Research for Development

Venugopalan Ittekkot
Jasmeet Kaur *Editors*

Science, Technology and Innovation Diplomacy in Developing Countries

Perceptions and Practice

Springer

Research for Development

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Editors

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Foreword

Under Science Diplomacy, three types of activities were noted in 2010 by the Royal Society and American Association for the Advancement of Science: (i) informing science and supporting foreign policy objectives (*Science in Diplomacy*), (ii) diplomacy facilitating international cooperation (*Diplomacy for Science*), and (iii) scientific cooperation improving international relations (*Science for Diplomacy*). Though science diplomacy has been widely talked about since the 2010 Conference and Publication, countries have been using science for diplomacy much earlier. For example, during the "cold war" to keep open the channels of communication between countries with differing political systems. Also, many of the activities of non-governmental organizations such as the International Council of Scientific Union (now International Science Council) were promoting partnerships between international and national science unions, or regional scientific institutions like CERN opening their research facilities to non-European scientists could be considered in this category.

Science and technology have the tools to confront many of the challenges facing humanity in the field of environment, health, and energy with their huge economic, social, and political consequences. The UN Development Agenda 2030 with its Sustainable Development Goals addresses the above challenges and highlights the role of international partnerships to develop and apply science and technology-based solutions, and the needed capacity for their implementation. To be successful, broad partnerships involving governmental and non-governmental actors are needed. Here too, NGOs have played an important role in developing the needed scientific base for understanding emerging issues, which were later used by governments to develop scientifically sound policies. An important example is the scientific assessment on the "Global Carbon Cycle" conducted by the Scientific Committee of Problems of the Environment (SCOPE) working in cooperation with UNEP some 40 years ago. It subsequently provided the background for the establishment of the IPCC. Through working with UN organizations, SCOPE has also helped bring to the political table recent topics that have major consequences such as plastics in the oceans and large marine ecosystems.

For developing countries, "Science Diplomacy" offers a tool to tackle these challenges by better leveraging international science partnerships and cooperation for

their specific needs. With their Conferences, Training Workshops, and publications for more than three decades, the NAM S&T Centre, New Delhi has been contributing to the promotion of science and technology in developing countries. This is being done in partnership with International Governmental and Non-governmental Scientific Organizations as well as research and academic networks. The Centre's current publication also focuses on science diplomacy in developing countries. The contributions to the book describe how countries have been able to leverage bilateral and regional North-South, and South-South Science and Technology Cooperation, and their participation in international organizations and science programs to strengthen their science and technology base by building the needed capacity. The publication will certainly enhance the awareness of the topic in developing countries. But more importantly, it informs on the prevailing perceptions of the subject and how it is being currently practiced as well as identifies the additional efforts and broad partnerships needed to better align science and policy at the national level. The book is a timely and useful contribution toward improving international science partnerships to achieve Sustainable Development Goals (SDGs).

Jon Samseth
President of SCOPE
Amstelveen, The Netherlands

Preface

Though Science Diplomacy has been practiced for many centuries in some form or other, it has assumed remarkable importance since the beginning of the twenty-first century. This comes from the need to tackle common problems facing humanity with the application of science and technology. The related UN initiatives such as the Millennium Declaration with its Millennium Development Goals (MDGs), or the current Sustainable Development Agenda 2030 with the Sustainable Development Goals (SDGs) required the services of diplomats as well as the active involvement and inputs from the scientific community. This cooperation between experts in Science and Technology and foreign policy personnel—in other words, Science, Technology and Innovation (STI) Diplomacy—becomes imperative in forging the needed regional and global partnerships and international cooperation to achieve the goals.

The topic got a new momentum with the joint Royal Society—American Association for the Advancement of Science (AAAS) Conference and Publication in 2010, and STI Diplomacy (STID) has become a discipline by itself. Today several programs and institutional facilities are available worldwide to promote the "Science of Science Diplomacy". The need for STI Diplomacy was further demonstrated during the Covid-19 pandemic when S&T Professionals played a proactive role in facilitating international cooperation among countries to benefit from scientific advancements for tackling the pandemic.

Considering the potential role of STID for developing countries in the application of S&T for sustainable development, the Centre for Science and Technology of the Non-Aligned and Other Developing Countries (NAM S&T Centre) has actively pursued its promotion in its member countries. The Centre organized Conferences and Training Workshops on the topic in the Islamic Republic of Iran, Republic of India, and Republic of South Africa with the participation of science and policy-making communities from developing countries. They were specially invited because of their engagements and knowledge in relevant STID fields in their respective countries and organizations. The current book is a collection of updated contributions from the above Workshops describing the current understanding and developments in STI Diplomacy by practicing policymakers and S&T professionals in Bolivia, Egypt, India, Iran, Nepal, Mauritius, Palestine, Sri Lanka, and South Africa as well

as invited chapters from S&T professionals in Europe engaged in cooperation with countries in the global South. These chapters have undergone NAM S&T Centre's internal review process.

The book mainly provides a developing country perspective on international S&T cooperation and the role of Science, Technology, and Innovation Diplomacy (STID) in leveraging it for sustainable development, and the need for strengthening the role of STID in foreign policy and strategies of governments.

We thank Dr. Amitava Bandopadhyay, Director-General of NAM S&T Centre for taking the initiative for the publication of the book, and his support and invaluable advice throughout the process. We are grateful to Ms. Manopriya Saravanan, Mr. Renu Boopalan and Ms. Diya Ma at Springer-Nature, Singapore for their advice and support in preparing this book.

It is hoped that the book will be a useful addition to the available literature on the topic and will provide information on how STID is being perceived by the S&T and science policy communities in the Global South with their attendant implications for relationships with partners in the Global North.

Hamburg, Germany — Venugopalan Ittekkot
New Delhi, India — Jasmeet Kaur Baweja

Introduction

It is widely recognized that *Science, Technology, and Innovation (STI)* is a key driver for economic empowerment and capacity building in any country. Many times, science and technology can be useful to improve relations between countries because there is a commonality of interest for all in the field of science. Moreover, science can play a bridging role between the countries through their scientists, which have weak political relations. It means that science can be effectively used as a tool of diplomacy for the sake of developing better relations among countries.

In the current globalized society, no country can exist without any relationship with other countries and must collaborate with each other on issues of mutual interest such as research and development, transfer of technology, trade, and commerce besides the diplomatic relationship.

In the age of global knowledge economy, STI Diplomacy has become an important mechanism for South-South and North-South relations in pursuit of scientific collaboration, co-generation of knowledge; usage of innovative technology for socio-economic benefits and fulfilling the Sustainable Development Agenda-2030. This reality is a clear indication that there is a need for countries in the global south to deepen cooperation and enhance competitive and comparative advantages through Science, Technology, and Innovation (STI). STI Diplomacy thus plays a critical role as an enabler and driver of knowledge and technology for economic development across the borders.

Experts in S&T can help the diplomatic community and facilitate negotiations on many issues with serious foreign policy implications. On the other hand, the acquisition of S&T knowledge, resources, and expertise from other influential countries might face enormous problems and bottlenecks; therefore, appropriate dialog and cooperation are required to sort them out. Diplomats who may not otherwise fully understand the scientific and technological intricacies need help from the scientists in such a scenario. In today's context, it is also ensured that STI Diplomacy as well as Research and Development (R&D) contribute positively to foreign policy and vice versa, leading to strong global STI governance through the deployment of STI policy as a mechanism to resolve the common developmental challenges.

Broadly the Global South should maximize efforts toward the strengthening of STI policies, initiatives, programs, and increased investments aimed at the advancement of scientific cooperation. Scientists and researchers, innovators, and entrepreneurs are at the center of influencing the global agenda through competitive thinking and collaboration and deserve strong support. Evidence-based initiatives will create better conditions for STI collaboration and an increase in successful regional, national and foreign policy agendas. The in-country policies on STI in the Global South must be strengthened to enable scientific advice to influence the amendments of foreign policies that directly convey how countries should engage beyond their political borders through STI Diplomacy.

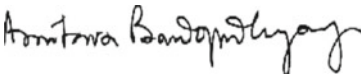
Considering the importance of the subject, the Centre for Science and Technology of the Non-Aligned and Other Developing Countries (NAM S&T Centre), New Delhi, India jointly with the respective organizations in Iran, India, and South Africa had organized a series of International Workshops/Training Programs in 2012, 2014, and 2019, respectively. These events generated significant interest among the participants from the NAM and Other Developing Countries including the host countries. Experiences from these activities and related individual contributions provided a basic foundation for this present book. It has also been realized that most of the information available on STI Diplomacy is available in scattered form in articles published in journals and electronic media and there are not many comprehensive books and monographs on the subject especially with respect to the developing countries.

In the present book titled "Science, Technology & Innovation Diplomacy in Developing Countries: Perceptions and Practice" which contains 23 Chapters contributed by experts from both the developing and developed countries, an effort has been made to compile existing knowledge on the subject and covers the highlights of both South-South and North-South Cooperation.

I take this opportunity to thank Prof. Jon Samseth, President, Scientific Committee of Problems of the Environment (SCOPE), Amstelveen, The Netherlands for kindly agreeing to write the "Foreword". For their kind support and encouragement, we are thankful to Dr. Loyola D'Silva, Executive Editor, Springer Nature, Singapore, and Mr. Renu Boopalan, Project Coordinator—Total Service, Books Production, Springer Nature, Chennai, India.

I would like to express my gratitude to the Editors, Prof. Venugopalan Ittekkot, Former Director, Leibniz Centre for Tropical Marine Research (ZMT), Bremen, Germany and Ms. Jasmeet Kaur Baweja, Programme Officer, NAM S&T Centre, New Delhi, India for their initiatives and efforts, and sharing their time in editing the papers for this book. I also express my gratitude to Mr. Madhusudan Bandyopadhyay, Senior Adviser, NAM S&T Centre for his kind advice and guidance in the planning of the book and for taking this publication project forward. I also acknowledge the interest and valuable efforts of the entire team of the NAM S&T Centre. I am especially thankful to Mr. Pankaj Buttan, Data Processing Manager, and Mr. Rahul Kumra, Private Secretary to the Director General, NAM S&T Centre for their support in bringing out this publication.

I hope that this publication will be a useful reference material for scientists, technologists, young researchers, diplomats, government officials, policymakers, and other stakeholders who are actively engaged directly or indirectly in STI Diplomacy and associated activities.



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Contents

Abbreviations

4IR	Fourth Industrial Revolution
4S	Society for the Social Studies of Science
AAAS	American Association for the Advancement of Science
AAS	African Academy of Sciences
ACP	African, Caribbean and Pacific
ADB	Asian Development Bank
Africa CDC	Africa Centres for Disease Control and Prevention
AFTCOR	Africa Taskforce on Coronavirus Preparedness and Response
AGOA	African Growth and Opportunity Act
AI	Artificial Intelligence
AIDIA	Asian Institute of Diplomacy and International Affairs, Kathmandu
AIST	National Institute of Advanced Industrial Science & Technology, Japan
ANSSI	National Cybersecurity Agency of France
ARC	Agricultural Research Council, South Africa
ARIC	Aerospace Research and Innovation Center
ART	Anti-Retroviral Treatment
ASEAN	Association of South-East Asian Nations
ASF	African Swine Fever
ASRT	Academy of Scientific Research & Technology, Egypt
ASSA	Association of Science Academies and Societies in Asia
ASSAf	Academy of Science of South Africa
AU	African Union
AVN	African Very Long Baseline Interferometry (VLBI) Network
BBNJ	Biodiversity of areas Beyond National Jurisdiction
BENEFIT	Benguela Environment Fisheries Interaction and Training
BIMSTEC	Bay of Bengal Initiative for Multi-Sectoral Technical and Economic Cooperation
BESSY	Berlin Electron Storage ring company for Synchrotron radiation

BMBF	Federal Ministry for Education and Research, Germany
BMZ	Feberal Ministry for Economic Cooperation, Germany
BRICS	Brazil, Russia, India, China, and South Africa
BSP	Biosolar Purification System
CAS	Chinese Academy of Sciences
CBD	Convention on Biological Diversity
CBPP	Contagious Bovine Pleuropneumonia
CBRC	Computational Biology Research Center
CCD	Convention to Combat Desertification
CDCP	Certified Data Centre Professionals
CEERI	CSIR-Central Electronics Engineering Research Institute, Pilani, India
CERN	European Council for Nuclear Research
CII	Confederation of Indian Industry
CMERI	CSIR-Central Mechanical Engineering Research Institute, Durgapur, India
CNPq	National Council for Scientific and Technological Development, Brazil
CNR	National Research Council, Italy
COD	Chemical Oxygen Demand
COP	Conference of the Parties
COVID	Corona Virus Disease
CSIR	Council for Scientific and Industrial Research
CSSRI	Central Soil Salinity Research Institute, Karnal, India
DAAD	German Academic Exchange Service
DAE	Department of Atomic Energy, India
DAILAB	DBT-AIST International Laboratory for Advance Biomedicine, IIT Delhi, India
DeSIRA	Development-Smart Innovation through Research in Agriculture Initiative
DESY	Deutsches Elektronen Synchrotron, Hamburg
DMC	Developing Member Country
DSI	Department of Science and Innovation, South Africa
DST	Department of Science and Technology, India
DUT	Durban University of Technology
EDB	Economic Development Board
EEZ	Exclusive Economic Zone
EMPHNET	Eastern Mediterranean Public Health Network
ENSA	Ecole Nationale Supérieure d'Architecture, France
ESOCITE	Latin American Association for the Social Studies of Science and Technology
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
FARC	Food and Agricultural Research Council
FAREI	Food and Agricultural Research and Extension Institute

FASIE	Foundation for Assistance to Small Innovative Enterprises, Russia
FASRC	Federation of Arab Scientific Research Councils
FDI	Foreign Direct Investment
FICCI	Federation of Indian Chambers of Commerce & Industry
FIDEA	Fishing Data East Africa
FMD	Foot-and-Mouth Disease
FSM	Faecal Sludge Management
FTE	Full Time Equivalents
GCC	Gulf Cooperation Countries
GDERD	Gross Domestic Expenditure on Research and Development
GII	Global Innovation Index
GISTIC	KACST Technology Innovation Center
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
GRC	Global Research Council
HCD	Human Capital Development
HCIE	Higher Council for Innovation and Excellence, Palestine
HDI	Human Development Index
HIV	Human Immunodeficiency Viruses
HPC	High Performance Computing
HSC	Higher School Certificate
HSRC	Human Sciences Research Council, South Africa
HySA	Hydrogen South Africa
IAC	Information Access Centre
IAFS	India-Africa Forum Summit
IAP	Inter Academy Partnership
IARI	Indian Agricultural Research Institute
IBSA	India, Brazil, and South Africa
ICAR	Indian Council of Agricultural Research
ICGEB	International Centre for Genetic Engineering and Biotechnology
ICMR	Indian Council of Medical Research
ICT	Information and Communication Technology
ICTA	Information and Communication Technologies Authority of Mauritius
IDRC	International Development Research Center
IEITCP	India-Ethiopia Innovation & Technology Commercialization Programme
IFA	Institute of Foreign Affairs
IFC	International Financial Centre
IFCPAR/CEFIPRA	Indo-French Centre for Promotion of Advanced Research
IGD	Institute for Global Dialogue
IIASA	International Institute for Applied Systems Analysis
IIT	Indian Institute of Technology
IJSC	India-Japan Science Council

ILO	International Labour Organisation
IMO	International Maritime Organization
IMF	International Monetary Fund
INS	Indian Nuclear Society
INSA	Indian National Science Academy
IOM	International Organization for Migration
IORARC	Indian Ocean Rim Association for Regional Co-operation
IORG	Indian Ocean Research Group
IOTO	Indian Ocean Tourism Organisation
IPBES	Intergovernmental Platform on Biodiversity and Ecosystem Services
IPOI	Indo-Pacific Oceans' Initiative
IPR	Intellectual Property Right
ISA	International Solar Alliance
ISC	International Science Council
ISC-ROA	ISC Regional Office for Africa
ISRO	Indian Space Research Organization
ISRP	India Science and Research Fellowship Programme
ISTAD	International S&T Affairs Directorate, CSIR, India
ITA	Information Technology Authority (ITA), Oman
ITER	International Thermonuclear Experimental Reactor
ITU	International Telecommunication Union
JAES	Japan Atomic Energy Society
JAMSTEC	Japan Agency for Marine-Earth Science and Technology
JAXA	Japan Space Exploration Agency
JINR	Joint Institute for Nuclear Research
JIRCAS	Japan International Research Center for Agricultural Sciences
JIRI	Joint Initiative for Research and Innovation
JWG	Joint Working Group
KACST	King Abdulaziz City for Science and Technology
KEK	High Energy Accelerator Research Organization, Japan
KPIs	Key Performance Indicators
KSP	Knowledge Sharing Program
KYUTECH	Kyushu Institute of Technology
LAPA	Local Adaptation Plans of Action
LASEE	Law of Action and the Foreign Service of the State
LATAM	Latin American Region
LDCs	Least Developed Countries
MADAM	Mangrove Dynamics and Management
MAFF	Ministry of Agriculture, Forestry and Fisheries, Japan
MCSA	Minerals Council of South Africa
MDGs	Millennium Development Goals
MDT	Mauritius Deuterium Telescope
MEA	Ministry of External Affairs, India

MEDRC	Middle East Desalination Research Center
MeitY	Ministry of Electronics & Information Technology, India
MENA	Middle East and North Africa
MERCOSUR	Southern Common Market
MESC	Middle East Scientific Cooperation group
MEXT	Ministry of Education, Culture, Sports, Science and Technology, Japan
MFAA	Mid-Frequency Aperture Array
MIC	Middle Income Country
MITRA	Multi-frequency Interferometry Telescope for Radio Astronomy
MMP	Mandela Mining Precinct
MNRE	Ministry of New & Renewable Energy, India
MOA	Memorandum of Association
MoAFW	Ministry of Agriculture and Farmers' Welfare, India
MoCIT	Ministry of Communication and Information Technology, India
MoEFCC	Ministry of Environment, Forest and Climate Change, India
MoES	Ministry of Earth Sciences, India
MoEST	Ministry of Education, Science and Technology, Nepal
MoFA	Ministry of Foreign Affairs, Nepal
MoFE	Ministry of Forestry and Environment
MON	Ministry of Education and Science, Russia
MOST	Ministry of Science and Technology
MoU	Memorandum of Understanding
MRC	Mauritius Research Council
MRIC	Mauritius Research and Innovation Council
MRT	Mauritius Radio Telescope
MTCI	Ministry of Technology, Communication and Innovation, Mauritius
MTSF	Medium-Term Strategic Framework
NACI	National Advisory Council on Innovation, South Africa
NAFTA	North America Free Trade Area
NAL	CSIR-National Aerospace Laboratories (NAL), Bengaluru, India
NAM S&T Centre	Centre for Science and Technology of the Non-Aligned and Other Developing Countries
NAM	Non-Aligned Movement
NASAC	Network of African Science Academies
NASRC	Nepal Agriculture Research Council
NAST	Nepal Academy of Science and Technology
NASTEC	National Science and Technology Commission of Sri Lanka
NCPOR	National Center for Polar & Ocean Research
NDP	National Development Plan

NEERI	CSIR- National Environmental Engineering Research Institute, Nagpur, India
NEPAD	New Partnership for African Development
NGO	Non-Governmental Organization
NHRC	Nepal Health Research Council
NIA	National Information Society Agency
NIPR	National Institute of Polar Research, Japan
NIRDA	National Industrial Research & Development Agency
NNDV	Normalized Difference Vegetation Index
NPA	National Policy Agenda
NPC	National Planning Commission
NRDS	National Research and Development Strategy
NRF	National Research Foundation
NRN	Non-Resident Nepali
NRNA	Non-Resident Nepali Association
NSFC	National Natural Science Foundation
NSI	National System of Innovation
NSTDA	National Science and Technology Development Agency, Nepal
NUPPAC 11	Conference on Nuclear and Particle Physics
ODA	Official Development Assistance
OIE	Office Internationale des Epozooties (World Organization for Animal Health)
O-RET	Ocean-Renewable Energy Technology
OWSD	Organization for Women in Science for the Developing World
PALAST	Palestinian Academy for Science and Technology
PHC	Hubert Curien Partenariat
Pica	Palestinian International Cooperation Agency
PMG	Parliamentary Monitoring Group
PPR	Peste des Petits Ruminants
PRIO	Peace Research Institute Oslo
R&D	Research and Development
RDI	Research Development and Innovation
RDT	Research, Development and Training
RETA	Regional Technical Assistance
RFBR	Russian Foundation for Basic Research
S&T	Science and technology
SADST	South African Department of Science and Technology
SANReN	South African National Research and Education Networks
SASKA	South African Square Kilometre Array
SAARC	South Asian Association for Regional Cooperation
SACIDS	Southern Africa Centre for Infectious Disease Surveillance
SACMEQ	Southern and Eastern Africa Consortium for Monitoring Educational Quality

SACNASP	South African Council for Natural Scientific Professions
SADC	Southern African Development Cooperation
SAFIRC	South African Fourth Industrial Revolution Centre
SANSA	South African National Space Agency
SARAO	South African Radio Astronomy Observatory
SARGDDC	South Africa Regional Global Disease Detection Centre
SATREPS	Science, Technology, and Research Partnership for Sustainable Development
SC	Steering Committee
SCO	Shanghai Cooperation Organisation
SESAME	Synchrotron-Light for Experimental Science and Applications in the Middle East
SIDS	Small Island Developing State
SISTERs	Satellite Institutes for Special Training Education and Research
SKA	Square Kilometre Array
SME	Small and Medium Enterprises
SPICE	Science for the Protection of Indonesian Coastal Ecosystems
SSARAO	South African Radio Astronomy Observatory
SSC	South-South Cooperation
SSTC	South-South and Triangular Cooperation
STEM	Sciences, Technology, Engineering and Mathematics
STEPAN	Science and Technology Policy Asian Network
STI	Science, Technology and Innovation
STID	Science, Technology and Innovation Diplomacy
STIEP	Science, Technology, and Innovation-driven Entrepreneurship Partnership
STIP	Science, Technology and Innovation Policy
STISA	Science, Technology and Innovation Strategy for Africa
SWIO	South West Indian Ocean
SWIOFC	Southwest Indian Ocean Fisheries Commission
TADs	Transboundary Animal Diseases
TAFIRI	Tanzania Fisheries Research Institute
TENET	Tertiary Education & Research Network of South Africa
TIA	Technology and Innovation Agency
TIMSS	Trends in International Mathematics and Science Study
TRL	Technology Readiness Level
TVET	Technical and Vocational Education and Training
TWAS	The World Academy of Sciences
TWAS-SAREP	TWAS—Sub Saharan Africa Regional Partner
TYAN	TWAS Young Affiliates Network
TYIP	Ten-Year Innovation Plan
UAE	United Arab Emirates
UCT	University of Cape Town
UN	United Nations

UN OCHA	UN Office for the Coordination of Humanitarian Affairs
UN TAA	UN Technical Assistance Administration
UNCLOS	UN Convention on the Law of the Sea
UNCTAD	UN Conference on Trade and Development
UNDP	UN Development Programme
UNEP	UN Environmental Programme
UNESCO	UN Educational, Scientific and Cultural Organization
UN-ESCWA	UN Economic and Social Commission for Western Asia
UN-FCCC	UN Framework Convention on Climate Change
UNODC	UN Office on Drugs and Crime
UoM	University of Mauritius
VATEL	International Business School, France
VLBI	Very Long Baseline Interferometry
VPN	Virtual Private Network
WASCAL	West African Science Service Centre on Climate Change and Adapted Land Use
WEF	World Economic Forum
WFI	World Food India
WFP	World Food Programme
WHO	World Health Organization
WIOGEN	West Indian Ocean Governance & Exchange Network
WIOMSA	Western Indian Ocean Marine Science Association
WIPO	World Intellectual Property Organisation
WTO	World Trade Organisation
ZMT	Leibniz Centre for Tropical Marine Research, Bremen, Germany

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This book provides a developing country perspective on the internationalization of science and the role of science, technology and innovation diplomacy (STID) in leveraging scientific cooperation for sustainable development. Through more than 20 articles contributed by individuals from government departments and academic and research institutions in nine developing countries, it provides a conceptual understanding of the subject and reveals the prevailing perceptions on its practices. The book highlights the significance of international cooperation at bilateral, regional and multilateral levels as well as the challenges in developing North-South Cooperation and the need for strengthening STID in foreign policy and strategies of governments. The book is a useful reference for scientists, technologists, researchers, diplomats, government officials, policy makers and other stakeholders who are engaged directly or indirectly in STID and associated activities.