economic development.

Nevertheless, Armenian scientists who remained have persevered and have achieved impressive results despite severe financial limitations. Now more than ever, science and technology (S&T) are critically important to the future of Armenia. For the past decade, the international community has recognized Armenia's technical wherewithal and has provided substantial financial support for its maintenance. The International Science and Technology Center headquartered in Moscow has become the most important external source of funds for research, and the U.S.

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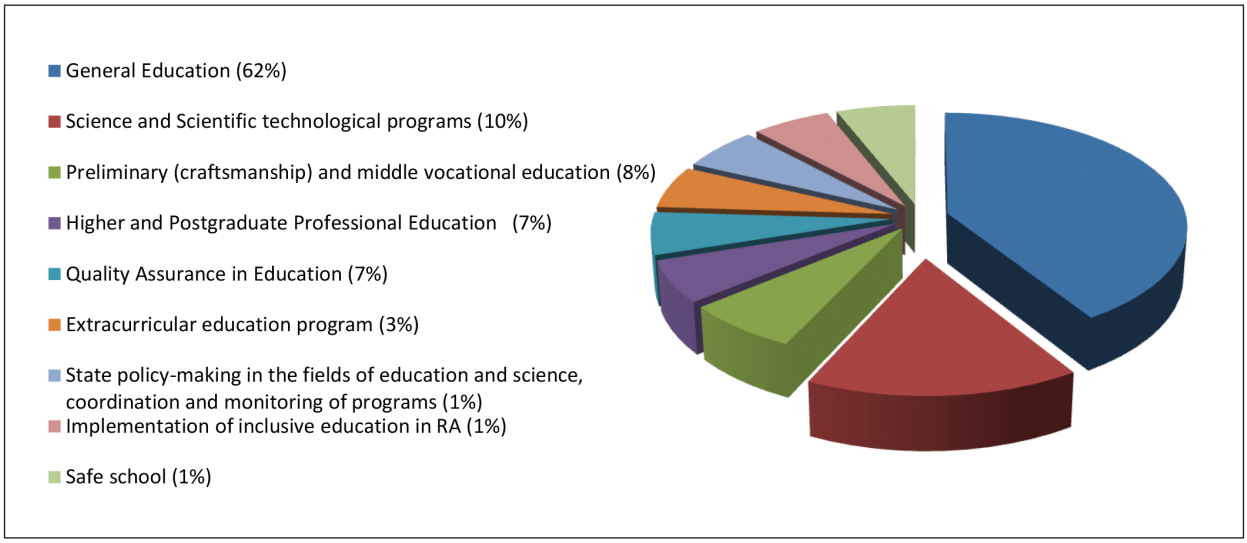
Civilian Research and Development Foundation also plays a significant role in supporting research, both directly and through the National Foundation of Science and Advanced Technologies (NFSAT). Various projects supported by the World Bank, the European Bank for Reconstruction and Development, and bilateral assistance programs of a number of donors also have technology dimensions. Armenian Diaspora also played an important role in financing needy students and families of deceased and invalided soldiers of the Artsakh conflict and supporting Goris-Stepanakert highway construction[1]. There have been a few successes in recent years. Private entrepreneurs in the information technology sector have developed an industry with annual export sales reported at $50 million[2]. Also, on the international scene, the Byurakan Observatory named after the academician Victor Ambartsumian remains an important facility for optical astronomy. Modernization of the agricultural sector is leading to increased exports to countries of the former Soviet Union. Foreign students are paying substantial tuition to study at Armenian universities. Medical services are being offered to patients from nearby states as well as to Armenians. Small specialty companies are beginning to find niches in high-technology markets such as the production of fuel cells and the design and manufacture of circuit board components[3].

Foreign media in their publications often mentioned Armenia as a "Silicon Valley of the former Soviet Union". In 1994 the magazine "New York Times" published a story[4] of four Armenian brothers who, in the waning years of the old Soviet Union, when it first allowed some experimentation with private enterprise, decided to start a computer company with no money and, worse, no computers. Some seven years later, their company, named Aragast B had 100 employees whose accomplishments include writing software for banks in Siberia and selling computerized dictionaries to schools as far away as California.

The development of information technology, science and research remains a strategic priority for Armenian authority. It is anticipated that 8.8% of State budget of Armenia for 2019 will be allocated to education and science. The chart below shows the percentage of draft state budget of Armenia for 2019 allocated to education and science[5]:

Figure 1: Draft State Budget of Armenia for 2019 allocated to education, science and scientific technological programs



In the Republic of Armenia, the leading agency that is responsible for the governance of science, including the drafting of legislation, rules and regulations on the organization and funding of science is Science Committee (SC). The committee was established with the support of the Government of Armenia in 2007 and is operating under the Ministry of Education and Science of the Republic of Armenia. Shortly after the creation of the SC, competitive project financing was introduced to complement basic funding of public research institutions. SC is also the lead agency for the development and implementation of research programs in Armenia. During that period of time the SC elaborated the following key documents "Science and Technology Development Priorities for 2010–2014", "Strategic Action Plan for the Development of Science for 2011–2015" and "Strategy for the Development of Science for 2011–2020", which were adopted by the government of RA in 2010. The country's "Strategy for the Development of Science 2011–2020"[6] envisions that by 2020, Armenia will be a country with a knowledge-based economy and would be competitive within the European Research Area with its level of basic and applied research. It fixes the following targets:

- Creation of a system capable of sustaining the development of science and technology;
- Development of scientific potential, modernization of scientific infrastructure;
- Promotion of basic and applied research;
- Creation of a synergistic system of education, science and innovation; and
- Becoming a prime location for scientific specialization in the European Research Area.

In November 2016 Armenia gained the status of H2020 Associated Country. The agreement associating Armenia to Horizon 2020 was signed by Levon Mkrtchyan, Armenian Minister for Education and Science, and Carlos Moedas, European Commissioner for Research, Science and Innovation in Brussels. The Agreement entered into force from November 2016 after being ratified by the National Assembly of RA. Horizon 2020 is the biggest EU Research and Innovation programme ever with nearly €80 billion of funding available over 7 years (2014-2020)[7]. It is the financial instrument implementing the Innovation Union and it is open to everyone. Horizon 2020 also aims to enhance EU international research cooperation. Within the framework of this agreement Armenian researchers and innovators are allowed to take part in Horizon 2020 Research and Innovation programme under the same conditions as their counterparts from EU member states (before signing of this agreement Armenia participated in Horizon 2020 as a third country).

Besides Horizon 2020, Armenia cooperates with EU within a wide verity of other programs such as Erasmus + (EU exchange student program) aims to support actions in the fields of education, training, youth and sport for the period 2014-2020, including Tempus and Mundus. In order to achieve its objectives Erasmus + Program implements the following 3 Key Actions (KA) and other activities[8]:

- Learning mobility of individuals (KA1)
- Cooperation for innovation and exchange of good practices (KA2)
- Support for policy reform (KA3)
- Jean Monnet Activities
- Actions in the field of sport

Tempus – European Union's programme that supports the modernization of higher education in the EU's surrounding area. It promotes institutional cooperation that involves the European Union and Partner Countries and focuses on the reform and modernization of higher education systems in the Partner Countries.

Erasmus Mundus Joint Master Degrees (EMJMDs)[9] programme is a cooperation and mobility programme in the field of higher education that aims to enhance the quality of European higher education and to promote dialogue and understanding between people and cultures through cooperation between Europe and the rest of the world. EMJMDs supports to:

- higher education institutions that wish to implement joint programmes at postgraduate level or to set-up inter-institutional cooperation

partnerships between universities from Europe and targeted Third-Countries;

- individual students, researchers and university staff who wish to spend a study/research /teaching period in the context of one of the above mentioned joint programmes or cooperation partnerships;
- any organization active in the field of higher education that wishes to develop projects aimed at enhancing the attractiveness, profile, visibility and image of European higher education worldwide.

Over the past decade, the government of the Republic of Armenia has made an effort to encourage science–industry linkages. The Armenian information technology sector has been particularly active: a number of public–private partnerships have been established between companies and universities in order to give students marketable skills and generate innovative ideas at the interface of science and business. Examples are Synopsys Inc. and the Enterprise Incubator Foundation:

Synopsys Inc. multinational specializes in the provision of software and related services to accelerate innovation in chips and electronic systems. In 2004, Synopsys acquired LEDA systems, which had established an Interdepartmental chair on microelectronic circuits and systems with the State Engineering University of Armenia. The Chair, now part of the global Synopsys University Programme, supplies Armenia with more than 60 microchip and electronic design automation specialists each year. Synopsys has since expanded this initiative by opening interdepartmental chairs at Yerevan State University, the Russian–Armenian (Slavonic) University and the European Regional Academy.

Enterprise Incubator Foundation (EIF) was established in 2002 within the framework of the World Bank's "Enterprise Incubator" project[10]. The mission of the company is to support the development of information and communication technology sector in Armenia through creating a productive environment for innovation, technological advancement and company growth[11]. Nowadays EIT has become one of the largest technology business incubators and consulting companies in the region, operating in Yerevan, Armenia. The Company has a big experience in building linkages between business and research communities in key technology markets. Moreover, EIF is conducting startup/team competitions such as Science and Technology Entrepreneurship Program (STEP) and Innovation Marching Grants Competitions[12]. The main objectives of EIF are:

- Developing effective information and communication technology infrastructure to enhance technological advance and transition to knowledge economy.
- Enhancing nationwide access to computers and development of e-society.
- Promoting Armenian enterprises and increasing their competitiveness in the global markets.
- Creating new channels for attracting foreign direct investment to Armenia.
- Building linkages with business and research communities in key technology markets.
- Fostering formation of start-ups and their further development.
- Developing managerial and professional workforce and fostering productivity improvement in Armenian companies.
- Improving access of local firms to best international practices and experience.

In 24 February 2017 Memorandum of Understanding on "Promoting the fields of Information Technologies, Informatisation, Telecommunication and Innovation" was signed between the Government of the Republic of Armenia and the Company "Technology and Science Dynamics" (TSD). According to the document, representative offices of **Armenian Science and Technology Center** Private Public Partnership program (ASTC) initiated in Yerevan, Armenia in 2017 by **Technology and Science Dynamics LLC,** will be established in the target markets through the state-private cooperation which will promote the increase of the investment rating of the country's economy and ICT sector and also ensure high level of awareness of the ICT sector. Taking into consideration the fact

that Armenia nowadays is a leading country in the ICT sector in the region, and it is one of the fastest growing sectors of the economy, this Memorandum will contribute to Armenia's more effective integration at international platforms, as well as well as the promotion of the investments. In order to arrange the activities of the representative offices more efficiently, the Government of RA will provide free office space in the embassies and consulates of Armenia in foreign countries, where possible. Today the first positive results are already obvious. Representative offices have already been established in five countries: the USA, Belgium, France, Italy and Bolivia[13]. According to the Minister of Transport, Communication and Information Technologies of RA, ASTC program is expected to be introduced in 17 countries presenting Armenian IT developments to the world.

The Foundation for Armenian Science and Technology (FAST) launched in 2016. FAST amplifies and empowers scientific advancement and technological innovation in Armenia and beyond. FAST is building an ecosystem of innovation to lead scientists, technologists and innovators in Armenia and beyond to success on the global stage. With a focus on entrepreneurial endeavors, FAST empowers innovators to bring cutting-edge, commercially viable and globally competitive solutions to life. We partner with academic, governmental and non-governmental organizations alongside global players to explore and create what's next. The Co-founder of FAST, Mr. Ruben Vardanyan in one of his interviews said "FAST has to become a platform for bringing about the technological breakthrough in Armenia in the areas of IT and computer science, artificial intelligence, high-tech materials, robotics biotechnology, advanced engineering and manufacturing technologies"[14]. Mr Ruben is a businessman and philanthropist and also the co-founder of the "Initiatives for the Development of Armenia" (IDeA).

Chess Mandatory in Schools

A country of about three million people, Armenia is considered one of the strongest chess nations today. Among countries, Armenia has one of the most chess grandmasters per capita. Armenian authorities say teaching chess in school is about building character, not breeding chess champions[15]. During these years significant work has been accomplished, such as psychological research to assess the effectiveness of teaching chess and the influence of chess as a school subject on the development of children's logic, creative thinking, accountability for their action, intellect and other qualities. Since the academic year 2011-12, chess lessons have been made part of the curriculum in every public school in Armenia, making it the first country in the world to make chess mandatory in schools. Over $1.5 million was spent to implement the program in the country. Today, every primary school in the country has chess as a part of its curriculum for children above the age of six. In the opinion of Armenian GM Smbat Lputian "Bringing chess into schools is the best way to build the future, if we teach children discipline, patience, strategy and focus from a young age, we can create a world where everyone is a grandmaster". The education minister says "We hope that the Armenian teaching model might become among the best in the world"[16]

Giving importance to the return of traditional songs and dances to daily life and making them part of a living culture through preservation, elaboration and popularization, and to the promotion of development of national self-consciousness, in *2014* "National Song and Dance'" subject was introduced for the 5-7 grades in schools in Yerevan and in the provinces. The program aimed at strengthening national values in children from an early age. The ministry of education called the program "Armenian know-how." The subject "Folk songs and dances" is one of the best ways of educating worthy citizens of Armenia.

Conclusion

Science is a priority not only for economic but also for strategic growth of Armenia. At the same time, the Armenian culture has long respected literacy and learning, and looking towards knowledge-based economy is a realistic approach for both the government and international

donors. New projects aimed at developing the means for technological innovation in Armenia and the mobilization of scientific, technological and financial resources of the Armenian and international communities should be encouraged by the Government of the Republic of Armenia. In this regard, the opportunities should be given to Armenian scientists, particularly to younger ones, to undertake basic and applied research, development and discovery, use their scientific and research potential to address critical national issues.

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Global Health Diplomacy: A Strategic Opportunity for Egypt

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Introduction

Science diplomacy is a driver of scientific and technological excellence, a key for tackling global challenges and a powerful tool for improving relations across countries, regions and cultures. It is one of the best sources of soft power & an important instrument in today's increasingly complex world.

Global Health Diplomacy

Global Health Diplomacy (GHD) brings together the disciplines of public health, international affairs, management, law and economics and focuses on negotiations that shape and manage the global policy environment for health. The relationship between health, foreign policy and trade is at the cutting edge of global health diplomacy. (WHO, 2019)

The goals of this unit are:

- To support the development of a more systematic and pro-active approach to identify and understand key current and future changes impacting global public health
- To build capacity among Member States to support the necessary collective action to take advantage of opportunities and mitigate the risks for health

The strategic relevance of health has changed, as health has become an integral part of economic, geopolitical, security, and social justice agendas, including human rights and domestic-foreign policy, among other emerging agendas. Policies in the areas outside of the health sector, such as trade and economic

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development, now need to be complemented by those in the areas of environment and health. There is an increasing recognition of health as a goal of foreign policy and as a key contributor to development, peace, poverty reduction, social justice and human rights. (EMRO, 2019)

Role of Diplomacy in Health

The role of diplomacy in health is vital. An increasing number of health challenges can no longer be resolved at the technical level only – they require political negotiations and solutions, and often need to involve a wide range of actors.

Global health diplomacy focuses on those health issues that need the cooperation of many countries to address issues of common concern, but health diplomacy can also play a central role at the regional, bilateral and national level.

Health diplomacy refers to the negotiation processes that shape and manage the policy environment for health. It is conducted in many venues, some of which are focused on health negotiations during the annual meeting of the World Health Assembly, and some of which have a broader agenda, such as the United Nations General Assembly or the Human Rights Council (EMRO, 2014)

Strengthening health diplomacy will depend on strong leadership and political commitment that positions health higher on both the political agenda and the development agenda. This can include the role of heads of government in taking health issues forward, helping set the agenda and strategic goals, and making political space and resources available. (EURO, 2015)

Health diplomacy contributes to relationship building. It can help overcome obstacles and be a cross-cutting catalyst for many initiatives. It can help develop community trust, create and coordinate response, improve access and create an atmosphere for engagement while ensuring harmony with regional cultures.

Health diplomacy can raise awareness that health is not just a national issue but has many global and trans-boundary dimensions and can significantly contribute to global public goods and people's welfare all around the world. It responds to the fact that many of the health challenges of the 21st century will require solutions that will be political rather than technical.

Health diplomacy is important for the countries of the WHO Eastern Mediterranean Region because many of the development issues they face relate directly to health and because it is disproportionately affected by manmade and humanitarian crises. It is gaining in relevance as the Region has to find solutions to issues that require global action and collaboration across borders, such as Middle East Respiratory Syndrome (MERS), humanitarian health relief, non-communicable diseases and antimicrobial resistance. But experience also shows that health diplomacy at the national and regional level is critical for the implementation of health programs through complex partnerships. For example, polio eradication in the region is dependent on successful negotiations with many players whose trust has to be gained, in order to strengthen control programs and create a safe and secure environment for vaccination campaigns. (EMRO, 2019)

Health Diplomacy in Egypt

As a developing country with vast human resources and a rapidly-growing economy, reforming Egypt's health care sector is a top priority for the national social development agenda.

This sector had not been overlooked, even before the Egyptian revolution took place in early 2011, there was a concrete governmental vision for a healthcare system in 2025. Today, the current political situation confronting Egypt as it weaves its new future poses numerous challenges on many fronts, most important of which is mobilizing more economic resources for developing our human assets. Therefore, it is only natural that such a vision for health enhancement will gain more traction and becomes a paramount pillar guiding the process of the needed health care reform to build upon achieved past successes while working to address upcoming challenges. (The Centre for Global Health and Diplomacy, 2018)

Work streams demonstrated the defined dimensions of the Egyptian health reform program, the most crucial of which include providing high quality care through financially-sustainable health insurance, spreading the coverage of primary care services, enhancing family planning services at a national level, institutionalizing and strengthening consumer protection, in addition to encouraging public-private partnerships.

Overall, Egypt's health indicators have improved significantly since 1960, with a health profile that is increasingly similar to developed countries. This continuous improvement in all aspects of public health in Egypt has indeed been internationally recognized, however, still concurrent with these successes, the spread of non-communicable diseases remains prevalent, most notably cancer, diabetes, cardiovascular diseases, and chronic respiratory diseases. (World Bank, 2018)

In response, Egypt has embraced the WHO Strategy and Action Plan to control and prevent these illnesses. Several initiatives were, in fact, launched in this regard at no cost to all Egyptians, including--but not limited to--the Children's Cancer Hospital "57357", the National Breast Cancer Screening Program, the National Hepatitis Campaign, and the National School Feeding Program. This, while also running multiple campaigns to promote increased awareness of these common diseases that have inflicted Egyptian society. (The Center for Global Health and Diplomacy, 2018)

HCV in Egypt

Egypt has one of the highest global burdens of hepatitis C virus (HCV) infections; it is estimated that prevalence of HCV is around 4.5% to 6.7%. Over the past few years, remarkable developments in the global commitment to address viral hepatitis have been witnessed. In May 2016, 194 countries of the World Health Assembly unanimously adopted the first□ever Global Health Sector Strategy on viral hepatitis, 2016–2021. Through these high□level strategies, countries made a commitment to eliminate viral hepatitis as a public health threat by 2030. (Asmaa G et al, 2017)

Egypt had recognized the enormous health, social and economic burden of hepatitis infection, which was the driver to establish national response to fight the disease. It has become clearer that the root causes, as well as catalysts of transmission of HCV and hepatitis B (HBV), are strongly associated with healthcare-related malpractices. There was an ever-growing need to establish a comprehensive Infection Prevention and Control program in the Egyptian Ministry of Health and Population (MoHP). Such a program was successfully launched in 2001 and has succeeded in improving adherence to infection prevention and control practices and developing the national infection control guidelines This was followed by the establishment of the Egyptian National Committee for Control of Viral Hepatitis (NCCVH) in 2006, which started to treat patients using interferon regimen. (Akel W et al, 2017)

By October 2014, and through successful model of health diplomacy and negotiations, the NCCVH introduced the first approved highly effective direct antiviral agent (DAAs) for nationwide treatment of HCV infection at 1% of its international price at that time; this medication has been shown to cure over 90% of those receiving such treatment. Subsequently, the MoHP introduced other approved DAAs consecutively during 2015 and 2016, in addition to encouraging the local manufacturers to produce highly effective generic medicines to effectively implement the elimination program in the shortest possible time. (MOHP, 2016)

In 2014, the MoHP in Egypt launched the "Plan of Action for the Prevention, Care and Treatment of Viral Hepatitis", which focuses on seven main components for viral hepatitis prevention and control, namely surveillance, infection prevention and control, blood safety, hepatitis B vaccination, care and treatment, communication, and research. (Omneya et al, 2018)

This large national program to treat patients with HCV infection was found to be feasible and manageable. Scaling up of the treatment program was possible with the availability of

more medications, with greater affordability through allocating more resources and decreasing costs, along with the decision to treat all stages of fibrosis and removing the requirement of a strict fibrosis assessment. (Seida et al, 2018)

In 2016, the World health Assembly approved the first global health sector strategy on viral hepatitis; a strategy that contributes to the achievement of the 2030 Agenda for Sustainable Development. Egypt is working towards achieving elimination, as a pioneering country, through real political leadership, commitment from MoHP to accomplish this task in collaboration with all other stakeholders; and presence of coordinated health civil society organizations working hand in hand with health authorities to identify cases from different geographical areas, and there are ongoing activities to implement the needed strategic directions to achieve global targets, such as eliminating hepatitis by 2023. (MOPMAR, 2016)

Hence, despite the high prevalence of hepatitis as an old and long-standing disease in Egypt, the resultant health workforce is well trained to manage such illnesses, utilizing those skilled healthcare workers dealing with liver diseases for decades and building upon their capacities. Egypt has an ambitious goal of eliminating hepatitis; this goal is guided by a clear political vision from the Egyptian president. (Elzanaty et al, 2015)

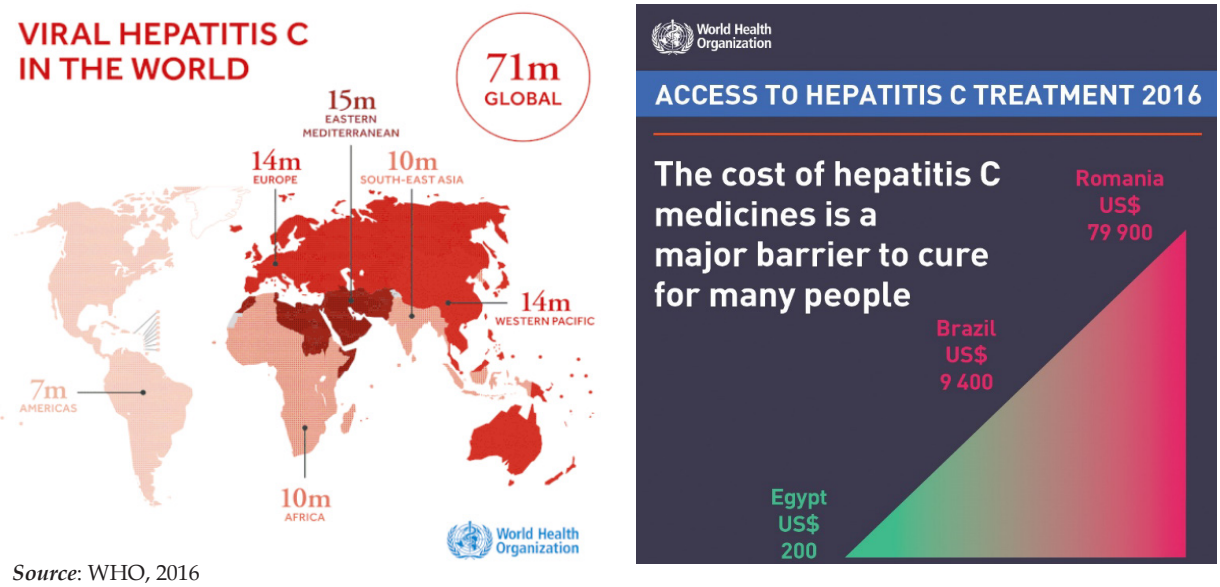
In October 2018, Egypt started a major screening in the worldwide for HCV and the non-communicable diseases (Hypertension, Diabetes and Obesity). The aim is to screen 45 million citizens in one year, respecting the WHO core testing principles of providing consent, confidentiality, counseling, correct results and connection to treatment for all people who will be discovered positive. (Doss et al, 2018)

Meanwhile, international partners such as the World Health Organization (WHO), USAID, Centers for Disease Control and Prevention (CDC) and the World Bank are working closely with the Government of Egypt to technically and financially support the optimistic goal of eliminating HCV. Building national capacities in managing huge data influx is very crucial to achieve such a target.

Potential for Strategic Health Diplomacy:

The point of weakness can be turned into a point of strength. The successful model of Egypt in treatment of HCV can be a wide door for health diplomacy between Egypt and other countries and even international organizations.

Figure 1: Worldwide HCV prevalence rate, and the cost of treatment in Egypt compared to other countries



Source: WHO, 2016

The prevalence of hepatitis is growing, but eliminating this global scourge is achievable. Doing so by 2030 would prevent nearly 36 million infections and 10 million deaths. However, the cost of vaccines, treatment, diagnostics, education, and coordination currently stand in the way of epidemic control. (Gower et al, 2014)

Egypt could make benefits from its successful initiative in treatment of HCV with this large-scale experience and also the low price of the medications when compared to other countries. This can be achieved by health diplomacy through strengthening bilateral with other countries, especially which cannot afford the high prices of the treatment. Also making strong relations with the international organizations as WHO will be helpful in this mandate. Besides, joint manufacturing may also consider a way of collaboration with the advanced countries in these fields to enhance the national industry.

Conclusion

Health diplomacy is very important in raising awareness that health is not just a national issue but has many global and trans-boundary dimensions. It responds to the fact that many of the health challenges of the twenty-one century will require solutions that will be political besides being technical.Egypt, as a developing country with vast human resources and a rapidly-growing economy, reforming health care sector is a top priority for the national social development agenda. Besides, Egypt has embraced the WHO Strategy and Action Plan to control and prevent the spread of non-communicable diseases.

Hence, Egypt has a very challenging opportunities concerning health diplomacy, by taking advantages in its successful initiatives in treatment of HCV, breast cancer, children cancers and non-communicable diseases through its specialized centers and low pricing of medications worldwide. Egypt can achieve a lot through using health diplomacy. Strengthening bilateral with other countries, especially which cannot afford the high prices of the treatment. Also making a strong relation with the international organizations as WHO will be helpful in this mandate. Besides, joint manufacturing may also consider a way of collaboration with the advanced countries in these fields to enhance the national industry.

Finally, Global Health Diplomacy can be considered a strategic opportunity for Egypt to make a great advancement and improvement in terms of science diplomacy and can helps it to empower and strengthen its bilateral and international relations with other countries and international organizations.

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Diplomacy and International Cooperation: Way Forward for STI in Dominican Republic

Max Emmanuel Brea Mella*

The Purpose of Science Diplomacy

Science diplomacy is the use of scientific collaborations among nations to address common problems and to build constructive international partnerships (1). The NRC Committee on Global Science Policy and Science Diplomacy focused on the definition of science diplomacy. They drew heavily on the Royal Society (2) and the American Association for the Advancement of Science description that focuses on examples of science diplomacy activities rather than stating a specific definition. Three main types of activities cited are (3): (Global Challenges 2017).

- "Science in diplomacy": Informing foreign policy objectives with scientific advice.
- "Diplomacy for science": Facilitating international science cooperation.
- "Science for diplomacy": Using scientific cooperation to improve international relations between countries.

The first can also be described as Science Policy in that it intends to expose policy makers with the best information available regarding science, technology and innovation to advise their decisions. The latter topics refer to facilitating cross-border collaborations to improve science or relationships between nations. SD is not new but continues to evolve in emerging areas that are not require international cooperation including medicine, the environment, nanotechnology, space, alternative energy and science education.

A concrete example of the use of science diplomacy

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is geosynchronous orbiting satellites. Most communication and broadcast satellites are placed in a geostationary orbit band about 36,000 km above the earth. The benefit of this location is that the satellite remains in a fixed position above the earth and requires a minimum energy to remain in that position. Limitations on the number of satellites in that orbit necessitates international cooperation in space allocations that must inherently be driven by an understanding of constraints on proximity to optimize overall usage (science in diplomacy).

This issue is further complicated by previous use of this region that has resulted in 10s of thousands of softball or larger objects (about 10 cm) floating in this band that are potentially harmful to operational satellites. The need to understand the physics and movement of these objectives is crucial to the sustainability of the 'satellite belt' and requires collaborative international network to advance that understanding (diplomacy for science).

Collaborations between countries on these issues including transferring technologies (e.g., to minimize satellite failure risk) can benefit maximization of this limited resource while enhancing international relationships beyond this critical need (science for diplomacy). (Global Challenges 2017).

International Cooperation in Science, Technology and Innovation

For the Dominican Republic as in many developing countries, international cooperation organizations play an important role in the design and implementation of science, technology and innovation (STI) policies. In the field of policies, various multilateral organizations, such as OECD and Inter-American Development Bank, along with bilateral organizations such as USAID, have contributed consultants for carrying out studies for drafting STI policies or programmes. For example, OECD financed a report on education policies in the Dominican Republic, and USAID has financed several studies of emergent industries. As for implementation, these organizations have financed specific programmes aimed at promoting STI policy instruments. For example, Inter-American Development Bank is financing a Programme to strengthen industry and support competitiveness in three clusters (plastics, cosmetics and cacao). Likewise, USAID is financing various projects for promoting the creation of agricultural clusters. The German Cooperation Agency (GIZ) is supporting a series of projects to improve management of natural resources, specifically in issues of desertification and deforestation. Owing to duplication in various projects, at least in agriculture, donors have established an informal round table to share information about the projects they finance and their results. (UNCTAD 2013).

Regulatory, Government and Private Sector Institution's involve in Science, Technology and Innovation

Regulatory institutions

The general Office for Norms and Quality system (DIGENOR) is the main regulatory entity concerned with science, technology and innovation. As part of the Ministry for Industry and Commerce, it provides several quality certification services, but its capacities are limited. The International Organization for Standardization (ISO) has designated DIGENOR as a "correspondent member", which is the status of a member that has no fully developed activities in standardization (Navarro 2009).

The National Office for Industrial Property (ONAPI) is responsible for the administration of legislation in the field of industrial property aimed at developing and protecting industrial property in the Dominican Republic. It was created in 2000 and is attached to the Ministry for Industry and Commerce. It administers the granting, maintenance and enforcement of the registration of various types of industrial property (patents for invention, utility models, registration of industrial designs and trademarks). (UNCTAD 2013).

Public Institutions Implementing STI

- **The Ministry of Higher Education, Science and Technology (MESCYT)** is the organ of the Executive, in the field of higher education, science and technology, responsible for promoting, regulating and managing the National System of Higher Education, Science and Technology. In accordance with its attributions, it oversees the execution of all the provisions of Law 139-01 and the policies issued by the Executive.
- It is the responsibility of this office to supervise the system. Therefore, it monitors policy compliance and also responsible for evaluation of all the concerned government bodies and their coordination. To that end, it is based in the office of the Deputy Minister of Higher Education and Science and Technology who is assisted by the National Council of Higher Education, Science and Technology. This office, assisted by the Council and other technical entities is responsible for ensuring the quality of higher education and development of scientific and technological research in the country. (MESCYT 2019).
- The Ministry of Higher Education, Science and Technology, has created a special program to allocate non-reimbursable resources competitively for financing of research projects, called the National Fund for Innovation and Scientific and Technological Development (FONDOCYT). This fund can also finance activities for innovation programmes and projects. However, it was only in 2005 that it called for tenders for financing the research activities.

The table below shows some public and private universities and Dominican state agencies who have been the beneficiaries of this fund

In terms of areas of research, the table above shows that during 2005–2009 FONDOCYT has given preference to financing projects in basic sciences, health, biomedicine and biotechnology.

Under the FONDOCyT, 544 researchers have benefited, of which 174 had the role of principal investigators, those responsible for each research project. It is necessary to clarify that the concentration of researchers with doctor degree in the FONDOCyT context does not necessarily represent the reality at the national level, in fact, in the teaching activity the percentage of higher education teachers with a doctorate degree has been between 2% and 4% in the last decade, according to the General Report of

Table II.7. Beneficiaries and FONDOCYT contribution, 2005–2008 (in pesos)

Beneficiaries	FONDOCYT contribution	%
Centre for Plant Biotechnology (CEBIVE)	2,560,522	1.2
Institute for Innovation in Biotechnology and Industry (IIBI)	46,482,871	22.6
Dominican Institute for Agrarian and Forestry Research (IDIAF)	37,620,951	18.3
Higher Institute for Agriculture (ISA)	1,166,379	0.6
Technological Institute of the Americas (ITLA)	3,333,450	1.6
Technological Institute of Santo Domingo (INTEC)	19,530,810	9.5
National Meteorology Office (ONAMET)	2,956,000	1.4
Pontifical Catholic University Madre y Maestra (PUCMM)	25,350,772	12.3
APEC University (UNAPEC)	2,918,705	1.4
Autonomous University of Santo Domingo (UASD)	41,124,136	20.0
Pedro Henríquez Ureña National University (UNPHU)	2,532,200	1.2
Technological University of Santiago (UTESA)	6,266,197	3.1
Miscellaneous	3,054,617	1.5
TOTAL	**205,391,611**	**100.0**

Source: MESCYT – FONDOCYT.

Table II.9. FONDOCYT financing, 2005–2009 (current dollars)

Area of science	Total financing 2005–2009	Number of projects financed
Basic sciences	3,784,004	27
Health and biomedicine	1,919,735	11
Biotechnology	1,868,044	27
Environment and natural resources	985,168	11
Sustainable production and food security	889,285	9
Biotechnology and genetic resources	723,764	5
Energy and biofuels	715,168	4
Development of hardware-software and innovation	630,235	4
Energy	125,679	3
Productive innovation	96,874	1
Food technology	95,768	2
Atmospheric sciences and climate change	85,905	1
Material research/applied physics	77,053	1
I+I in engineering	73,889	2
Health	74,573	2
Total	**12,165,144**	**110**

Higher Education Statistics, for the year 2012. On the other hand, the growth of the scientific community of FONDOCyT has been considerable and the importance of it can be perceived at a national level. The 544 researchers with which FONDOCyT had until 2014 participated in 256 projects. By 2015, 78 new projects and 214 new researchers were added, so the Scientific community, within the FONDOCyT context, currently exceeds 700 researchers. This means that by 2016, only FONDOCyT researchers reach 0.16 researchers per member of the PEA. It is worth noting that FONDOCyT does not focus on Social and Human Sciences projects, so if researchers in these areas still represent 40.9% of the national scientific community, we can assume that this community is approximately 1,282 researchers. (UNCTAD 2013).

The Centre for Development and Industrial Competitiveness (PRO-INDUSTRIA) is a decentralized public agency of the Ministry for Industry and Commerce. Its predecessor was the Industrial Development Corporation (CFI), which was created in 1962 to promote industrial development in the Dominican Republic. Its goal is to ensure the competitive development of the domestic manufacturing industry, proposing policies and programmes for support and stimulation of industrial renovation and innovation through the promotion of industrial zones, industrial parks and ties to international markets. Its main projects is the national **Programme for business incubation (PRO-INCUBE),** This programme has around 200 projects of which 35 have been incubated and 17 continue to function. **PRO-INCUBE** has a budget of only 300,000 pesos (approximately 8,000 dollars) and, therefore, is trying to raise funds through a network of angel investors with the support of Inter-American Development Bank, Andean Development Corporation and Ministry of Higher Education on Science and Technology. These funds would serve to finance projects using basic technology with a scheme of 50-per cent co-financing (UNCTAD 2013).

The National Council for the Promotion and support of Micro, small and Medium Enterprises (PROMIPYME) is an administrative dependency of the Ministry for Industry and Commerce. That Programme was created in 1997, and since 2010 it is the authority dealing with Small and Medium Enterprise's. It provides financing

and technical assistance for strengthening these industrial segments. The PROMIPYME budget is 2,000 million pesos (about 54 million dollars) in investments and has about 20,000 clients. PROMIPYMES has the following functions: provision of credit at low interest rates, training in industrial areas and services (trade). (UNCTAD 2013).

The National Council for agrarian and Forestry Research (CONIAF) is a decentralized institution of the Dominican Government, which strengthens, stimulates and orients the national system for development and transfer of agricultural and forestry technology. It offers financing through a research fund andpromoting the development of scientific and technological capacity in public and private institutions. It finances a maximum of 3 million pesos (approximately 81,000 dollars) for a maximum of two years. Since its creation in 2000, 116 research projects have been financed through public bidding for a total of nearly 102 million pesos. (UNCTAD 2013).

The Dominican Institute for agricultural and Forestry Research (IDIAF) is the main institute for public research. This institute was created in 1985, but began to function only in 2000 following a recommendation of the International Service for National Agricultural Research (ISNAR). Its mission is to ensure food security in the country and to promote the competitiveness of the Dominican agro-industry. (UNCTAD 2013).

The Institute for Innovation in biotechnology and Industry (IIBI) was created in 2005 to carry out scientific research, technological transfer and innovation, as well as to provide technical consultancy services in areas relevant to national development in order to contribute to improving the level of competitiveness. (UNCTAD 2013).

The private sector The Dominican Confederation of small and Medium Enterprises (CODOPYME) estimates that there are approximately 365,000 micro, small and medium sized companies in the Dominican Republic. They contribute close to one million jobs at the national level and 27 per cent of GDP (PUCMM undated). These data are only indicative because they include informal companies for which there is no official information. (UNCTAD 2013).

Free trade zones and industrial parks, the law on competitiveness and industrial innovation considers industrial parks to be the most efficient instruments for promoting development and industrial integration, achieving greater competitiveness, attracting foreign direct investment and promoting technological transfer. According to the National Council of Export Free Trade Zones (ADOZONA), there were 48 free trade zones operating in the Dominican Republic in 2008, with the oldest being La Romana, which dates back to 1961, and the most recent which is Multiparques, created in 2007. Out of the 48 free trade zones, 21 are private, 18 are public and three falls within the category of industrial parks with mixed administration. With 569 companies producing 189,000 jobs and 4,416 millions of dollars of exports. These figures make the Dominican Republic one of the regional leaders in free trade zones. Even though free trade zones in the country have a rather broad level of sectoral diversification (including textiles, clothing manufacturing, footwear, electronics, health products and medical applications). In 1998, at the initiative of President Fernández, the Cybernetic Park in Santo Domingo was created to promote foreign investment in information technology and telecommunication companies. According to ADOZONA, there were eight companies established in the Cybernetic Park in 2008, where occupation was 75 per cent of capacity and exports are only 1.5 million dollars. According to interviews with various officials of ClusterSoft, Cybernetic Park and the Technological Institute of Andres (ITLA) the main obstacle is a lack of trained human resources in this sector. (UNCTAD 2013).

The main Industrial Association

The Industrial Association of the Dominican Republic (AIRD). It was created in 1962 and has played a major role in the country's industrialization, assisting the creation of new industries. It also provides permanent consulting services and training. Currently, AIRD is carrying out the industrial innovation Programme

"Competing on Speed and Flexibility" financed by Inter-American Development Bank. This Programme seeks to encourage and improve the competitiveness of the Dominican industrial export sector, promoting the organizational model of clusters. Three sectors have been selected: cacao and chocolate products, cosmetics and plastics (packaging and molded products). (UNCTAD 2013).

Universities and Technological Institutes Universities

Higher education in the Dominican Republic has had a unique development. The first university in the Americas was founded in the Dominican Republic in 1538 with the name Santo Tomás de Aquino, which later became the Autonomous University of Santo Domingo (UASD). The offer of higher education expanded through the creation of the Católica Madre y Maestra University in 1962, the National Pedro Henríquez Ureña University in 1967 and the Institute for Higher Studies in 1968 (becoming the APEC University in 1985). This expansion of the educational supply responded to the need created by the expansion of demand for higher education that was straining the capacity of UASD. (UNCTAD 2013).

The National Institute for Vocational Training (INFOTEP) is the main authority of the national vocational training system for productive work. Its board of directors is formed by representatives of the business, labour and government sectors. Its function is to train human resources, advise companies and regulate vocational training. Vocational training is provided by INFOTEP through a network of affiliated centers and through the system's operational canters, more than 150 in all the Dominican Republic. These centers currently provide training for careers accredited by INFOTEP. This system covers roughly 30 per cent of the country's demand for training. (UNCTAD 2013).

Bringing Together the Private Sector and Universities

The relationship between the private sector and universities is very weak and almost non-existent. That is because, on the one hand, universities focus on teaching and do not carry out academic research activities that would allow them to produce knowledge and, on the other hand, most Dominican companies have low technological capacities and do not usually request technological services. Only 15 per cent of the company's report having some type of cooperation in their innovation activities. Among them, 8 per cent report that cooperation with universities was favorable. 17 per cent indicate that they have cooperated in some way with a university and 9 per cent with public research institutions. Recently, several universities, especially private universities, report having a more fluid relationship with the private sector and have begun to offer services to individual companies or to companies participating in clusters. (UNCTAD 2013).

Statistics on Science, Technology and Innovation

In this section the performance of the Dominican Republic in the field of science, technology and innovation has been shown. The performance of R&D in terms of innovation was a score of 29.33 and a position of 87 worldwide and 11 regionally. When comparing the GDP per capita of the country, the authors of the Global Innovation Index explain that the Dominican Republic complies with the scope of innovation expected according to its level of development, below the table. (Global Innovation Index. 2018.)

Evaluation of investment policies in science, technology and innovation

From a restricted perspective, the investment policy in science, technology and innovation in the Dominican Republic is evaluated through the results and impacts established from the following indicators, aimed at establishing a knowledge-based economy in the next 10 years, from 2008. These indicators are the following: (Marrero 2011)

Learning from India

India's experience in Science Diplomacy data since 1960 when they appointed their first

Tabla 3. Desempeño de República Dominicana

República Dominicana en el IGI	Puntaje (0-100)	Rank 2018 (de 126)	Puntaje (0-100)	Rank 2017 (de 127)	Variación en puntuación 18/17
Índice Global de Innovación	***29.3***	***87***	***31.2***	***79***	***-6%***
Ratio de Eficiencia de la Innovación	0.6	71	0.6	54	-1%
Subindice de Entrada	***36.77***	***92***	***37.8***	***88***	***-3%***
Instituciones	55.3	83	51.8	90	7%
Capital Humano e Investigación	16.7	105	17.6	109	-5%
Infraestructura	42	74	42.4	78	-1%
Sofisticación de mercado	44.9	73	45.4	70	-1%
Sofisticación de los negocios	24.9	95	31.9	67	-22%
Subindice de Salida	***21.89***	***77***	***24.5***	***72***	***-11%***
Producción de Conocimientos y Tecnología	16.6	92	17.2	91	-3%
Producción Creativa	27.2	69	31.9	60	-15%

Fuente: Elaboración propia a partir de los datos del Índice Global de Innovación

No.	Indicador	2018
1	Inversión interna total en I+D como parte del PIB	0.5%
2	Inversión en I+D por el sector empresarial como parte del total	33%
3	Inversión financiada por el sector empresarial como parte del total	25%
4	Impacto mínimo esperado de la inversión en innovación como parte del PIB	1%
5	Porcentaje de empresas innovadoras como parte del total intensivas en conocimiento y tecnología para los tres años finales del Plan	50%
6	Fuerza laboral en actividades de C&T como parte de la PEA	1
7	Número mínimo de solicitudes de patentes anuales por cada 100 mil habitantes solicitadas en la ONAPI a partir de 2014.	15
8	Investigadores localizados en el sector empresarial	25%
9	Formación de doctores en ciencia por año	100
10	Inversión de capital de riesgo para incubación y emprendimiento/PIB	0.0002%
11	Cuota de producción científica respecto al total centro-americano y caribeño	25%
12	Producción científica en alguna modalidad de colaboración internacional	50%
13	Incremento anual de matriculados en carreras universitarias de ciencia y tecnología con relación al año base 2006	20%
14	Incremento anual de tecnólogos de nivel postsecundario con relación al año base 2006	25%

Scientist Attache to their embassies in Japan, Dr. Ashok Jain, first attaché in the embassy of India in Japan, in his lecture "Sharing of Experiences in Science Diplomacy" said it was very difficult for him, since it was his first experience working in an Embassy being a physicist, what helped him was his relationship with his former teachers when he was doing his PHD in Japan. (RIS 2019). For the Dominican Republic this is something totally new since in our case we mostly use cultural and military attaché in some strategic countries.

India's Achievements through Science Diplomacy

The government of India has use Science, Technology and Innovation: Soft power for Indian Diplomacy India offers the advantages of a) a growing market for consumer goods based on advanced technologies; b) established and well developed R&D institutions; c) manufacturing and cost optimization capability for products based on advanced technologies; d) a legal framework for dealing with IPR issues; and e) a demographic dividend. Thus, the soft power advantage of technology and the Indian model of innovation for cost-optimized solutions could be effectively leveraged in foreign policy development. (Sadhana Relia, Arabinda Mitra, and T. Ramasami 2014)

In the 21st century, India's scientific cooperation with several members of the international community saw it assume the role of both the benefactor and the beneficiary in different cases. India provided technological aid to Afghanistan, Bhutan, Nepal, Bangladesh, and Palestine. India also accepted advanced technology from countries such as the US and Japan to aid its own infrastructure building and scientific advancement. Between 1999-2015, India's space program had launched satellites for 51 foreign countries, including scientifically advanced countries such as the UK, US, Canada, France, Germany, Japan, and Israel. However, India's quest for self-reliance in the defense sector was largely unsuccessful as its Light Combat Aircraft program failed to take off and its Dhruv military helicopters repeatedly crashed in Ecuador. (Saxena M. 2016)

The Cooperation with the Soviet Union, too, had begun to surface during the 1960s and the Indo-Soviet Treaty of Friendship and Cooperation was signed in 1971. Article I of the treaty emphasized mutual respect for state sovereignty and non-interference in internal affairs, conditions that India traditionally sought from its bilateral partners and still does. Articles VI-VII of the treaty include scientific and technological cooperation. This treaty is of special significance since technological aid from the UK, US, and Canada had largely subsided after the Indian Smiling Buddha nuclear tests of 1974, and the Soviet Union remained India's most significant scientific partner until it was dissolved in 1991. (Dolan, B.M. 2012).

Also, the United States and India have a rich history of collaboration in scientific research and education. As early as the 1950s, agricultural research collaboration flourished as U.S. Public Law 480 (PL480, also known as Food for Peace) supported the Green Revolution in India. Over the years, the funding mechanisms and research collaborations evolved and included an increasingly large number of U.S. technical agencies. The scientist-to-scientist partnerships continued through the ups and downs of the diplomatic relationship predominantly disputes over nuclear nonproliferation and Pakistan and representatives from the countries discussed an S&T agreement as early as 1993. In 2000, President Bill Clinton's visit to India strove to "engage India in developing a qualitatively new and closer relationship across a broad range of global, regional, and bilateral issues." While the two governments envisioned science as a strong pillar of this new partnership, the United States could not enter into a treaty-level agreement as India was under U.S. sanctions for its 1998 nuclear tests. Instead, during this presidential trip, the Indo-U.S. S&T Forum (IUSSTF) was established. This co-funded joint program went on to support the interaction of more than twelve thousand U.S. and Indian scientists in over three hundred technical workshops, forty virtual joint research centers, and thirty advanced training programs. The U.S. side financed its part of IUSSTF by redirecting rupees leftover from PL480 funding.

When additional U.S.-controlled rupees were uncovered a few years later, support for an S&T agreement resurfaced, as some officials thought a formal framework agreement would make it easier to direct PL480 funds to joint research projects. (Dolan, B.M. 2012).

S&T engagement between the United States and India remained robust following the signing of the agreement in 2005. Two joint commission meetings have been held, allowing for the review of implementation of the agreement. In addition, these bilateral meetings have provided a venue for discussing obstacles to cooperation. (Dolan, B.M. 2012).

Conclusion

The Dominican Republic is taking the first steps in its policy of science, technology and innovation, we have seen how FONDOCYT has helped many researchers and companies to which it has given funding to develop research programs, but a bad thing we have seen in this report is that human resources in the Dominican Republic are not prepared in science, technology and innovation, that's why the Dominican Republic should learn from India, as we have seen in this report India has achieved many accomplishments through Science Diplomacy, it has improved its development in science and technology, it has signed bilateral agreements related to this subject something that The Dominican Republic as president and non-member of the Security Council of the United Nations, should take this opportunity to implement Science Diplomacy in his International Policy, because science, due to its international and universal nature, has the power to cross borders and connect different peoples, communities, and societies. Science diplomacy builds on this power of science, using science as a tool to achieve foreign policy objectives where, not only the research outcomes, but also science itself as a process and way of communicating, may serve to promote peace and sustainable development, an instrument used by most developed countries and some in development, which brings great opportunities for the State and therefore it is transmitted in to the Dominican people.

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Science Diplomacy for Scientific and Technological Cooperation: Challenges for Colombia's Government

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Diana Yulieth Cespedes Pardo**

Introduction

Over last decades Colombia has focused its national and international efforts to foster international cooperation. Different administrations harmonized Colombia's foreign policy to achieve national goals. One of these goals was the promotion of Scientific and Technological Cooperation. Different key countries played an important role in this sense: historically the United States (due to the common interest in cooperation in the field of security), Brazil, Germany, India, Japan, Spain. This cooperation was established with the support of academia (universities, research institutions), the government (Administrative Department of Science, Technology and Innovation -COLCIENCIAS-, Ministry of Information and Communication Technology) and international cooperation agencies: JICA (Japanese International Cooperation Agency), DAAD (German Academic Service for Exchange), USAID (United States Agency for International Cooperation). (Embassy of Columbia in India, 2019

The Ministry Foreign Affairs and COLCIENCIAS were the promotors of strategic agreements, that have approached Colombia's interests to other worldwide interests, For example in multilateral organizations and conferences such as the United Nations Conference for Climate Change UNFCC), United Nations Programme for Development (UNDP), United Nations Development Fund for Women (UNIFEM), UNASUR (Union of South American Nations). In general terms, Colombia was the

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promotor of a joint and common work in different topics, highlighting the need of international cooperation to achieve common goals. Colombia enhanced the need for international scientific cooperation with a particular interest in specific fields: technology transfer, innovation, intellectual property.

Colombia's policymakers and diplomats had a clear idea of how international scientific collaboration works:

"scientifically advanced countries share similar research profiles that stimulate collaboration among them, and these countries collaborate in all major scientific fields. Developing countries, in contrast, are more likely to specialize in a few areas of science, often in fields that relate directly to some national need" (The Royal Society, 2010).

This article aims to describe the Colombian strategy to promote international scientific collaboration and the challenges that it implies for its future. The challenges include i) the need to have a close relationship with countries that nowadays play a fundamental role for scientific and technological development; ii) the need to have a national strategy that can describe the expectations of the country; iii) the need to train policymakers and officers who will be in charge to lead those negotiations.

Methodology Used for this Study

This study presents data examined, collected and analysed from different sources and perspectives:

- Interviews with Colombian diplomats and policymakers
- A review of the latest agreements signed between the government of Colombia and different international academic cooperation agencies
- A review of literature related to Science and Technology cooperation in in Colombia and in developing countries

Challenges for Colombia's Scientific and Technological Cooperation

There are specific challenges that include i) the need to have a close relationship with countries that nowadays play a fundamental role for scientific and technological development of Colombia; ii) the need to have a national strategy that can describe the expectations of Colombia; iii) the need to train policymakers and officers who will be in charge to lead those negotiations. (Embassy of Colombia in India, 2019).

• *Close relationship with countries that nowadays play a fundamental role for scientific and technological development*

Although the level of scientific capacity differs according to the country, there will always be perspectives, expectations and common interests for collaboration between developed and developing countries (Wagner, Science, 2001). In this sense, Science Diplomacy plays a fundamental role. Colombian diplomats, researchers and policymakers must be trained in this sense so they can have effective participations in the permanent negotiations. Countries such as Canada, China, United States, Germany, Japan and India are the nations who lead scientific and technological development, according to the OCDE (Organization for Economic Cooperation and Development) annual report 2018. These countries offer different channels to cooperate and it implies a deep knowledge of their motivation: geographic proximity, history, common language, specific problems, expertise, economic factors are the main drivers for collaborative research.

• *A national strategy that can describe the expectations of the country*

Institutions that promotes science and technologic initiatives and issues have played an essential role in societies for reaching economic development, for instance, Colombian's government has appointed through the Ministry of Information and Communications Technology and COLCIENCIAS.

According to this, the main effort is led by the Ministry of Information and Communications Technology who promotes policies, programs and projects in technologies and communications in order to improve the quality of life of Colombian citizens, and also to establish general conditions of operation and commercial exploitation (Mintic, 2017).

On the other hand, COLCIENCIAS is in charge of formulating short – medium and long term policies in science and technology, through supporting and funding researchers' education, but also it promotes science, technology and innovation development integrated to productive processes in the economy. It is creating a new culture that allows new values and generate knowledge and innovation in the country.

According to Colombian Government Plan (2018 – 2020) which pretends to generate a great pact that involves public and privates in order to dynamism economic development, given that reason, Government distribution of national budget has been designed 20,8 billons USD (1,9 %) in science and technology with the aim to face the challenges and problems in this field (National Planning Department, 2018).

It is important to point out, first of all, that the concept of Science Diplomacy has not been integrated in the Colombian foreign policy, however, nowadays the enormous gaps and backlogs in science and research have been notices, for that reason Ministry of Information and Communications Technology (Ministry of Information and Communications Technology of Columbia website) has already made a diagnostic identifying the follows problems:

- Low diversification and economic complexity of the productive apparatus in terms of exports are concentrated in first-time goods.
- Decreasing capabilities in adaptation to technological advances in companies.
- Lower personnel training in science and technology.
- Insufficient sources of funding for innovation
- Lower investment in technology and research in companies and the Government

Second, science diplomacy is not officially included as a practice of Colombia's foreign policy, however, the Ministry of Foreign Affairs is proactive and it promotes the development of cohesion and collaboration with international counterparts, considering the comparative advantages of Colombia. For instance, the government stablished a law called *"Spin-offs law"* to promote a deeper training of Colombian professionals and researchers. The law also includes the policy of attraction of Colombian personnel who live abroad and who are highly qualified (effective reinsertion of migration) (National Planning Department, 2018). Colombian diplomatic missions play a key role in these processes.

Third, Colombia is the second country with the highest biodiversity per square meter on the planet, 53% of its continental surface is covered by natural forests and it has 311 types of different continental and marine ecosystems. (SiB Colombia, 2018) The government has a strategic programme which involves partnership with local administrations. The aim of the programme is to promote awareness, conservation, management and sustainable use of biodiversity in the Colombian territories through science, technology and innovation. (COLCIENCIAS, 2016). It is important to highlight that due to the peace agreements Colombia has experienced a different and positive perception of the international community. The armed conflict has mined in the past the countries' development, however now Colombia focuses its efforts to these specific fields:

1. Biodiversity Issues
2. Research, Development and Innovation in Biotechnology
3. Mentality, Culture and Communications

- ***Train policymakers and officers who will be in charge to lead science diplomacy negotiations***

Even though Science Diplomacy has not already been officially recognized as a foreign policy practice in Colombia, there is an awareness of the need of cultivating professional who can lead the country's science diplomacy strategy. Colombia needs young academies, highly qualified, adaptable professionals, young scientists' associations, capacity building programs. They can instrument science-policy mechanisms and can be significant representatives in strategic conversation that can lead to a higher and long-term cooperation.

Conclusion and Recommendations

First, scientific and technological cooperation plays a very important role for Colombia' economic growth, this is why, the government is aware about the needs to harmonize its national needs and strategies with countries that could offer opportunities for international cooperation. Colombia has already stablished solid scientific and technological cooperation channels with countries such as: Brazil, Germany, India, Japan, Spain and the United States. Institutions like the Ministry Foreign Affairs and COLCIENCIAS have been the vehicle of strategic agreements, that have approached Colombia's interests in international organization and topics.

Second, there are specific challenges to achieve a solid collaboration in terms of science and technology. These challenges were previously explained: i) the need to have a close relationship with countries that nowadays play a fundamental role for scientific and technological development of Colombia; ii) the need to have a national strategy that can describe the expectations of Colombia; iii) the need to train policymakers and officers who will be in charge to lead those negotiations.

Finally, for the current government is crucial to work on those challenges in order to obtain a solid and long-term international cooperation. The Colombian Government Plan (2018 – 2020) has already established the framework of the social and economic growth, in this sense, its foreign policy has to reflect Colombia's perspectives.

It is certainly known that there are opportunities to start promoting science diplomacy as a priority in Colombian foreign policy, considering the role that science and technology plays for its economic growth.

The government should address their efforts in the following fields: (a) to reinforce the collaboration with industrialized and developing countries that allow access to information and research cooperation, as Brazil and India, (b) to encourage the awareness of science in citizens, companies and local government, so they can be more involved in protecting the environment and in scientific research, (c) to promote the presence of diplomat personnel with scientific backgrounds that can become "scientific attaches", (d) to reinforce the communication and alliances between the private sector, governmental institutions and academic units as universities and think tanks, (e) to develop new and own technology with a high impact and access to all Colombian citizens in order to generate a social cohesion, economic growth and the achievement of the Sustainable Development Goals (SDGs), f) to make all national efforts to accomplish the objectives of the Colombian Government Plan (2018 – 2020), giving a priority to science and technology.

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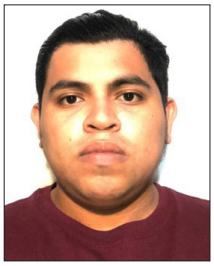
Panama-India Co-operation in S&T and Agriculture



Santiago Ortega*

Introduction

India and Panama represent two fast growing economies in their parts of their growth. In 1962 diplomatic relations between India and Panama were established and Panama was the first country in Central America to establish diplomatic relationship with India. In the recent years there has been an increase in activities on bi-lateral relations. The India-Panama trade has grown from 274.81 (in million $) in 2013-14 to 424.31 in 2016-17, in million $. The key bi-lateral agreements are MoU on Cultural and Educational Co-operation 2001and Mutual Cooperation between Ministry of Agriculture of India and the Ministry of Agricultural Development of Panama in the Field of Agricultural Research and Education, 2001. Last year, during the visit of Vice-President of India, Hon. Venkiah Naidu, India announced two Credit Lines of assistance , to set up a Centre for Biodiversity and Drug Discovery [valued at US$ 10 million] and a Centre for Innovation & Technology [valued at US$ 15 million]. Although the S&T co-operation between the countries is very limited , it is suggested that a beginning can be made, using this as a stepping stone. Panama can learn a lot from India and also can explore the growing market in India for goods and services. India can help Panama in making its S&T system more dynamic and innovative and can play a critical role in capacity building. In this paper I focus on S&T co-operation while it is obvious that both countries can work together and grow together. National Secretariat of Science, Technology and Innovation (SENACYT) which is the Panamese equivalent of

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National Science Foundation of USA has an Office of International Cooperation, can play a key role in this as promoting internatuional and bi-lateral collaboration is part of its mandate. Agriculture represents another area for mutually beneficial collaboration between India and Panama. Taking advantage of location of Panama, India can set up joint ventures in agriculture to tap the South and Central American markets and to help agricultural sector in Panama to realice its potential. However a challenge in this will be the growing collaboration between China and Panama in inter alia, agriculture.

Panama's S&T Plan

Panama has an ambitious S&T Action plan which was announced in 2015 as National Strategic Plan for Science, Technology and Innovation (PENCYT) 2015-2019. The Plan's key objective is to meet the three challenges in achieving sustainable development, social inclusion and sustainable competitiveness. With this in mind the Plan has the following Programs:

- Program "Science, Research, Technological Development and Innovation for Sustainable Development
- Program "Science, Research, Technological Development and Innovation for Social Inclusion"
- Program "Science, Research, Technological Development and Innovation for Competitiveness and Dynamic Entrepreneurship"
- Program "Development of Science and Scientific Capacities"
- Program "Strengthening the Governance Capacities of the National Science, Technology and Innovation System"

Review by OECD has pointed out the strengths and weaknesses in the National Innovation System of Panama. (OECD 2015) . The underinvestment in R&D is a major weakness and data from the World Bank shows that Panama dedicates 0.35 % of its GDP expenditure in Research and Development, This shows the lack of investments in pure science research in the country (World Bank Group, 2019). Recent reports by the Inter-American Development Bank have shown a deficiency in the educational system in Panama, quantifying that only 3.3 % of the GDP is spent in education (Vega Loo, 2017). The United Nations Educational Scientific and Cultural Organisation (UNESCO) recommends that number to be at least 8%, so that it matches similar investment by the countries part of the Organisation for Economic Co-operation and Development.

This figure is also worrying in higher education, the Global Competitiveness Report of 2008, rates Panama's quality of vocational training 45.8 out of 100, and the skillset of graduates with 47.4, which makes Panama 91 and 97 out of 140 in the world in those fields, respectively (World Economic Forum, 2018). Regarding the easiness of finding skilled employees, Panama is rated 110th best in the world, according to this report.

In order to take advantage of this potential a priority most be given to the field of sciences, technology, Engineering and Mathematics. In 2009 the results of the Programme for International Student Assessment showed that between 70% to 80% of students in high school don't have the basic knowledge in Science in Math (Molina, 2018).

For reasons of space we will not review the strengths and shortcomings in Panama's S&T policy and National Innovation System. However it is worth pointing out that Panama faces the same issues as in the case of many other developing countries, such as, low investment in R&D, lack of expertise or non-availability of experts in key and emerging fields in S&T and lack of synergy among the different actors in the National Innovation System.

India-Panama Cooperation in S&T and Agriculture

Taking advantage of the recent positive developments including the two credit lines provided by India, both countries should establish a working group to identify potential areas in S&T collaboration. The idea should be that the collaboration should enable Panama to meet its objectives in S&T and enhance its competitiveness

and achieve social inclusion. The bi-lateral collaboration can benefit from India's experience and expertise in frugal innovation, grassroots innovation and application of S&T to meet basic needs. Similarly India's capability in emerging technologies like Nanotechnology can be useful in deploying relevant applications in health, water and sanitation. It is suggested that India and Panama can use the national strategic plan of Panama in S&T to identify specific applications, opportunities in capacity building and scope for joint R&D. Later in this paper I argue that Panama can join the International Solar Alliance and benefit from it.

Service sector contributes more to GDP than any other sector and this has more to with the location of Panama that enables it to benefit from marine/shipping related services. Agriculture represents a 17% of the country's GDP, while Panama under invests in agriculture(World Bank Group, 2019).

India has had a significant success in agriculture and their experience could help Panama in the renovation of this economical segment through the development of a seed market, modernization and specialization of farm machinery and the use of ICT (Srinivas, 2018).

Panama is really far behind the seed-selling business as it can possibly be. With near to non-existent procedures or frameworks for a formal seed system to take place. However, the country has taken steps to facilitate investment in this sector with financing from the banking sector being more accessible. This opens up the opportunity for the exploration of this line of business. India's commitment to help Panama to increase its productivity could be through comprehensive plans for technical assistance, credit lines in agriculture and capacity building in value addition related initiatives. In African countries seed and agro inputs sector has seen many partnerships and collaborations such as, the partnering of Indo-American Hybrid Seed Ltd, Nirmal Seeds, Ganga Kaveri, Ankur Seeds, Rasi Seeds and Nuziveedu Seeds with Syngenta Seeds2B/African Seed Trade Association (AFSTA) (Srinivas, 2018). In Panama while the seed sector is not well developed, India can take advantage of location of Panama to promote export oriented agriculture and value addition by processing. Panama's location and climate combined with availability of land can be harnessed to set up integrated farms that can combine farming with food processing. Panama has a well-developed logistics infrastructure, the best one in the region, so this can come handy is export and import of agricultural produce and processed food.

.Finally, the implementation of ICT´s into agriculture is the way forward in the modernization of Panama's agriculture. There is a nation-wide access to 4G LTE mobile network and a very reliable structure of optical fiber providing access to high speed internet in the country.

With that being said, there are issues in transportation and infrastructure in agricultural sector. These have to be addressed.

Can Panama and India Collaborate on Energy?

The recent collaboration between Panama and China is unprecedented an could lead the ways between the Panama other big players of the south. Should this decision lead the way to strengthen its science background? If their vision is to become a key player in the Americas, the answer is yes.

The Solar Alliance is an example of a major achievement in Science Diplomacy and in Triangular Cooperation. The decision, led by India, to create an International Alliance to motivate the use of renewable energy thus taking advantage of the sun demonstrates the need to move towards a clean and affordable way of accessing and using energy.

This initiative that was introduced to the world just before the 2015 United Nations Climate Change Conference show the world that collaboration will define the economic development of the next decades. Nowadays, 121 countries make of the alliance but why isn´t Panama in the membership record of this alliance?

Panama has decided that the country must base 70% of its energy use on renewable energy by

2030. The country has very diversified means of production of energy. It has already established 21 hydroelectric plants nationwide, 4 thermoelectric plants and 1 wind park. However, it still relies on natural gas and oil.

A great way to take advantage of Panama's position would be to become part of the Solar Alliance. So far, Panama has not had any big project to produce solar energy for domestic or commercial purposes so the decision to enter this market will represent significant expenses to its first mover, who will bare the burden of innovation in this field.

With the great resources of experience that the International Solar Alliance has to offer, Panama could make the initial steps to produce solar energy and decrease its reliability on fossil fuels, which has both economic, social and environmental benefits. Panama is listed as a prospective member of the International Solar Alliance in its website but there is missing political willingness to take the necessary steps to enjoy the benefits of going solar.

Conclusions

The biggest challenge, perhaps, to Panama would be enabling the necessary internal mechanisms to ensure it takes full advantage of the India, world's fastest growing economy. Exports to India should be increased and diversified. Similarly Panama should enhance its capacity to absorb technology and benefit from it. This will take time but cannot be ignored. India can lend a helping hand in this. India's institutions in technology transfer and commercialization can help their counterparts in Panama in technology absorption, valorization and in using the intellectual property system effectively. There are many opportunities that are waiting to be explored, ranging from training of scientists to working together in building institutions and transforming the current ones. There needs to be a greater involvement of scientific and technical institutions in transfer of technology..

A stronger, more effective agricultural and energy sector could help diversify Panama´s economy which heavily relies on services. At the same time, it could enable the achievement of the Sustainable Development Goals by Panama.

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