South-South in Action

Sustainable Development through the Peaceful Uses of Nuclear Science and Technology

The International Atomic Energy Agency

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United Nations
Office for South-South Cooperation

IAEA
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Foreword

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The International Atomic Energy Agency (IAEA) and the United Nations Office for South-South Cooperation (UNOSSC) are pleased to jointly present this volume of South-South in Action. This is the first report of the IAEA on South-South and triangular cooperation. The Agency greatly welcomes the opportunity to contribute to the South-South in Action series.

The IAEA, while perhaps best known as the world's "nuclear watchdog", has a long history of helping countries to achieve their development goals. For more than 60 years, it has worked to make nuclear science and technology available to developing countries in ways that make a real difference to the lives of their people.

Many developing countries have acquired a high level of expertise in nuclear technology in areas such as human health and agriculture, and many actively support neighbouring countries, for example by providing training on nuclear techniques to doctors and scientists. There are numerous excellent examples of South-South cooperation in the use of peaceful nuclear technology. This makes a vital contribution to helping the Agency to deliver its support to Member States.

Since 2015, helping countries to achieve the Sustainable Development Goals using relevant nuclear technology has been an important part of the Agency's work. In fact, the IAEA helps countries to use nuclear science and technology to meet at least nine of the 17 Sustainable Development Goals directly, including those aimed at ending hunger, improving human health, increasing the availability of clean water and, of course, increasing access to affordable and clean energy. This report provides an overview of the IAEA achievements to date.

In implementing its Atoms for Peace and Development mandate, the Agency works closely with Member States, United Nations partners and development agencies. The 2030 Agenda for Sustainable Development has created significant momentum for the IAEA by highlighting the importance of scientific and technological innovation in accelerating sustainable development. Nuclear science and technology are already making a major contribution and their potential is enormous.

The Second High-level United Nations Conference on South-South Cooperation to be held in March 2019 will provide an occasion to reflect on the progress made since the 1978 adoption of the Buenos Aires Plan of Action for Promoting and Implementing Technical Cooperation among Developing Countries and to consider new opportunities.

The IAEA is committed to expanding the application of South-South and triangular cooperation in the field of peaceful nuclear technology as part of its contribution to global efforts to achieve sustainable development.

TheIAEA,whichbringstogether171MemberStates,hasitsheadquartersinVienna,Austria.(Photocredit:HazelPattison/IAEA)

Introduction

THEIAEA:“ATOMSFORPEACEANDDEVELOPMENT”

Guided by the goal of using nuclear energy for the benefit of mankind, the IAEA has been making a unique contribution to peace and development for over 60 years. The IAEA mandate is to work with its Member States and multiple partners worldwide to support the safe, secure and peaceful application of nuclear technology. This is reflected in the IAEA mandate: “Atoms for Peace and Development”.

The 2030 Agenda for Sustainable Development and the Addis Ababa Action Agenda explicitly recognize the role of innovation, science and technology as drivers of sustainable development. Well-known for its work in ensuring the non-proliferation of nuclear weapons, the IAEA also plays a unique role in the development architecture as the only United Nations agency specifically mandated to support the transfer of nuclear technology and know-how. Based on that mandate, the IAEA facilitates the exchange of nuclear technology and knowledge for peaceful uses to and among Member States, with a particular focus on the needs of less technologically developed countries.

The IAEA supports Member States to use nuclear technologies as enablers of socioeconomic progress, thus helping countries to achieve their national development targets. Member States have successfully applied these technologies to fight Ebola and avian influenza outbreaks, map out groundwater resources, develop crops that produce more resilient and abundant food, measure pollution and combat cancer, to mention just a few examples.

Evidence-based decision-making will be key for the success of the 2030 Agenda. Through its role as a provider of credible, fast and accurate data through nuclear technology, the IAEA is an effective partner of Member States and policymakers seeking to keep track of progress in different areas of development and adopt effective policies.

South-South and triangular partnerships play an important role in supporting the sharing of nuclear knowledge and technology and enhancing the impact and sustainability of the IAEA contribution to sustainable development.

By promoting regional self-reliance and strengthening local ownership and expertise, the work of the IAEA is consistent with the objectives and principles of South-South cooperation identified in the 1978 Buenos Aires Plan of Action for Promoting and Implementing Technical Cooperation among Developing Countries (BAPA) and the 2009 Nairobi outcome document.

This report provides an overview of the IAEA experience in applying South-South and triangular cooperation modalities in its work,[1] primarily through its technical cooperation programme. Chapter I presents the policy and programmatic framework shaping the Agency´s approach. Chapter II provides a compilation of stories that illustrate the concrete impact of South-South and triangular cooperation in different areas of IAEA engagement. Chapter III takes stock of the IAEA experience to date and outlines the way forward.

1 ReferencestoSouth-Southcooperationandtriangularcooperationinthisreportareinlinewiththedefinitionsprovidedinthe2016 NoteoftheSecretary-GeneralontheframeworkofoperationalguidelinesonUnitedNationssupporttoSouth-Southandtriangularcooperation (documentSSC/19/3).ThroughoutitsactivitiesinsupportofMemberStates,theIAEAcombinesbothapproachesinacomplementarymanner. Referencestotechnicalcooperationamongdevelopingcountries(TCDC),foundinanumberofIAEAdocuments,aretobeunderstoodinthe same vein.

IAEA Director General Mr. Yukiya Amano together with other keynote speakers at an IAEA General Conference side event on "Atoms for Peace and Development: IAEA and the Post-2015 Sustainable Development Goals", IAEA, Vienna, Austria, 15 September 2015. (Photo credit: Dean Calma/IAEA)

Chapter 1

POLICYANDPROGRAMMATICFRAMEWORKFORSOUTH-SOUTH AND TRIANGULAR COOPERATION

Policy and Strategic Outlook

Promoting the Peaceful Use of Nuclear Technology

With 171 Member States, the IAEA is the world's principal forum for scientific and technical cooperation in the peaceful use of nuclear technology. Its mission is underpinned by three main areas of work: non-proliferation of nuclear weapons, ensuring the safety and security of nuclear facilities and nuclear applications, and supporting the peaceful uses of nuclear technology.

The IAEA draws its mandate from the IAEA Statute,[2] which entered into force on 29 July 1957. Article II of the Statute states that the purpose of the IAEA is to "accelerate and enlarge the contribution of atomic energy to peace, health and prosperity throughout the world" and to ensure, "so far as it is able, that assistance provided by it or at its request or under its supervision or control is not used in such a way as to further any military purpose". Article III lists the broad functions that the IAEA is authorized to perform, including promoting "the practical application of atomic energy for peaceful purposes" and providing materials, services, equipment and facilities for that purpose; fostering "the exchange of scientific and technical information on peaceful uses of atomic energy"; and encouraging "the exchange and training of scientists and experts in the field of peaceful uses of atomic energy" (p. 5).

These provisions underline the importance of fostering the exchange of scientific and technical information and encouraging the exchange and training of scientists and experts in the field of peaceful uses of atomic energy. Indeed, IAEA activities in this regard started immediately, with over 200 fellowships awarded in 1958, followed by the launch of a fully fledged technical assistance programme (later called the "technical cooperation programme") in 1959.

Tailor-made Assistance with a Focus on Developing Countries

Building on the Statute, guiding principles and general operating rules[3] further define the parameters of IAEA technical assistance, reiterating, inter alia, the principles of non-conditionality, sovereignty of States and alignment with national development priorities. The document identifies the promotion of cooperation between States as a way to advance the contribution of atomic energy to peace and prosperity. It also states that "[t]he nature, extent and scope of technical assistance to be provided to the requesting State or

2 The full text is available at https://www.iaea.org/sites/default/files/statute.pdf.
3 ThemostupdatedversionofthedocumentTheRevisedGuidingPrinciplesandGeneralOperatingRulestoGoverntheProvisionofTechnicalAssistance by the Agency is available at https://www.iaea.org/sites/default/files/publications/documents/infcircs/1979/infcirc267.pdf.

group of States shall be defined by the Government or Governments concerned", thus articulating a tailor-made and demand-driven mechanism.

Advancing Cooperation among Developing Countries and Fostering Self-reliance

As developing countries enhanced their national capacities and institutions to apply and develop nuclear technologies, further emphasis was placed on developing South-South and triangular cooperation approaches. These approaches have been generally referred to by the IAEA as "technical cooperation among developing countries (TCDC)". The increased interest of Member States in fostering this cooperation has been reflected in General Conference resolutions[4] related to the work of the IAEA technical cooperation programme. Throughout the years, Member States have consistently encouraged strengthening TCDC, including as a mechanism to provide support to least developed countries (LDCs).

Reflecting this policy direction, the IAEA overall Technical Cooperation Strategy[5] and the Medium Term Strategy for the period 2018–2023[6] provide the strategic framework for incorporating South-South and triangular cooperation approaches into programmatic activities.

The Technical Cooperation Strategy outlines the importance of making effective use of nuclear science and technology to achieve "tangible socioeconomic impact". The Strategy highlights the central role of TCDC as a mechanism for strengthening the efficiency and effectiveness of technical cooperation activities and optimizing the use of resources. It emphasizes the importance of directing technical cooperation towards fostering self-reliance, noting that as countries and institutions advance their technical knowledge and understanding, the IAEA would increasingly become a source of quality assurance, a focal point for information exchange, and a catalyst for regional and international cooperation.

On this basis, the IAEA maximizes the potential of technically-advanced countries and institutions to lead regional initiatives and serve as multipliers, thus ensuring the self-sustainability of its technical cooperation activities.

"As countries progress with development, their growing capabilities and experience become important resources for others attempting to follow a similar path. Some of the more advanced developing countries have nuclear know-how and nuclear establishments that equal those of developed countries in certain areas. The Agency plays an important role in the nuclear field in fostering partnerships among such countries, and between them and the least developed countries (LDCs). It is integral to the TC [Technical Cooperation] Strategy to expand this role to the maximum extent possible"

(Technical Cooperation Strategy, para. 26).

The Medium Term Strategy 2018-2023, which serves as a strategic direction and roadmap for the Secretariat to prepare the IAEA programme and budget during the period in question, notes the importance of collaboration among Member States, including research and development on the beneficial uses of nuclear energy and nuclear sciences. It also notes that Member State capacities will be used where possible through various networks and the IAEA Collaborating Centre scheme. The Medium Term Strategy also highlights the importance of supporting knowledge-sharing to foster nuclear safety and security and facilitate increased access to nuclear science and technology.

4 IAEA General Conference resolutions are available at https://www-legacy.iaea.org/About/Policy/GC/GC61/Resolutions/index.html.
5 The full text of document GOV/INF/824 is available at https://www.iaea.org/sites/default/files/documents/tc/TC-Strategy.pdf.
6 The full texts of current and past IAEA Medium Term Strategies are available at https://www.iaea.org/about/overview/medium-term-strategy.

"The Agency will seek to promote cooperation in response to evolving challenges for development through information and knowledge exchange, as well as through capacity strengthening initiatives among Member States, utilizing in particular the expertise available in resource centres in the regions"

(Medium Term Strategy 2018-2023).

Leveraging Partnerships for South-South Cooperation

The 2030 Agenda calls on Member States and the international community at large to revitalize the global partnership for development (Sustainable Development Goal 17). The IAEA participates in the United Nations High-level Political Forum to take stock of progress on the Sustainable Development Goals (SDGs). It also is part of the United Nations Inter-agency Task Team on Science, Technology and Innovation for the SDGs, a component of the Technology Facilitation Mechanism launched under the 2030 Agenda.

Because the work of the IAEA often relates to areas of development where other actors play a leading role, partnerships are of particular importance for the Agency. To ensure coordinated action and the complementarity of its work, the IAEA has developed effective partnerships with individual Member States, international and regional organizations, research institutes, academia and the private sector. The IAEA sees partnerships as a strategic enabler for achieving its objectives, increasing the impact of its work and effectively addressing the needs and expectations of its Member States.

In line with the targets of Goal 17, interregional and regional IAEA projects provide a platform for countries at different levels of technological development to join efforts and expand their knowledge of and access to scientific expertise as well as further technological innovation for development. They also enable specialists to work collaboratively to address common challenges and improve or learn new skills.

The partnership between the IAEA and the Food and Agriculture Organization of the United Nations (FAO) offers a unique example of inter-agency cooperation, where the Joint FAO/IAEA Programme of Nuclear Techniques in Food and Agriculture is implemented though the Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture, established in 1964 and hosted at IAEA headquarters. This strategic partnership has enabled the two organizations to work in synergy through joint programming based on their complementary mandates and common goals. The work carried out has had a tangible socioeconomic impact at the national, regional and global levels, contributing to food security, poverty alleviation and sustainable livelihoods.

Another key partnership is the one established with the World Health Organization (WHO), with which the IAEA works closely on cancer-related issues and non-communicable diseases. The IAEA/WHO Network of Secondary Standard Dosimetry Laboratories (SSDL

Groundbreaking for the renovation of the IAEA nuclear applications laboratories and celebration of the 50th anniversary of the Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture, Seibersdorf, Austria, 29 September 2014. (Photo credit: Dean Calma/IAEA)

Network),[7] established in 1976, is an important element of this partnership. It was set up to improve accuracy in radiation dosimetry, which is essential in radiation therapy for cancer patients. The Network also promotes cooperation among its members, with the aim of facilitating the exchange of experiences and mutual support where possible.

At present, the IAEA Department of Technical Cooperation has 55 active partnership agreements, enabling the Agency to maximize the impact of its activities. Some of these arrangements explicitly include elements of South-South and triangular cooperation, as is the case, for example, with the Practical Arrangements signed in February 2018 with the Government of Indonesia on enhancing technical cooperation among developing countries and strengthening South-South cooperation, as well as agreements with the Government of Portugal in 2018, with Brazil in 2018, and with the China Atomic Energy Authority (CAEA) in 2017. Under the latter agreement, China agreed to provide regional training courses and longer-term education programmes such as master's degree and PhD programmes for students from developing countries, including LDCs and small island developing States (SIDS).

In addition, other forms of South-South and triangular cooperation take place outside formal partnership agreements or memorandums of understanding, such as the ongoing cooperation of Viet Nam with the Lao People's Democratic Republic and Cambodia. At present, through projects supported by the IAEA, Viet Nam is supporting Cambodia on radiation safety and the Lao People's Democratic Republic on non-destructive testing.[8]

Representatives from Cambodia, the Lao People's Democratic Republic, Viet Nam and the IAEA met in Vienna, Austria, on 11–13 June 2018. (Photo credit: IAEA)

7 More information is available at https://ssdl.iaea.org/Home/Members.

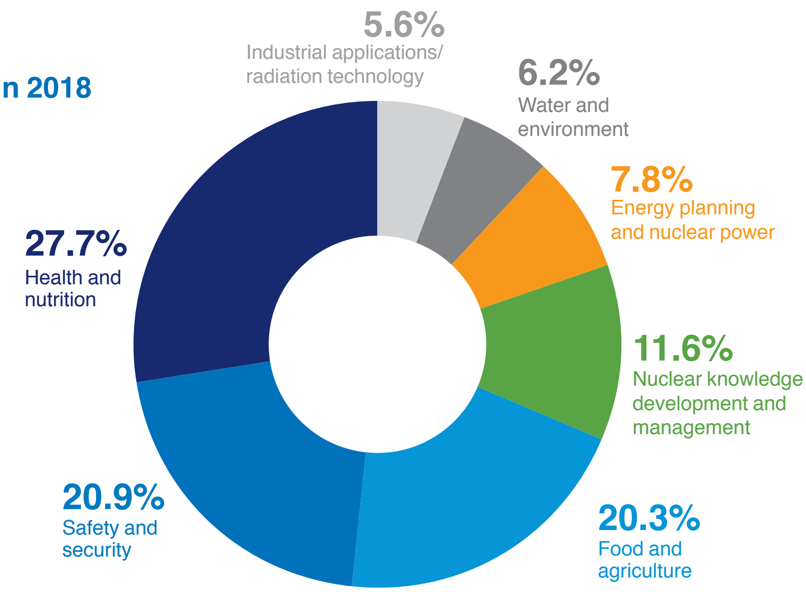
8 Non-destructive testing is used in industry to evaluate the integrity and properties of materials or components without causing damage to the tested object. It is used in fields as diverse as industry, art and archaeology, and emergency response.

The Technical Cooperation Programme

Supporting National and Regional Development Priorities through the Technical Cooperation Programme

The technical cooperation programme is the major IAEA vehicle for transferring nuclear technology to Member States, helping them to address key development priorities in seven areas of work: health and nutrition, food and agriculture, water and the environment, industrial applications and radiation technology, energy planning and nuclear power, radiation protection and nuclear safety and security, and nuclear knowledge development and management (see graph below).

IAEA technical cooperation disbursements by technical field in 2018



Work under each of these areas takes place through the implementation of projects designed to address development priorities identified by Member States and to have a sustainable socioeconomic impact. Projects are selected and prioritized based on national ownership and the existence of an enabling environment, which guarantees that they enjoy strong support from the government(s) involved.

FIGURES **2018**

146 Countries/territories receiving support

1,816 Fellowships and scientific visits

6,739 Meetings participants and other personnel assignments

TCF implementation rate **85,7%**

New resources for the technical cooperation programme: **€100m**
Technical Cooperation Fund: **€82.6 million**
Extrabudgetary resources: **€17.2m**
In-kind contributions: **€0.3m**

136 Revised Supplementary Agreements (as at 31 December 2018)

3,640 Expert and lectures assignments

3,282 participants in training courses'

196 Regional interregional training courses

€85.7 million 2018 target for voluntary contributions to the Technical Cooperation Fund (TCF)

€124.1m TC 2018 year-end budget (TCF, extrabudgetary resources and in-kind contributions)

CPFs valid as at 31 December 2018 **100**

CPFs signed in 2018 **24**

€27.9m Total value of TC procurement

91,4% Rate of attainment on payments at the end of 2018

Within the technical cooperation programme, South-South and triangular cooperation approaches are applied mainly in projects implemented under four regional/cooperative arrangements as well as in other regional and interregional projects. These projects bring together countries at different stages of technological development and offer a framework for adopting South-South and triangular cooperation approaches through pooling resources, facilitating the sharing of knowledge, experience and technology, and networking and cooperation among countries and institutions.

> *"The IAEA technical cooperation programme, as the major mechanism for the Agency to provide development services to its Member States, has transferred nuclear technology, supported human and institutional capacity-building, shared knowledge and expertise, and facilitated regional and international cooperation. It has decades of experience in working in partnership to achieve a common goal, which will serve it well in the era of the Sustainable Development Goals."*
>
> *Mr. Dazhu Yang, Deputy Director General, Head of the Department of Technical Cooperation*

Regional/Cooperative Agreements: An Effective Platform for South-South and Triangular Cooperation

The four regional/cooperative agreements under the auspices of the IAEA provide a permanent framework for dialogue and collaboration among countries in each region as well as a useful platform for interregional cooperation. Countries in each region come together on a regular basis, identify regional priorities as well as existing resources, and collectively agree on the projects that will be implemented. Those agreements foster regional ownership of activities and ensure that those activities are closely aligned with national and regional development needs.

While each of the agreements functions under specific modalities, all four share a general focus on strengthening capacities, sharing knowledge, resources and best practices among their members, and promoting sustainability and collaboration among the diverse actors using or associated with nuclear science and technology. Results achieved through South-South and triangular cooperation within the four agreements include:

- Strengthened cancer treatment and improvement of patient care and capacities in nuclear medicine programmes;
- Production of high-quality research on air quality and the environmental impact of industrial activities;
- Development of bioenergy and more resistant crops;
- Enhanced regional capabilities for monitoring marine radioactivity;
- Assessment of deep groundwater resources for sustainable management;
- Greater sustainability of national nuclear institutions; and
- Development of non-destructive testing capabilities.

Regional Cooperative Agreement for Research, Development and Training Related to Nuclear Science and Technology for Asia and the Pacific (RCA)[9]

RCA is the longest-standing regional cooperative agreement under Agency auspices. Under this agreement, scientists from six participating countries in the Asia and the Pacific region began working together in 1972 in diverse fields, including the application of nuclear science techniques for the breeding of new varieties of food crops. It progressively attracted the interest of other countries in the region and at present brings together 20 countries[10] at different levels of technological

9 More information is available at http://www.rcaro.org/.
10 As of 30 November 2018.

IAEA expert demonstrating linear accelerator quality-control procedures to medical physics residents from RCA countries enrolled in radiotherapy clinical training. (Photo credit: Brendan Healy/IAEA)

development, including a number of LDCs. In 2002, a Regional Office was established in the Republic of Korea to advance the work of RCA and develop partnerships with other organizations.

RCA aims to promote collaboration among countries through targeted projects in priority areas, which include agriculture, the environment, human health and industry. Over 100 projects have been implemented to date, many of which featured South-South or triangular cooperation approaches. During the 2018 annual RCA coordination meeting, RCA participating States identified the further integration of South-South cooperation into future programmes as a priority for action.

Regional Cooperation Agreement for the Promotion of Nuclear Science and Technology in Latin America and the Caribbean (ARCAL)[11]

ARCAL, established in 1984, brings together 21 IAEA Member States[12] in Latin America and the Caribbean. This regional agreement addresses key development priorities in the region, focusing on pressing needs related to food security, human health, environment, energy, industry and radiological safety. Its activities take place under the framework of the 2016–2021 Regional Strategic Profile and support horizontal cooperation among countries to maximize the use of existing resources and institutions, benefiting from the capabilities and expertise in a number of technologically advanced countries within the region.

As part of an IAEA and ARCAL project, "sleepy" sterile male flies are being placed into special aerial release boxes in the Dominican Republic. (Photo credit: Laura Gil Martinez/IAEA)

11 More information is available at https://www.arcal-lac.org.
12 As of 30 November 2018.

African Regional Cooperative Agreement for Research, Development and Training Related to Nuclear Science and Technology (AFRA)[13]

AFRA was established in 1990. Under the AFRA framework, African countries cooperate to advance their self-reliance in nuclear science and technology. Priorities under the Regional Strategic Cooperative Framework 2019–2023 include human health, food and agriculture, and radiation safety.

Thirty-two AFRA regional designated centres (RDCs) in the above-mentioned fields play a key role in facilitating South-South and triangular cooperation within the region. RDCs are institutions able to provide regional training and expert services under the agreement. They also play an important role in postgraduate training, key to addressing the need for qualified professionals in the region.[14]

A specific project on promoting cooperation among countries in the region through triangular partnerships was first launched under AFRA in 2010. The aim of the project was to ensure the sustainability of nuclear technologies established in the region. Under that project, more technologically advanced countries (usually through RDCs) were paired with less advanced

13 More information is available at http://www.afra-web.org.

14 Two AFRA RDCs, the Department of Nuclear Engineering of the University of Alexandria, Egypt, and the Graduate School of Nuclear and Allied Sciences of the University of Ghana, host 10 candidates from African Member States each year as part of the AFRA Master's Programme in Nuclear Science and Technology.

National Nuclear Research Institute, Ghana Atomic Energy Commission (GAEC), Accra, Ghana. (Photo credit: Dean Calma/IAEA)

Participants at the 29th Technica Working Group Meeting of AFRA held in Accra, Ghana, in July 2018. (Photo credit: IAEA)

countries, which fostered the development of vibrant partnerships through visits and training courses.

Under the framework of that project and with IAEA support, Morocco supported Egypt, Kenya, Sudan and Zimbabwe in the effective use of radiotracers in industrial applications resulting in the certification of practitioners under the International Society for Tracer and Radiation Applications (ISTRA) scheme – the first time that that was achieved on African soil. Morocco also helped non-destructive testing personnel from the Democratic Republic of the Congo and Zimbabwe to gain certification in non-destructive testing and supported Côte d'Ivoire in using radioisotopes in conservation agriculture. South Africa also provided training and certification in non-destructive testing, in that case to professionals from Cameroon and Sudan. Sudan benefited additionally from the support of Egypt, as Egyptian lecturers provided postgraduate teaching. Digital radiography experts from Ghana and Tunisia worked together to increase their digital radiography capacities and attended training courses in Malaysia, which added a component of interregional cooperation. Furthermore, Algeria assisted Burkina Faso in calibrating several instruments used in occupational exposure control and supported Côte d'Ivoire in conducting a survey on the levels of radon (a radioactive gas) in selected areas of the country. A follow-up project will be launched in 2019. The scope of cooperation will be expanded to the institutional level in an effort to increase the number of competent facilities using nuclear techniques in Africa.

"AFRA uses African experts to generate research evidence and provide direct interventions on the applications of nuclear science and technology, thus contributing to advancing several SDGs – notably in the areas of health and nutrition, food and agriculture and in industry – through the safe use of these technologies. These experts have diagnosed and treated cancers, made food safer, developed new crop varieties on better soils and provided clean water."

Prof. Wilfred F. Mbacham, Chair, AFRA Programme Management Committee

Cooperative Agreement for Arab States in Asia for Research, Development and Training Related to Nuclear Science and Technology (ARASIA)[15]

ARASIA, which entered into force in 2002, brings together 11 Member States.[16] Under this agreement, States Parties carry out, in cooperation with each other and with the Agency, activities for training, research, development and applications of nuclear science and technology. ARASIA Member States have cooperated closely on a number of projects related to investigating pollution in urban environments, enhancing the use of salt-affected soils and saline water for crop and

15 More information is available at http://web.aec.org.sy/arasia/.
16 As of 30 November 2018.

biomass production, enhancing wheat and barley productivity, and harmonizing radiation practices. In 2017, ARASIA States Parties started the process of establishing regional resource centres, and in 2018, the first resource centres were designated in Kuwait and Lebanon, focusing on nuclear medicine. The designations recognize the valuable scientific and technical expertise available in ARASIA States Parties and the associated infrastructural and human resources. The centres will play a key role in the coming years in supporting active cooperation among ARASIA State Parties.

While there is no formalized framework of cooperation for the Europe region, the IAEA provides technical cooperation support to 32 countries in Europe and Central Asia. Member States in that region generally apply a wide range of nuclear technologies for development, and considerable resources, technologies and know-how exist within the region. This paves the way not only for cooperation among countries in Europe but also for their participation in triangular cooperation projects with less technologically advanced countries.

MembersoftheARASIABoardofRepresentativesmeton18September 2018onthesidelinesofthe62ndIAEAGeneralConference.(Photo credit: C. Karle/IAEA)

Regional Networks

A number of regional networks have been set up under each of the Agreements, with the support of the IAEA. On food security, the African Food Security Network (AFoSaN),[17] the Food Safety Asia Network[18] and the Red Analitica de Latino America y el Caribe (RACLA)[19] bring together food-safety institutions and laboratories from their respective regions. The Veterinary Diagnostic Laboratory (VETLAB) Network, originally established under the African Regional Cooperative Agreement for Research, Development and Training Related to Nuclear Science and Technology (AFRA), has now been extended to 44 Member States in Africa and 19 Member States in Asia.[20]

Furthermore, the IAEA assists Member States and the international community in retaining and transferring knowledge. Four regional networks for Africa, Asia, Europe, and Latin America and the Caribbean play a particularly important role in facilitating knowledge transfer and networking in higher education, training and research. Under the framework of the Asian Network for Education in Nuclear Technology (ANENT), the Latin American Network for Education in Nuclear Technology (LANENT), the African Network for Education in Education in Nuclear Science and Technology (AFRA-NEST) and the Regional Network for Education and Training in Nuclear Technology (STAR-NET), established in 2004, 2011, 2013 and 2015, respectively, Member States cooperate in education, capacity-building and knowledge management with support from the Agency. The educational networks hold joint meetings periodically to identify and discuss common needs and synergies.

17 More information is available at http://www.africanfoodsafetynetwork.org.
18 Moreinformationisavailableathttp://www.foodsafetyasia.net.
19 More information is available at http://www.red-ralaca.net.
20 https://www.iaea.org/newscenter/multimedia/videos/vetlab-helping-to-ensure-farmers-have-a-stable-future.Formoreinformationonthe VETLABNetwork,seechapterII,sectiontitled"PreventingtheSpreadofZoonotic Diseases and Protecting Livestock through Concerted Efforts".

Inter-agreement and Interregional Cooperation

The Quadripartite Forum functions as a mechanism for inter-agreement cooperation, bringing together the Chairpersons of each of the four regional/cooperative agreements. It serves as a platform to exchange experiences, information and best practices as well as to explore common areas of interregional collaboration.

A number of IAEA projects seek to promote interregional cooperation, including a flagship project initiated in 2017 to support small island developing States (SIDS)[21] in addressing common priorities such as combating the effects of climate change. This project, which recognizes the unique vulnerabilities faced by SIDS as noted in the SIDS Accelerated Modalities of Action (SAMOA) Pathway and the 2030 Agenda, recognizes the increased interest of SIDS in cooperation on the use of nuclear-based technologies, and it is specifically tailored to their needs. Nuclear techniques provide scientific data, which helps SIDS to adopt policies towards climate change mitigation and adaptation. These policies can be applied to monitor ocean acidification (ocean absorption of carbon dioxide released into the atmosphere by human activities), coastal pollution, seafood safety and monitoring of marine ecosystems. Nuclear technologies also help countries to better manage their water resources. The interregional project, launched in 2017, aims to build relevant technical capacity in the SIDS in the three regions and foster cooperation among countries, including through triangular partnerships.

IAEA Regional Training Centres and Collaborating Centres: Hubs for South-South and Triangular Cooperation

Important tools for supporting the application of South-South and triangular cooperation modalities are the IAEA Collaborating Centres and Regional Training Centres in Member States.

The IAEA collaborates with designated Member States institutions – Collaborating Centres[22] – to promote the practical use of nuclear techniques worldwide and implement its own programmatic activities. This has proven to be an efficient mechanism for the sharing of resources and know-how. The IAEA network of Regional Training Centres[23] assists Member States in building competence in radiation, transport and waste safety. These centres support the development of competencies in Africa, Asia and the Pacific, Europe and Latin America by hosting education and training events, promoting IAEA safety standards and providing expertise to Member States. The centres also promote and expand regional education and training networks, organize fellowship programmes and regional workshops, and prepare and translate educational materials.

21 Small island developing States (SIDS) are low-lying coastal countries located in the Caribbean, the Pacific, Africa regions, the Indian Ocean and the South China Sea. They build their culture and livelihoods based largely on oceans and are experiencing first-hand the effects of climate change, including ocean acidification, rising sea levels and extreme weather events.

22 A list of active Collaborating Centres is available at https://www.iaea.org/sites/default/files/18/06/collaborating-centres.pdf.

23 More information on Regional Training Centres is available at https://www.iaea.org/services/training/regional-centres-radiation-transport-waste-safety.

Photo credit: Nicole Jawerth/IAEA

Chapter 2

SOUTH-SOUTH AND TRIANGULAR COOPERATION IN ACTION: IMPACT STORIES

Nuclear Technology for Ensuring Food Security: Developing New Crops

According to the 2017 Revision of World Population Prospects prepared by the Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat,[24] the world's population is expected to increase by about one billion people over the next 13 years, reaching 8.6 billion in 2030, and to increase further to 9.8 billion in 2050. Most of this growth will take place in Africa and Asia. FAO estimates that, "to meet demand, agriculture in 2050 will need to produce almost 50 percent more food, feed and biofuel than it did in 2012".[25] This challenge is aggravated by the negative effects of climate change, including more extreme weather conditions and increasingly unpredictable weather patterns. Countries are therefore under pressure to ensure that agriculture becomes more productive and resilient while at the same time supporting the sustainable use of natural resources.

Ending hunger and building inclusive and sustainable food systems are key priorities for IAEA Member States working towards achieving the Sustainable Development Goals. The IAEA helps countries to increase agricultural resilience and productivity through the application of nuclear techniques. South-South and triangular approaches are being successfully applied in regional and interregional projects delivering support to Member States, empowering countries across regions to use nuclear techniques as part of their ongoing efforts to ensure food security.

Interregional Cooperation to Defeat Devastating Wheat Disease

Wheat is the most widely grown crop in the world, playing an important role in the economies of many African countries. Wheat farmers have battled plant diseases, including fungi, for years. One aggressive

Nuclear science helps women farmers in Sudan to leave poverty behind. (Photo credit: Nicole Jawerth/IAEA)

24 https://population.un.org/wpp/.
25 FAO, The Future of Food and Agriculture: Trends and Challenges, p. 46. Available at http://www.fao.org/3/a-i6583e.pdf.

type of fungi, called wheat black stem rust or *Puccinia graminis*, has been of particular concern. This lethal fungus was largely brought under control in the 1960s thanks to the development by the American agronomist Norman Borlaug, 1970 winner of the Nobel Peace Prize, of wheat varieties resistant to the fungus.

In 1999, however, stem rust re-emerged in Uganda. Ug99, as this strain was later called on account of the place and year of its first sighting, began to spread to wheat crops across Africa, including Ethiopia, Kenya and South Africa, and then to Yemen and the Islamic Republic of Iran, reaching 17 countries by 2008 and causing devastating losses. Experts warned about the risk of its spread to the world's main wheat producers in Europe and Asia, presenting a potential threat to global food security. Combating the disease with fungicides was deemed unfeasible owing to their cost and associated environmental concerns.

The Science: Plant Mutation Breeding

Plants mutate over time to adapt to the environment and survive. However, this natural course may take millions of years, and nuclear technology can be used very effectively to accelerate it. By exposing seeds or plant tissue to radiation such as gamma rays, scientists speed up the natural process of mutation, and breeders are able to develop new varieties showing traits such as higher yield, increased adaptability and pest resistance. Plant mutation breeding does not involve gene modification but rather uses a plant's own genetic resources and mimics the natural process of spontaneous mutation.

In 2009, in support of international efforts to combat Ug99, the IAEA, in collaboration with FAO as well as national and international research institutes, initiated an interregional project to develop wheat varieties resistant to the fungus by using plant mutation breeding.

The project provided a South-South and triangular cooperation platform for participating countries to cooperate with each other and with the IAEA in a triangular manner, maximizing the use of existing technological capacities in participating countries. The project brought together countries affected by Ug99, including Ethiopia, the Islamic Republic of Iran, Kenya, South Africa, Uganda and Yemen, and wheat-producing countries in neighbouring areas such as Algeria, Jordan and Tunisia as well as countries interested in preventing the spread of the disease to other regions, including the Australia, China, Turkey and the United States of America. Several national and international scientific institutions supported the project, with those in countries with more developed technological capacities providing genetic resources, experimental protocols, capacity-building and mentoring to participating Member States and institutions with fewer resources.

The IAEA Plant Breeding and Genetics Laboratory in Seibersdorf, Austria, contributed to the project by irradiating wheat seeds provided by countries. The process continued in Kenya, where scientists grew plant samples and tested their resilience against Ug99. Further testing took place in Ethiopia and Yemen.

In 2013, scientists from the University of Eldoret in Kenya reached a milestone with the development of the first successful mutant variety of wheat resistant to Ug99, named Eldo Ngano 1. Because of its

Mr. Jackson Mandago, Governor of Uasin Gishu County, Kenya (right), examines a new variety of disease-resistant wheat growing at the University of Eldoret with university plant breeder Ms. Miriam Kinyua (centre) and IAEA plant-breeding specialist Mr. Liang Qu (left), 5 September 2013. (Photo credit: Greg Webb/IAEA)

unprecedented rapid development, 54 tons of Eldo Ngano 1 seeds were ready for distribution to local farmers in 2014. Overall, 13 resistant mutant lines were identified in wheat varieties from six countries: Algeria, Iraq, Kenya, the Syrian Arab Republic, Uganda and Yemen.

By 2014, participating countries were able to exchange seeds of resistant mutant lines for breeding as well as applicable biotechnologies to speed up the process of inducing resistant genetic mutations and DNA methods to screen for disease resistance. The sharing of that information empowered them to develop their own research, contributing to the sustainability of local and regional capacities to prevent and address possible future outbreaks of that and other crop diseases.

Sharing of Knowledge and Know-how for Better, Stronger Crops

For several years, the IAEA has supported countries in the Asia-Pacific region in developing and applying nuclear technology to improve crops such as rice, soybeans and sorghum, making them higher yielding and more resistant to the effects of climate change.

As countries built their national capacities for the application of nuclear technologies, often with IAEA assistance, they became progressively able to share their experiences and expertise with other countries facing similar challenges within the region and beyond.

In Indonesia, for example, the IAEA supported scientists from the National Nuclear Energy Agency (BATAN) in developing new crop varieties that enabled local farmers to increase productivity despite adverse weather and soil conditions. The BATAN Centre for Isotopes and Radiation Application (CIRA) successfully developed a wide variety of mutant plants and received an outstanding achievement award from the IAEA Director General.

Researchers at BATAN use irradiation to induce genetic alteration in crops and then select plants with new and useful traits. (Photo credit: Yustantiana/BATAN)

Three years later, CIRA became an IAEA collaborating centre. This collaboration is now helping to improve plant mutation breeding techniques and disseminating them throughout the region so that agricultural activities can achieve increased yields and greater resilience to climate change. In addition, CIRA is engaged in sharing knowledge and nuclear techniques, providing training courses to other scientists from the region as well as from other regions facing similar challenges. This builds on the experience of BATAN/CIRA as an active hub for South-South knowledge transfer, with extensive experience in hosting scientific visits and fellowships for nuclear professionals, including from across Africa. For example, in 2017, CIRA hosted Mozambican technicians who worked with CIRA experts under an IAEA-sponsored project to conduct trials of new strains of climate-smart millet crops that could improve yields in Mozambique.

Building on the above, a Practical Arrangement was signed in February 2018 between the IAEA and the Indonesian Ministry of Research, Technology and Higher Education of the Republic of Indonesia on enhancing technical cooperation among developing countries and strengthening South-South cooperation. This agreement provides further impetus to the sharing

of expertise and technical collaboration between Indonesia and other countries on the application of nuclear technologies in food and agriculture as well as in other areas.

Preventing the Spread of Zoonotic Diseases and Protecting Livestock through Concerted Efforts

While the term “zoonotic diseases” might be unfamiliar to the general public, the devastating effects of many of such diseases, including Ebola and avian flu, are well-known, having affected a number of countries in the recent past.

Zoonotic diseases are generally defined as diseases and infections that are naturally transmitted between animals and humans. WHO estimates that “at least 61 per cent of all human pathogens are zoonotic, and have represented 75 per cent of all emerging pathogens during the past decade”.[26] As human populations grow and spread into previously isolated environments, they are increasingly in contact with formerly untouched wildlife and their diseases. As a result, experts predict that in the future, outbreaks of existing and new zoonotic diseases could be more severe than those seen to date.

Zoonotic diseases are as much a health concern as an economic hurdle, causing vast economic losses and perpetuating poverty. They predominantly affect low- and middle-income countries, which face particular challenges in confronting these diseases. This is especially the case when it comes to quick and effective diagnosis in animals and wildlife, which is critical for containing and preventing their transmission to humans.

Early and accurate diagnosis of diseases in animals is also key to protecting livestock, on which about one

26 https://www.who.int/neglected_diseases/diseases/zoonoses/en/.

Scientists at the National Veterinary Laboratory (LANAVET) in Yaoundé, Cameroon, study a variety of insects for genetic purposes. To African countries facing the threat of disease outbreaks, the IAEA's help in equipping laboratories and training scientists in the use of nuclear-derived techniques for quick diagnosis is critical. (Photo credit: Laura Gil Martinez/IAEA)

billion people, mostly pastoralists in South Asia and sub-Saharan Africa, depend for food and livelihood. Animal diseases limit the trade of animals and food from animal origin and restrict breeding, affecting food security and having a significant economic impact.

Along with early detection, effective regional coordination and the sharing of epidemiological information among health and veterinary institutions in different countries play a key role in avoiding the spread of zoonotic diseases and maintaining healthy livestock.

The IAEA, in partnership with FAO and in collaboration with WHO, supports Member States in the use of nuclear-derived techniques for identifying diseases in animals, including zoonotic diseases. Nuclear as well as nuclear-related technologies play important roles in animal health management. They are easy to use, rapid, accurate and effective, thus offering significant advantages over other methods. One of these techniques, polymerase chain reaction (PCR), is a highly sensitive and accurate technique that is well-suited for identifying virus strains and bacteria. It uses an enzyme to identify pathogens with high accuracy. A complementary nuclear-derived technique, sequencing, involves finding the way the nucleic acid (RNA and DNA) information inside pathogens is gathered, which helps to understand the origin and evolution of a certain disease.

The work of the Agency focuses on the transfer and application of these techniques as well as on the reinforcement of national and regional networks to share epidemiological information faster and more efficiently in order to ensure national preparedness. Throughout these activities, the IAEA facilitates South-South cooperation aiming at reinforcing national capacities, building on regional experience and good practices and fostering knowledge- sharing among countries that depend on each other for devising effective prevention and response mechanisms. In addition, the Agency provides support to ensure that such cutting-edge, nuclear-derived techniques are used in a safe manner.

Building an Interregional Network of Laboratories

An interregional network of laboratories called the VETLAB Network, supported by the IAEA, offers scientists across countries in Africa and Asia a platform for diagnosing and monitoring diseases using nuclear-based technologies. Providing a flexible mechanism for South-South and triangular cooperation, the Network enables countries to share data and compare findings as well as to raise awareness about emerging diseases and adopt timely prevention and containment measures.

The VETLAB Network was first established to connect technical expertise in the global battle against rinderpest, a highly contagious viral disease afflicting cattle, buffalo, yak and several wildlife species, which was declared eradicated in 2011. A key element was the Africa-wide implementation of a technology based on immunoassay – a serological test – which provided the platform to monitor national vaccination programmes of the Pan African Rinderpest Campaign. That led to an annual economic benefit to the region estimated at $920 million. The networking of laboratories able to use efficient nuclear-related technology to facilitate surveillance and diagnosis in the field played a key role in combating that disease.

Building on that success, the IAEA, supported by the African Renaissance Fund and the Agency's Peaceful Uses Initiative, facilitated the expansion of the Network, which now connects laboratories in 44 African and 19 Asian countries. Within its membership, the VETLAB Network identified the leading laboratories of Botswana, Cameroon, Côte d'Ivoire and Ethiopia to provide regional support. The IAEA, in partnership with FAO, works with these laboratories to improve their analytical capabilities and increase the number of tests that they perform so that they, in turn, can conduct tests for neighbouring countries with labs that have not yet received ISO accreditation.

VETLABNetworkscientistslearnhowtousethemulti-pathogenassay.(Photocredit:IAEA)

The VETLAB Network has shown its value as a game changer. For example, when the avian influenza virus was spreading across Asia and Africa in the early 2000s, virus samples gathered from the field often had to be shipped by plane to far-away countries for diagnosis, thus delaying the implementation of effective responses. In contrast, in 2015, when a highly pathogenic avian influenza H5N1 strain re-emerged in western Africa and avian flu was suspected in Togo, samples were sent to a lab in neighbouring Ghana through the VETLAB Network, and results were quickly provided. That same year, the VETLAB Network laboratory in Cameroon provided diagnostic services for African swine fever to Chad. These examples illustrate how South-South cooperation takes place through the Network.

Networking and information exchanges remain the cornerstone of the VETLAB Network. The IAEA facilitates such efforts by encouraging and facilitating contacts among veterinary laboratory scientists through workshops and coordination meetings. These coordination meetings offer a unique opportunity for countries facing similar challenges to exchange information on the latest technological advances and to coordinate activities such as training, information dissemination and the design of disease control strategies. During the latest of such meetings, hosted by the IAEA in August 2018, VETLAB Network members from Africa and Asia discussed steps for improving the proficiency of laboratories in rapid detection, enhancing quality control, and sharing and verifying standard operating procedures. The meeting also served to take stock of the latest developments in the fight against the peste des petits ruminants (PPR),

The Science: Immunoassay and Molecular Techniques

The latest generation of molecular diagnostic technologies offers unparalleled detection and discrimination methodologies that are vital for the sensitive detection and identification of pathogens. They are designed to allow a rapid and reliable diagnosis at the farm site, helping veterinary authorities, extension services and farmers to control and eradicate disease outbreaks that impair animal health and productivity.

- *Nuclear and nuclear-related immunoassays and molecular techniques provide sensitive, robust, specific and rapid results and offer significant advantages over conventional biological methods such as complement fixation tests or culture techniques as well as the possibility of point-of-care applications.*
- *Isotopes are used as markers to label protein and nucleic acid molecules, enabling specific and sensitive detection and characterization of harmful pathogens, as implemented in the polymerase chain reaction (PCR) that multiplies a single pathogen gene to millions of exact copies in a short time, enabling easy detection of only a few pathogens in a sick animal, and the enzyme-linked immunosorbent assays (ELISAs) that analyse serum to assess disease status through the rapid testing of thousands of samples at a time, which is vital in disease surveillance and for export certification.*

a highly contagious virus disease affecting sheep and goats, through technology transfers and the collaboration among VETLAB Network members.

Learning Lessons from Ebola, Supporting Regional Prevention Efforts

The 2014 outbreak of Ebola virus disease (EVD), which was first reported in Guinea and later spread across Liberia, Guinea, Sierra Leone and other countries, claimed the lives of over 10,000 people.[27]

The IAEA rapid response measures, undertaken in cooperation with WHO and the United Nations Mission for Ebola Emergency Response, contributed to the global efforts to fight the outbreak. The Agency support included the provision of specialized diagnostic equipment to Sierra Leone, Liberia and Guinea, thus strengthening the ability of the countries to diagnose EVD quickly using PCR.

The outbreak underlined the need to reinforce preventive and collaborative mechanisms to avoid the spread of zoonotic diseases. Starting in 2015, the IAEA implemented a joint IAEA/FAO regional project aimed at strengthening the capacity of African Member States to monitor wildlife and livestock and detect outbreaks of zoonotic diseases at an early stage. The project brought together experts from affected African countries, providing a platform for cooperation among them, thus supporting the regional strategies of WHO and FAO to strengthen the cooperation between human health and animal health experts and to increase preparedness.

The national and regional networks that were created under this initiative offer a permanent structure for countries to address the outbreak of zoonotic diseases in a coordinated manner, including through the pooling of resources and sharing of expertise.

In August 2017, more than 150 human health, veterinary and wildlife experts from 40 African countries met at IAEA headquarters in Vienna to share experiences in order to improve national surveillance networks for monitoring and containing the spread of highly contagious viruses, including avian influenza, Ebola, Marburg virus disease, Crimean-Congo hemorrhagic fever and monkeypox.

The IAEA also facilitated bilateral information exchanges between experts and institutions in the region. These visits and exchanges served to strengthen collaboration for the effective surveillance and control of zoonotic diseases.

Sharing Experiences

In 2017, Mr. Abel Wade, Director of the National Veterinary Laboratory in Yaoundé, Cameroon, was hosted by Mr. Emmanuel Nakouné, Scientific Director at the Pasteur Institute in Bangui, Central African Republic, for a week of information exchange and joint work. Wade learned how doctors in Bangui spotted Ebola in the early 2000s and a monkeypox outbreak later using nuclear-derived techniques and he could share his expertise and experience in stopping the spread of a dangerous zoonotic disease that affected Cameroon. Later, Wade travelled to Ndjamena, Chad, where he learned about his peers' experience in using nuclear-derived techniques to identify rabies and tuberculosis.

Mr.AbelWade(left),DirectoroftheNationalVeterinaryLaboratoryin Yaoundé,Cameroon,andMr.EmmanuelNakouné(right),Scientific DirectorattheInstitutPasteurinBangui,CentralAfricanRepublic,sharing theirexpertiseandexperience.(Photocredit:LauraGilMartinez/IAEA)

27 Moreinformationonthe2014outbreakisavailableathttp://www.who.int/csr/disease/ebola/en/.

Supporting the Development of Regionally Produced Radiopharmaceuticals and Targeted Cancer Therapy

The 2030 Agenda recognizes the impact of non-communicable diseases (NCDs) on development and includes the reduction by one third of premature mortality from NCDs as one of the targets under Sustainable Development Goal 3: “Ensure healthy lives and promote well-being for all at all ages”.

Every year, cancer claims the lives of 8 million people worldwide, including 4 million people who die prematurely, that is, between the ages of 30 and 69.[28] It is estimated that by 2030, over two thirds of all cancer-related deaths will occur in developing countries. In many of those countries, prevention, screening, early diagnosis and treatment services are inadequate. The effective treatment of cancer, including through radiotherapy, constitutes a high priority for a number of IAEA Member States, particularly low- and middle-income countries.

Radiotherapy is a common and effective form of cancer treatment, which uses high energy, ionizing radiation to destroy cancer cells and reduce tumors. Radiotherapy can be given externally, using a machine, or internally through various methods, including radiopharmaceutical therapy. Radiopharmaceuticals have traditionally been used for diagnosis purposes as part of what is commonly referred to as “diagnostic imaging”. When used for treatment, radiopharmaceuticals transport targeted doses of radiation directly to tumours and their metastases, thereby sparing healthy tissue. A number of therapeutic radiopharmaceuticals are used to treat various malignancies including non-Hodgkin’s lymphoma, neuroendocrine tumors, metastatic bone disease and hepatocellular carcinoma. However, the effective and large-scale production of radiopharmaceuticals often poses a challenge for countries with limited resources. Most of the radiopharmaceuticals have a very short half-life (lose efficacy rapidly), generally must be produced close to where they will be used, and require the handling of radioactive substances and complex chemical processing. In addition, the lack of an adequate number of qualified professionals, harmonized protocols and proper infrastructure for radiation therapy in Member States hampers the treatment of cancer in a timely and effective manner.

The number of people who can affordably access diagnostic medical care in Bangladesh has increased three times over the last ten years as the country has expanded and strengthened its nuclear medical services. Health officials have worked steadily, with the support of the IAEA, to build a nuclear medicine system with well-trained medical staff, advanced imaging tools and a cost-effective source of essential radiopharmaceuticals. (Photo credit: N. Jawerth/IAEA)

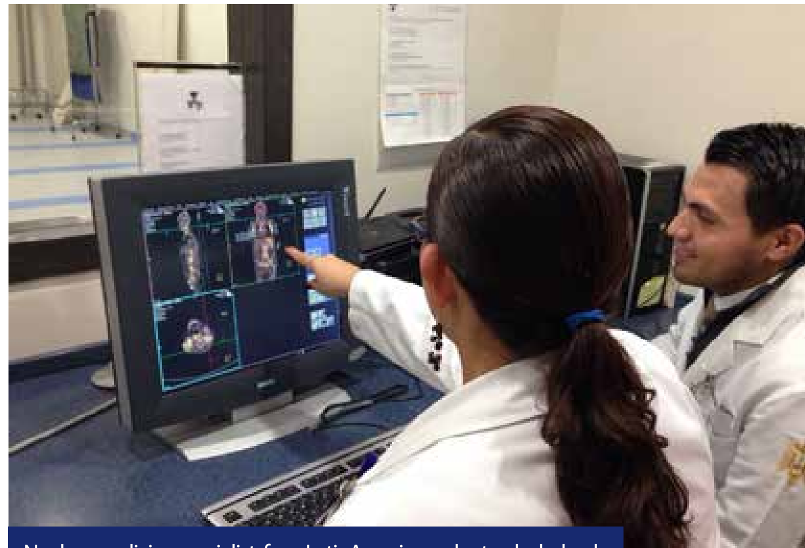
28 More statistical information is available at http://gco.iarc.fr/today/home.

As part of its efforts to help States to overcome the above-mentioned challenges, the IAEA facilitates South-South and triangular cooperation within the framework of regional agreements, aimed at sharing resources and expertise and developing common guidelines for the production and use of radiopharmaceuticals and other radiotherapy. In addition, the IAEA has encouraged and supported the creation of regional education courses and online platforms that strengthen and connect local capacities to develop and apply nuclear technologies for cancer therapy.

Cooperation among Countries in Latin America and the Caribbean to Fight Cancer

The Agency supports the sharing of knowledge and expertise among countries and technical institutions in Latin America and the Caribbean. Nuclear medicine and radiotherapy have advanced substantially in the last several decades owing in part to IAEA support. Despite this progress, more remains to be done to enlarge the geographical reach of advanced technologies, which are not evenly spread out throughout the region. The ARCAL Regional Strategic Profile[29] 2016–2021 notes that 50–60 per cent of cancer-related deaths in the region could be prevented by applying the available knowledge and technologies, including nuclear medicine and radiotherapy. In light of this, ARCAL Member States have identified the development of regionally produced radiopharmaceuticals and the qualification of a sufficient number of radiotherapy technicians and specialized medical physicists as priorities for technical cooperation.

Supported by the IAEA, a project implemented under ARCAL aimed to advance the development of regionally produced therapeutic radiopharmaceuticals to strengthen cancer control programmes. It brought together experts from Argentina, Brazil, Chile, Colombia, Costa Rica, Cuba, Ecuador, Guatemala, Mexico, Nicaragua, Paraguay, Peru, Uruguay and the Bolivarian Republic of Venezuela. Capitalizing on their individual capacities, those countries worked closely to identify best practices in place and cooperated in the drafting of common guidelines. Through the project, which began in early 2014, 49 state-of-the-art protocols and guidelines for the preparation and quality control of radiopharmaceuticals for use in therapy were jointly developed and agreed, as well as for preclinical trials and dosimetry studies. Nearly 120 specialists from the 14 participating countries were trained in the implementation of agreed protocols. That improvement of capacities for the preparation and quality control of therapeutic radiopharmaceuticals was possible only through the creation of a regional network that built on countries' strengths in that field of activity.



Nuclear medicine specialists from Latin America evaluate whole-body images produced by single photon emission computed tomography scanners after administering a radiopharmaceutical to a patient. (Photo credit: IAEA)

In 2018, the first-ever cooperation meeting between national dosimetry laboratories in Latin American and Caribbean countries laid the foundations for better radiation protection of patients and workers in the region. The IAEA-led meeting, which took place in Recife, Brazil, with the support of the Department of Nuclear Energy of the Federal University of Pernambuco, Brazil, and the Metrology Laboratory of Ionizing Radiation in Recife, facilitated knowledge-

29 https://www-pub.iaea.org/books/iaeabooks/10958/ARCAL-Regional-Strategic-Profile-for-Latin-America-and-the-Caribbean-RSP-2016-2021.

sharing among experts from 26 institutions from 20 countries in the region. Participants assessed the status of secondary standard dosimetry laboratories (SSDLs), which provide calibrations, in the region, identified gaps and strengthened cooperation among laboratories.

"It is through encounters like these that we discover that we are not alone, that other colleagues in other countries have similar problems. During the meeting, I found that some experts were interested in Uruguay's way of measuring doses from cobalt-60 irradiators and in medical imaging, methods that are now being shared with them. Similarly, I learnt about some of Brazil's efficient and low-cost solutions in measuring radiation."

Guillermo Balay, Head of the Secondary Standard Dosimetry Laboratory, Laboatorios Tecnogestión, Ministry of Industry, Energy and Mining, Uruguay

Developing Professional Qualifications and Education

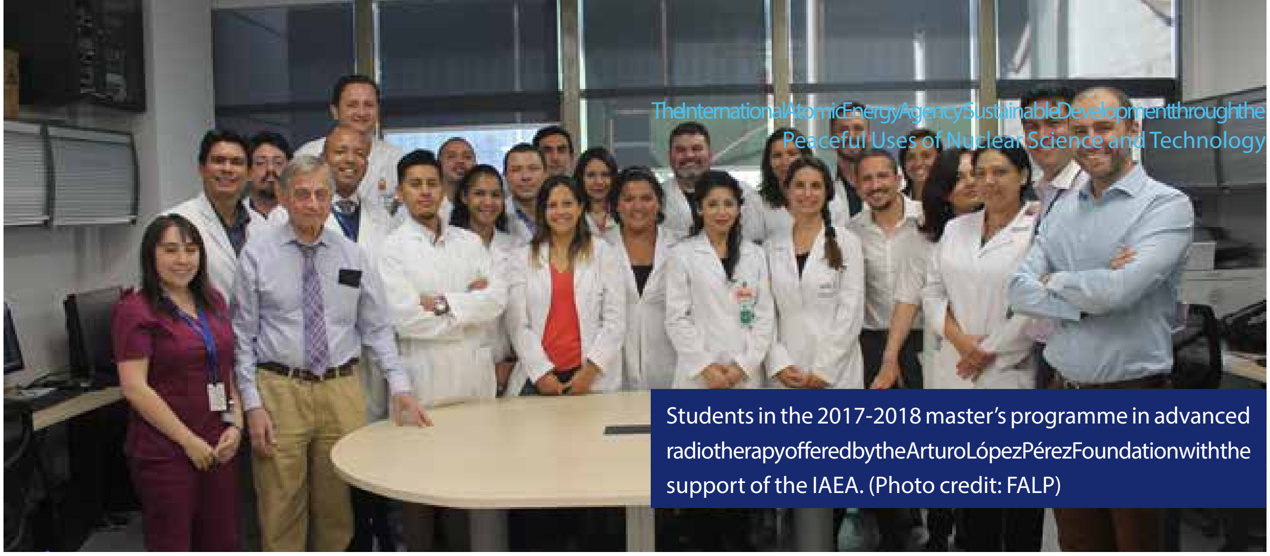
A number of Member States across Latin America and the Caribbean but also in Africa and the Asia-Pacific region lack sufficient skilled cancer care professionals. The IAEA has supported the establishment of specialized courses and networks that enable students and practitioners to further develop their technical competence, consult each other on how to address challenging cases and draw from each other's expertise. Online training through the IAEA Human Health Campus is also available. The Campus is designed to serve as an informative resource for health professionals working in medical physics, nuclear medicine, radiology, radiation oncology and nutrition. It offers professionals insight into different aspects of modern clinical practice.

In Latin America, the IAEA partnered with the Chilean Arturo López Pérez Foundation (FALP) and the University of Los Andes to design and deliver a one-year master's programme in advanced radiotherapy for students from Latin America and the Caribbean. While training programmes for radiation oncologists existed in many countries in the region, regional programmes in advanced technologies were not available until the IAEA launched this master's programme. The programme provides students with tools to implement the newest radiation technologies effectively and safely in their countries while fostering regional collaboration and knowledge-sharing. The programme was launched in June 2017, with the first batch of students graduating in 2018. The second edition of the master´s programme, supported by ARCAL, started in September 2018 with participants from Argentina, Colombia, Costa Rica, Cuba, Ecuador, Mexico and Uruguay.

"For the students, the past six months have been important for two reasons: we have participated actively in high-tech, theoretical and practical workshops and in the Latin American Congress of Radiation Therapy, and our way of thinking has changed. Progressively, with each clinical case, we experienced a paradigm shift, justifying our decisions on a strong scientific basis while also accounting for resource availability and individual scenarios. Everyone – students and teachers – has grown and learned along the way, both at a professional and a personal level. I have no doubt that this first year will lay the foundation for the expected future editions so necessary to radiotherapy in Latin America, a practice that is determined to keep improving."

María Cecilia Atencio Rosselot, Argentina, participant in the first master's programme in advanced radiotherapy for students from Latin America and the Caribbean

In Africa, the IAEA helped to establish the Africa Radiation Oncology Network (AFRONET), which enables professionals in radiotherapy centres in English-speaking countries to discuss individual medical cases and share views on their treatment. AFRONET has provided a unique opportunity for participating centres to present and discuss cases with experts from within and outside Africa. The network has benefited fully qualified professionals



Students in the 2017-2018 master's programme in advanced radiotherapy offered by the Arturo López Pérez Foundation with the support of the IAEA. (Photo credit: FALP)

as well as trainees by providing them with access to high-quality lectures and evidence-based case discussions. Using a multidisciplinary Virtual Tumor Board, where cancer professionals present, discuss and review challenging cancer cases through a secure online platform, the Network provides an excellent platform for South-South and triangular cooperation, strengthening clinical decision-making in radiotherapy centres across anglophone Africa. It also helps national institutions and experts to connect with one another to exchange ideas and expand their knowledge as well as share their existing expertise to provide patients with better care. Given the success of AFRONET, its expansion to other regions is currently being discussed.

In the Asia and the Pacific region, the IAEA supported a project implemented by RCA, which developed common standards for education and clinical training as well as criteria for professional recognition of qualified medical physicists by the appropriate regulatory authorities. As the first step in the project, regional needs and existing resources were assessed through a survey and specially designed questionnaires. Participating countries then cooperated through a series of technical meetings and developed common standards for education and clinical training that were published on the IAEA website. In addition, the project resulted in the establishment of an IAEA e-learning platform called the Advanced Medical Physics Learning Environment (AMPLE). Pilots of clinical training programmes using AMPLE were established in Bangladesh, India, Indonesia, the Philippines, Singapore and Thailand, enabling medical physicists to learn from the most experienced institutions within the region.

The Science: What Is Nuclear and Radiation Medicine? What Does a Medical Physicist Do?

The advancements in medical technology have led to a dramatic surge in the development and availability of new cancer treatments. The treatment of cancer involves different strategies, such as chemotherapy, surgery, radiation therapy and, most recently, targeted therapies, such as the use of radionuclide-based therapies employed in nuclear medicine. External radiotherapy with ionizing radiation is the most frequently employed radiation treatment of cancer patients. In this approach, the primary tumor and a limited area around it are treated through irradiation with high-energy X-rays.

Another treatment option available for certain types of cancer is the use of targeted radionuclide therapy, which is based on administering radioactive substances to patients. Just like chemotherapy, this therapy is a systemic treatment, reaching cells throughout the body by travelling through the bloodstream. Unlike chemotherapy, however, these radioactive substances specifically target diseased cells, thus reducing potential side effects.

Medical physicists are highly-trained specialists who work with very sophisticated technology used in radiation medicine to diagnose and treat patients with diseases such as cancer and cardiovascular diseases. In nuclear and radiation medicine, doctors rely on sophisticated machines with very specific requirements that need to be properly tested, installed and calibrated to benefit patients and keep them safe. For example, for machine calibration, medical physicists do calculations and measurements to determine the exact dose of a radiation beam of a machine and use it to safely treat a patient.

Groundwater constitutes 30 percent of the world's available freshwater. Groundwater is often hidden deep in aquifers, permeable rocks and sediments and is extracted using pumping wells. A growing global population, coupled with more intensive agriculture and increasing industrial use, has led to an ever-rising demand for groundwater. (Photo credit: D. Calma/IAEA)

Integrated Management of Shared Groundwater Resources

Ensuring the availability and quality of water is a fundamental development challenge. Sustainable Development Goal 6, "Ensure availability and sustainable management of water and sanitation for all", underlines the importance of adequate policies, and target 6.5 aims for the implementation, by 2030, of "integrated water resources management at all levels, including through transboundary cooperation as appropriate". Good water governance and water-related policies informed by reliable data and evidence are essential to effectively combat water scarcity.

The IAEA, in partnership with Member States and relevant international and regional organizations, encourages and facilitates cooperation among countries on the use of nuclear technologies such as isotope hydrology for finding, assessing and mapping groundwater resources. The data obtained enables evidence-based decisions that ensure the sustainable use of resources.

Collaborative Mapping of Groundwater in the Sahel

Home to 135 million people, the Sahel stretches from West Africa to Central and North Africa, an area of more than 7 million square kilometres. The Sahel region lies within a unique climatic zone, characterized by unstable weather conditions. In recent decades, the region has suffered from extreme drought, which has resulted in a severe water shortage. One of the biggest challenges that the region faces is access to clean water not only for drinking but also for food production and sanitation.

The IAEA, through a regional project implemented between 2012 and 2017, assisted Sahel countries in using nuclear technology to determine the origins, flow paths and renewal rates of shared groundwater systems and to assess the groundwater quality.

Activities under the project covered five major transboundary aquifer systems (the Iullemeden Aquifer System, the Liptako-Gourma and Upper Volta

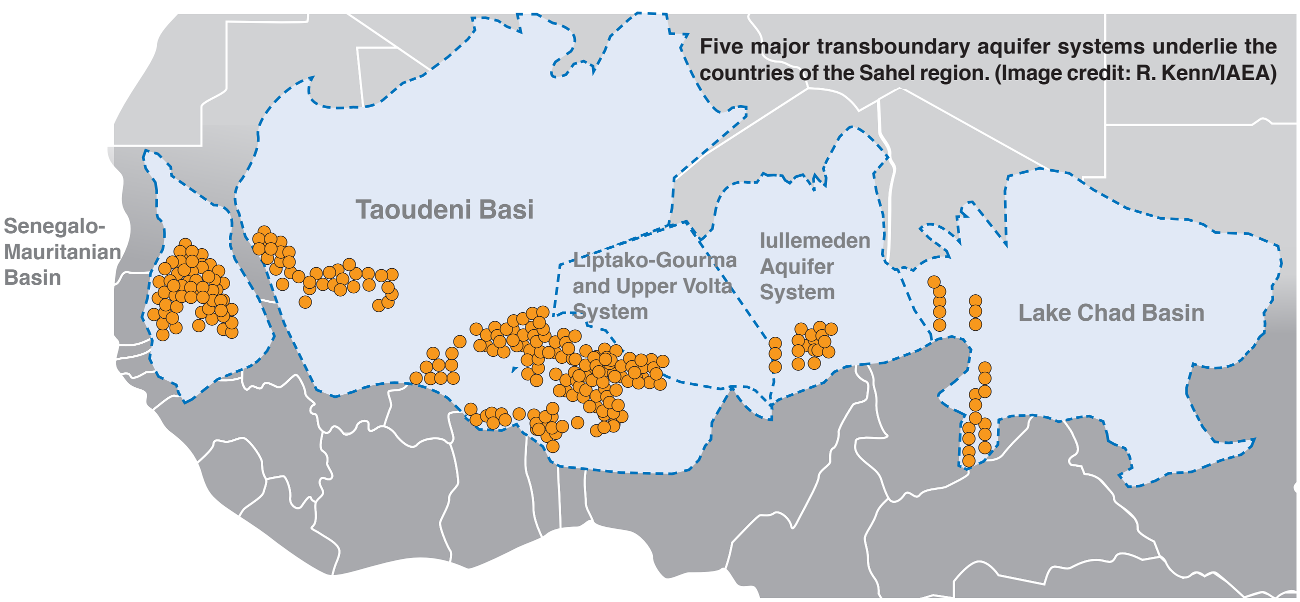
System, the Senegalo-Mauritanian Basin, the Lake Chad Basin and the Taoudeni Basin) shared by 13 African Member States: Algeria, Benin, Burkina Faso, Cameroon, the Central African Republic, Chad, Ghana, Mali, Mauritania, Niger, Nigeria, Senegal and Togo.

By building sustainable capacities in water sampling and isotope hydrology, the IAEA enabled the countries to study the features of the main aquifers as well as the interaction between water bodies and to assess the vulnerability of groundwater to pollution and the impact of climate change on water availability. The project supported a comprehensive approach to integrated sustainable groundwater management. It was implemented in cooperation with the United Nations Educational, Scientific and Cultural Organization (UNESCO), relevant river basin authorities (the Niger Basin Authority, the Lake Chad Basin Commission, the Volta Basin Authority, the Liptako-Gourma Integrated Development Authority and the Organization for the Development of the Senegal River), and the German Federal Institute for Geosciences and Natural Resources. The project was also supported through the Peaceful Uses Initiative by Japan, New Zealand, the Republic of Korea, Sweden and the United States.

The project provided a platform for effective South-South and triangular collaboration on technical and management issues at both the basin and subregional levels. It resulted in the first-ever comprehensive overview of groundwater characteristics in the Sahel region. The data provided valuable information for the countries, including on the origin, recharge sources and flow patterns of the aquifers and on contamination levels in the basins. This information, gathered in a collaborative manner, will enable policymakers to take evidence-based decisions on shared water management.

> *"This information is like gold. With it, we can tell the Government where we have shallow, renewable water to drill wells, where pollution comes from, or how long quality water will last."*
>
> *Eric Foto, Head of the Isotope Hydrology Laboratory at the University of Bangui, Central African Republic*

A follow-up project is currently ongoing to further integrate the management of groundwater resources in the Sahel by operationalizing the network of counterpart institutions to complete the



Five major transboundary aquifer systems underlie the countries of the Sahel region. (Image credit: R. Kenn/IAEA)

The Science: Isotope Hydrology

Isotope hydrology is a branch of the hydrological sciences based on the use of environmental isotopic and other naturally occurring geochemical tracers to gain insights about the origin, movement and history of water within the hydrological cycle.

During the evaporation and condensation of water, the concentration of the stable isotopes (naturally occurring atoms of different mass) of oxygen and hydrogen changes. As a result, each water body acquires its individual and characteristic isotopic "fingerprint", which is used by scientists to decipher hydrological processes and interactions within the water cycle. Other stable isotopes of carbon and nitrogen are used in a similar manner to study, for example, pollution in aquatic environments,

Naturally occurring radioisotopes, such as tritium and carbon-14, whose concentration decreases with time, are also found in water. These isotopes in surface or groundwater can be measured, and knowing their respective half-lives, the "age" or residence time of water within a particular water body can be determined. The information on water age, flow and transport in the water cycle obtained by isotope methods is essential to derive insights into water availability and sustainability and to assess groundwater vulnerability to pollution.

characterization, management and monitoring of groundwater resources and by translating hydrological data into policies and legal frameworks. This project will incorporate the IAEA Water Availability Enhancement (IWAVE) methodology, with Benin, Cameroon, Ghana, Niger and Nigeria as the participating countries. The technical and management capabilities resulting from this follow-up project are expected to provide core leadership and expertise for the sustainable management of shared water resources in Africa and contribute to the achievement by African Member States of their Sustainable Development Goal 6 plans and targets.

IAEA Water Availability Enhancement (IWAVE) Methodology

IWAVE is an innovative approach by the IAEA to help its Member States to answer the fundamental question: "Is national hydrological understanding adequate to realize SDG 6, the 'Water for All' goal?" IWAVE produces a national hydrological "sketch" of the information needed to increase water availability and identifies and implements the required technical capacities needed to produce information and knowledge to understand water availability – particularly groundwater – using comprehensive water-resource assessment methodologies, including isotope hydrology.

Project counterparts prepare samples for noble gas analysis of spring water. (Photo credit: L. Castro/ESPH)

Taking Stock of Groundwater Resources in Latin America

In many parts of Latin America, home to one third of the world's freshwater resources, groundwater resources are the main and sometimes only source of water, providing services for urban supply, economic activities and the maintenance of ecosystems. Aquifers are vulnerable to pollution as only 20 per cent of wastewater in the region is treated. This leads to the pollution of rivers and coastal areas, which exposes the population to harmful pollutants and has tremendous environmental impact. Efforts to address these challenges in the past were largely ineffective owing to a lack of comprehensive understanding of hydrology.

To help Member States in Latin America to address these issues and increase their collaboration on transboundary water management, the IAEA implemented a number of projects based on the use of isotope hydrology and the IWAVE methodology. For example, a project on "improving knowledge of groundwater resources to contribute to its protection, integrated management and governance", implemented between 2014 and 2018, provided a platform for 11 Latin American countries to evaluate the availability of hydrological information and existing policies and capacities for hydrological data collection.

In line with the IAEA approach to foster strong regional ownership and self-reliance, mechanisms for South-South cooperation were formalized within the project framework. For example, experts from Argentina and Colombia led courses, workshops and consultations in Ecuador and Nicaragua. In Argentina, the laboratory of the Universidad Mar del Plata analysed the isotopic compositions of water samples from different counterparts from the region, and an isotope hydrology laboratory was established in Nicaragua with the technical advice of an Argentinian expert. Triangular cooperation also played an important role, as experts from Portugal and Spain provided support, including expertise in scientific, technological and water resource management issues. As a result, regional isotope monitoring networks were established, which will support the development or improvement of hydrogeological management models, contributing to the region's progress towards sustainable water resources.

In Latin America, the IAEA also supported Argentina, Brazil, Paraguay and Uruguay in assessing the age, origin and evolution of the large Guaraní transboundary aquifer running under their territories. Using isotope hydrology, the four countries jointly analysed the aquifer to evaluate the age, origin and evolution of the groundwater as well as its quality and exposure to contamination. The resulting studies generated an integrated picture of the whole aquifer. Previously, the four countries had lacked the information that they needed to assess the impact of human activities on groundwater and how to best protect and use it sustainably.

Through these activities, the IAEA helped Member States to make evidence-based decisions on a key development issue – the sustainable management of transboundary water resources – and provided mechanisms for technology transfer and South-South cooperation. The IAEA and its partners contributed to the countries' self-reliance in the management of shared water resources, assisting them with establishing sustainable technical capacities.

Fostering Nuclear Research, Education and Knowledge-sharing

Nuclear technology requires a high level of technical expertise that needs to be developed and kept accessible for current and future generations. The IAEA supports coordinated research in the nuclear field as well as nuclear knowledge-sharing among Member States in order to leverage technical knowledge and capacities at the national and regional levels to contribute to socioeconomic development.

In line with the targets of Sustainable Development Goal 17, IAEA activities bring together countries at different stages of technological development to join

efforts and expand their knowledge of and access to nuclear scientific expertise. Several platforms and networks created under the auspices of the IAEA and supported by the Agency enable scientists and institutions to work collaboratively, building their expertise and advancing self-reliance.

Triangular Cooperation through Coordinated Research

Within the IAEA scope of work, South-South cooperation and triangular cooperation play an important role not only in the transfer of nuclear technology for peaceful purposes but also in its development and validation. Coordinated research, engaging institutions at different stages of technological development, contributes to building sustainable research capacities.

The IAEA connects research institutions from across the globe to collaborate on the use of nuclear applications in diverse sectors, from agriculture, human health, industry, hydrology and terrestrial and marine environments to nuclear energy and economic studies and nuclear safety and security. These activities are primarily implemented through coordinated research projects (CRPs). Each project typically brings together research institutions from a range of countries at different stages of technological and scientific development, which work together for three to five years.

The IAEA encourages and assists research on and development and practical use of atomic energy and its applications for peaceful purposes throughout the world. (Photo credit: IAEA)

CRPs provide a unique opportunity for scientists to conduct joint research through triangular cooperation, thus fostering the acquisition and dissemination of knowledge and technology among countries and building professional relationships and networks among scientists that often thrive well beyond the lifetime of a particular project.

Coordinated Research Activities in 2017 at a Glance
135 active CRPs
1,600 research institutions involved through research, technical and doctoral contracts or research agreements
74 research coordination meetings organized
€6.8 million expenditure

The research resulting from this cooperative work makes a substantive contribution to advances in different fields, including the treatment of serious malignancies. For example, in 2015, a paper focusing on cancer treatment resulting from a coordinated research project undertaken by eight research centres in Brazil, Chile, Hungary, India, Italy, the Philippines, the Republic of Korea and Thailand, with the advice of researchers from France, Italy, Turkey and the United Kingdom of Great Britain and Northern Ireland, received the Editor's Choice Award from *The Journal of Nuclear Medicine.*

The research, reflected in a paper titled "Prospective international cohort study demonstrates inability of interim PET to predict treatment failure in diffuse large B-cell lymphoma"[30], helped doctors to

30 http://jnm.snmjournals.org/content/55/12/1936.full?sid=22ce6b16-d5e9-46f0-9c77-80e507c74fe1.

Mr. Robert Carr, one of the authors of the IAEA paper on cancer treatment, receives The Journal of Nuclear Medicine Editor's Choice Award at the Society of Nuclear Medicine and Molecular Imaging annual meeting. (Photo credit: R. Kashyap/IAEA)

effectively evaluate and treat patients with a form of non-Hodgkin's lymphoma, a very-fast-growing and aggressive type of cancer, using a nuclear diagnostic imaging technique.

Furthermore, scientific evidence produced through coordinated research supported by the IAEA is making an important contribution to decision-making on development issues. For example, a CRP on breastfeeding addressed questions of whether or not infants fed exclusively with human milk for six months grew better, how much milk they consumed and whether the quantity of human milk production adversely affected the mother's own body composition, especially if the mother was HIV-positive.

The results of the research provided important findings for devising effective breastfeeding campaigns and nutrition policies. In the first place, the research confirmed that following the WHO recommendations on breastfeeding benefited children's health. It showed that if mothers adhered to the recommendations, their children consumed adequate amounts of human milk and those who were exclusively breastfed consistently for six months gained more fat-free mass at one year of age, indicating a healthy growth. It also showed that exclusive breastfeeding rates in participating countries were actually much lower than reported, by at least 40 per cent. The CRP confirmed that neither human milk production nor the health of babies of HIV-infected mothers was affected by the HIV infection – it thus being safe for HIV-affected mothers to breastfeed. Participating countries in this CRP included Burkina Faso, India, Jamaica, Kenya, South Africa, Sri Lanka and Thailand, with expert support from Australia, the United Kingdom and the United States.

The deuterium oxide dose-to-mother technique provides accurate information about breastfeeding patterns to public health policymakers, thus playing an important role in improving the health and well-being of vulnerable populations worldwide. (Photo credit: IAEA)

The Science: Deuterium Oxide Dose-to-mother Technique

In many countries, only limited information is available on breastfeeding practices (quantity of milk consumed by the babies, time of introduction of other food). The deuterium oxide dose-to-mother technique can help to overcome the practical problems linked to the test weighting, which is the conventional method to measure breastmilk intake.

A lactating mother drinks a small amount of deuterium oxide (water containing the stable isotope of hydrogen known as deuterium). Within a few hours, the deuterium is distributed throughout her body and is incorporated into her milk. Over a period of 14 days, samples of saliva are collected from the mother and child, revealing the changes in isotope concentration. This gives researchers insight into the baby's intake of human milk and whether the baby has consumed water from other sources. After the mother has taken the dose of deuterium oxide, the deuterium gradually disappears from her body and appears in the body of the baby. Deuterium in the baby's body comes only from the milk consumed during breastfeeding. As the deuterium is eliminated from the mother's body, the enrichment in her milk declines and therefore the enrichment in the baby's body also falls. A mathematical model is used to determine how much of the deuterium given to the mother appears in the baby's saliva. This is related to the amount of human milk consumed by the baby. This model also gives an estimate of the amount of water from sources other than the mother's milk and therefore whether or not the baby is exclusively breastfed.

There is no radiation hazard associated with the use of deuterium, which is completely harmless at the levels used to assess infant feeding practices. Deuterium is naturally present at very low levels in drinking water and food.

Complementary research undertaken under a doctoral programme in Kenya showed that there were no differences in growth, body composition or breast milk intake among HIV-negative infants whether born to HIV-positive or HIV-negative mothers. Interestingly, the research also showed that infants born to HIV-positive mothers were more likely to receive exclusive breastfeeding than those born to HIV-negative mothers, most likely owing to heightened counselling efforts to support HIV-infected mothers. From a policymaking perspective, this indicated that counselling and breastfeeding support should be expanded to all mothers regardless of HIV status.

Supporting the Sustainability and Self-reliance of National Nuclear Institutions

National nuclear institutions play a key role in developing nuclear technology and devising new applications of nuclear science as well as in fostering knowledge of and access to nuclear science and technology. In several Member States, particularly low- and middle-income countries, these institutions rely largely on government funding. The IAEA provides support to national nuclear institutions and supports cooperation among institutions in different countries with the aim of increasing their sustainability and self-reliance, helping them to raise awareness about the socioeconomic impact of their activities.

In Africa, nuclear technologies are playing an increasing role in addressing development challenges, so it is important for national nuclear institutions to mobilize their own resources by demonstrating their contribution to national development. The IAEA has worked since 2014 with 12 Member States to help national nuclear institutions to reach out to potential end users of nuclear technology in the public and private sectors. The goal has been to maximize the contributions of these institutions to development and to promote self-reliance including by increasing their use of regional resources and networking.

The IAEA has supported these efforts by engaging triangular cooperation mechanisms. For example, national nuclear institutions from Egypt, Ghana, Morocco, Nigeria, South Africa and the United Republic of Tanzania – countries that possess robust human and physical infrastructure – helped nuclear research and development institutions in other African countries to reach out to end users through the execution of strategic and business action plans. An expanded regional project was launched in 2016, seeking to bolster the self-reliance of national nuclear institutions but with a focus on lower-income countries.

Similar efforts towards increasing self-reliance have taken place in the Asia-Pacific region, where an IAEA technical cooperation project is supporting efforts to promote the sustainability and networking of national nuclear institutions. Under this framework, the IAEA is promoting regional networking to exchange expertise in areas of comparative technological advantage.

The Agency has brought together senior managers from across Asia to discuss how national nuclear institutions can promote nuclear technologies, increase their impact and advance their self-reliance. Nuclear institutions in the region such as the National Nuclear Energy Agency (BATAN) of Indonesia and the Korea Atomic Energy Research Institute (KAERI) are sharing their experience in showcasing the socioeconomic impact of their activities, generating revenues and adapting to evolving technological needs.

Work towards strengthening and making national nuclear institutions more sustainable is also taking place in Latin America and the Caribbean under the ARCAL cooperative framework. In March 2018, during a meeting held in Mexico, representatives from 15 Member States in the region agreed on a workplan to promote regional sustainability and create collaborative networks.

Good examples of the results achieved by this initiative are the agreements signed in September 2018 between the National Institute for Nuclear Research (ININ) of Mexico and the Peruvian Institute of Nuclear Energy (IPEN) and in October 2018 between ININ and the Atomic Energy Commission (CEA) of Costa Rica, respectively. These agreements will foster cooperation in the areas of capacity-building and joint research, particularly in the production of medicinal radio compounds.

"This Memorandum of Understanding will allow us to more effectively share best practices in order to ensure that sustainability characterizes all the services and technologies we use and implement to address problems of a national character."

Ms. Lydia Paredes, Director General, ININ

The agreements foresee the exchange of specialized personnel, nuclear scientific information, equipment and supplies and provide an opportunity to conduct joint research projects on topics of common interest not only for the participating institutions but also for the entire Latin America and Caribbean region.

Mr. Dazhu Yang, IAEA Deputy Director General, Head of the Department of Technical Cooperation, observes the ININ hot cell for the production of radiopharmaceuticals. (Photo credit: ININ)

Photo credit: O. Yusuf/IAEA

Chapter 3

THE WAY FORWARD

The impact stories illustrate the extensive experience of the IAEA in applying South-South and triangular cooperation mechanisms in a flexible and tailor-made manner, focusing on adding value to its activities in support of Member States development priorities and seizing opportunities to build on and expand existing capacities and networks.

South-South cooperation and triangular cooperation have proven their value as effective modalities for sharing knowledge and enhancing the impact of the Agency contribution to development in the context of the 2030 Agenda, including relevant Sustainable Development Goals. Through the use of South-South and triangular cooperation modalities, the IAEA has supported Member States in jointly finding practical approaches to address common development challenges.

Applied as a complement to other types of cooperation, including North-South partnerships, South-South cooperation and triangular cooperation have strengthened the impact of the work of the IAEA in transferring nuclear technology for peaceful purposes to Member States. They have made technology transfer more closely aligned to the needs and priorities of beneficiary countries, fostered the efficient use of the limited resources of the Agency and reinforced the sustainability of its activities.

A key to success in the use of these modalities of cooperation has been to rely on strong national and regional ownership and commitment and to seek ways to institutionalize networks and partnerships so as to foster self-reliance.

Looking forward, the Agency will continue to develop South-South and triangular partnerships strategically, using them as a tool to deliver on its mandate of supporting the peaceful uses of nuclear technology to advance Member States development priorities.

The Agency will continue to work closely with the regional cooperation agreements (AFRA, ARASIA, ARCAL and RCA), which have facilitated and supported South-South and triangular cooperation since their inception, to further develop the sustainability of triangular partnerships and regional networks operating under these frameworks. In addition, it will seek to identify further opportunities for inter-agreement and interregional cooperation among countries sharing common challenges, such as SIDS.

In seeking to maximize the impact of South-South and triangular partnerships, the IAEA will encourage the sharing of existing nuclear application facilities and infrastructure among Member States, and it will continue to facilitate the exchange of expertise and knowledge through fellowships and expert visits.

In addition, the IAEA will continue to engage with other United Nations system organizations to share knowledge and experiences as well as to identify further opportunities for South-South and triangular cooperation. It also will continue to apply South-South cooperation and triangular cooperation to their full potential in support of the development priorities of its Member States.