



South-South Technology Transfer and Knowledge: from Shared Challenges to Shared Solutions



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A. Introduction

Technology and knowledge are key factors of production and drivers of economic growth in the current global economy. In addition, they contribute to sustainable development by minimizing the negative environmental and social impacts without the need to reduce economic activity. This is particularly important for countries of the Global South, which must grow their economies to bridge the gap with the developed world. This makes it crucial to acquire new technologies and knowledge to help develop and grow their economies while also being sustainable.

Technology and knowledge transfer takes place from the Global North to the South as a result of increased investment, trade and communication globally. It is commonly known that this “technology transfer” traditionally flows in direction from the Global North to the Global South. The reason is that the Global North has higher capital, greater access to finance, and technological capabilities, which are lacking in the Global South. Various multi-lateral and bi-lateral agreements have been utilized to promote the flow of knowledge and technology in this direction.

However, there are fewer known instances of such technology and knowledge transfer taking place within the Global South itself. Many countries in the Global South possess technologies and knowledge that are unique to their environment and society, making them even more valuable and economically relevant for other countries that share this context.

In this issue of ‘Eye on the South’, we focus on knowledge and technology transfer within the Global South in selected sectors. We start with an overview of the sector and explain why knowledge and technology are important to developing the sector. We will then briefly explain the ongoing transfer from the North to the South and the limitations of this transfer. The bulk of each section, however, will focus on transfer of knowledge and technology within the Global South, with two case studies explaining the advantages of this emerging type of technology transfer.

In this issue, we will cover and analyze topics in the field of hydrocarbons, agriculture, ICT, healthcare and education.

B. Oil and Gas

B.1. The importance of technology and knowledge in the oil and gas sector

Technology and knowledge transfer in the oil and gas industry is crucial for developing countries as it helps develop and improve their energy security and meet their industrial needs. As new discoveries are made, new extraction methods are required to recover these new deposits. As new environmental regulations are imposed, there is a need for new eco-friendly technology to meet these regulations. In addition, new skills and a better management system for the workers are required to help them meet these needs. All these changes will help contribute to better energy security and environmental protection, which eventually leads to long-term economic and social development.

B.2. Legacy cooperation

An example of technology transfer and capacity building from the Global North to the South in the oil industry is the partnership between Norway and Tanzania. Norway leveraged its experience in oil and gas extraction to help support Tanzania develop its own sector through transfer of underwater drilling techniques and the seismic survey technologies. This allowed Tanzania to identify new oil deposits and more efficiently extract them. Norwegian state-owned company Petoro, which specializes in offshore exploration and drilling, financed much of the training program and helped Tanzania in tapping and exploring its own underwater oil reserves.

Despite the significant advancements that benefit the oil industry in Tanzania, there are inherent limitations.

- dependence on continuous support from the donor country to provide and finance these training programs. This does not make it sustainable in the long run as financial or political difficulties may emerge in the future.
- In many cases, technology transfer from a wealthier country often requires long-term financial investments and long-term commitment, which can make the recipient country excessively reliant on a single source of finance and technology.
- There are technological mismatches, which means that the needs of a developed country in the Global North are different from those of a country in the Global South. For example, Norwegian technology is designed for a colder offshore climate

compared to the warmer climate in Tanzania, which affects the performance and durability of machinery in a different climate.

- Much of the skills and knowledge transferred assumes there is a supporting infrastructure for oil and gas extraction such as developed transportation, logistics, and supply chains, which are readily available in a developed country like Norway. Developing countries such as Tanzania face challenges in providing the necessary infrastructure to fully benefit from these skills.
- Intellectual property and proprietary technology issues can pose barriers, limiting the extent of knowledge and technology that can be shared.

Hence, while beneficial, legacy collaboration must navigate these complexities to ensure sustainable growth in the recipient country's oil and gas sector.

B.3. New South-South cooperation

Since the 1970s, many countries in the Global South have undergone periods of oil and gas nationalization, particularly in the downstream sector. This shift has created numerous opportunities for South-south collaboration within the industry. Knowledge and technology transfer in this industry within the Global South offers significant advantages over traditional North-South cooperation.

- Technologies and practices developed within the Global South are specifically designed to address the unique environmental, economic, and social conditions in developing countries, enhancing the relevance and effectiveness of technology transfer. Countries within geographic proximity often share similar environmental factors, such as climate and geological features, which makes knowledge and techniques adapted to these conditions more relevant. Additionally, economies in the Global South are often labor-intensive, leading to technological solutions better suited to their specific production processes. Social similarities among neighboring countries further facilitate the sharing and teaching of these practices, making knowledge transfer smoother and easier.
- Expertise and technology developed in the Global South is more focused on being cost-effective to overcome financial barriers, which is the biggest challenge faced by the region. The transfer of technology is also at a lower cost than that of developed countries and is cheaper to implement.
- There is a focus on building local capacities through continuous knowledge sharing between professionals and institutions within the Global South. This is more



sustainable in the long term as knowledge is exchanged both ways, which incentivizes knowledge cooperation in the long term since both sides benefit. In contrast, hiring external experts relies on continuous external funding which does not make it sustainable.

Collectively, the exchange of technological capacities in the sector is mutually beneficial, helping the Global South become more energy-secure in the long run.

B.4. Case Study for South-South Cooperation

i. Brazil Petrobras

Brazil's state-owned oil company Petrobras plays a significant role in transferring knowledge and technology and has a significant presence in Africa.

- Petrobras offers capacity building to national oil companies (NOCs) in the Global South, providing training programs and workshops to share its expertise in offshore oil exploration. These programs are given to professionals from various countries in the global south, even countries where Petrobras does not operate¹. In addition, the company provides a knowledge management system which is available to most NOCs in developing countries.
- Petrobras also engages in collaborative research and development with various universities and research institutions in Bolivia, Colombia and Angola. The research is mostly focused on sustainable practices in the oil industry and conducting research in the field of offshore oil drilling. The most notable agreement is between Petrobras and Angola's state owned Sonangol, which focuses on deep-water drilling and enhanced oil recovery techniques. Both countries have conducted research to improve their efficiency and develop technologies tailored to the unique geological conditions of Angola and Brazil's offshore oil fields.

ii. Malaysia Petronas

Malaysia's state-owned oil company, PETRONAS, is involved in all stages of the petroleum value chain, from upstream exploration to downstream refining, which includes marketing and distribution. Following the nationalization of oil concessions

¹ Parshall, Joel. "Petrobras: A Legacy of Growth Continuing and Accelerating." J Pet Technol 62 (2010) <https://onepetro.org/JPT/article-abstract/62/08/26/194276/Petrobras-A-Legacy-of-Growth-Continuing-and>



in 1974, the Malaysian government consolidated control over oil resources, leveraging rising oil revenues to invest in developing its workforce and technical expertise in oil extraction. These policies made PETRONAS the first vertically integrated national oil company in the world.

Since 1990, PETRONAS has expanded its operations internationally, particularly within the Global South, including in Algeria, Nigeria, Ghana, and Vietnam. This expansion did not only encompass oil production and refining activities, but also the dissemination of technical skills and knowledge, especially towards blue-collar workers in the sector, developed during the nationalization period of the 1970s and 1980s.

PETRONAS has been actively involved in supporting Nigeria's oil and gas sector through technology transfer, capacity building, and joint ventures. The agreement with Nigeria is unique as a larger proportion of the joint-venture is dedicated to training other professionals, than engaging in oil activity. This helps enhance Nigeria's exploration and production capabilities to become more self-sufficient, cost-effective and efficient. It has done this by:

- Sharing its advanced deep-water drilling and production. This includes the transfer of seismic survey technologies developed in Malaysia, which were used for mapping and identifying oil reserves in Nigeria that would otherwise have remained undiscovered.
- Helping train Nigerian professionals in new drilling techniques, safety protocols, and environmental management practices. These training sessions helped teach how to operate and maintain oil extraction equipment and helped reduce the dependency of the country on foreign oil companies, helping make the industry more sustainable. Previously, the Nigerian government would have had to outsource its oil extraction equipment to a multinational oil company.
- The training of professionals in Nigeria instead of replacing them with foreign consultants has had broader economic and social benefits, and has created numerous job opportunities, both directly in the industry and indirectly through supporting sectors.
- In addition to technical training, PETRONAS has supported capacity-building initiatives aimed at enhancing the overall capabilities of Nigeria's oil and gas workforce. This includes workshops and seminars on project management, regulatory compliance, and best practices in the industry. This has helped in building Nigerian oil projects that are more cost effective and minimize

environmental damage. The benefits also extend to the community living near oilfields such as farmers and fisherman who are sometimes exposed to the negative effects of oil production.

- The training by PETRONAS increased oil production, which contributed to Nigeria's economic growth, providing additional revenue for social and economic development projects.
- PETRONAS has also facilitated Nigeria's access to development funding from multilateral institutions by complying with international regulations which helps in improving access to external development financing.

Overall, these benefits lead to increased oil production and self-sufficiency which provided increased oil revenue for economic and social development projects. PETRONAS' collaboration with Nigeria shows how national oil companies in the Global South can support each other through technology transfer, capacity building, and joint ventures. This partnership has not only enhanced Nigeria's oil production capabilities and minimized the environmental impact, but also contributed to its overall economic and social development.

B.5. Key messages

Knowledge and expertise sharing of the oil and gas industry within the Global South offers benefits for self-reliance, sustainability, and economic growth for these countries. This collaboration in capacity-building, technology transfer, and joint ventures fosters the development of local skills, and reduces dependency on foreign expertise and multinational oil companies. It promotes new homegrown solutions to regional challenges. This exchange of knowledge allows for more efficient, cost-effective operations and the adoption of sustainable practices tailored to specific environmental and economic needs. It brings economic benefits, including higher employment, oil revenue growth, and improved environmental management. This mutual understanding is built on similar social and economic contexts, which makes it more relevant, cost-effective, and adaptable to local challenges, unlike multinational oil companies that are less suited to tackling regional issues.

C. Agriculture

C.1. The importance of technology and knowledge in the agricultural sector

Knowledge sharing in the agriculture industry to develop new methods helps address challenges such as climate change and a growing population, which leads to enhanced food security. The exchange of best practices and sharing of agriculture technologies between countries can lead to improved crop yields, reduced harvest losses, and the implementation of sustainable farming methods that reduce environmental degradation. This promotes resilience against environmental and economic shocks, boosts the local economies in rural areas, and leads to a more sustainable global agricultural industry, which benefits both producers and consumers of agricultural goods.

C.2. Legacy cooperation

Agricultural development in developing countries has traditionally been supported through bilateral and multilateral initiatives. The World Bank's Global Agriculture and Food Security Program (GAFSP) aims to strengthen the resilience of smallholder farmers in the Global South by allocating grants to government programs in rural areas to help implement agricultural solutions. The various initiatives under the GAFSP program were effective, and as of 2023 helped improve agriculture yields and improved the total factor productivity of these developing countries.²

However, the benefits of these programs were only realized by countries that were already climate-ready, and among those, only agricultural adaptation aid projects were implemented successfully. Many countries in Africa and South-West Asia are excluded because of their lack of climate-ready infrastructure, while countries that were classified as climate vulnerable were not able to apply for grants. There are also other limitations of North-South cooperation, which include environmental differences in climate and soil quality, which means agricultural practices in the North may not be applicable for the warmer countries in the South. Many advanced technologies may not be affordable for small farmers, nor more cost-effective since farming is more labor intensive in developing countries. Finally, the transfer of knowledge and technology, though

² Supporting agriculture in developing countries: New insights on the impact of official development assistance using a climate perspective, by Maria Teresa Trentinaglia, Lucia Baldi, and Massimo Peri.

sometimes beneficial to farmers, remains limited. North-South cooperation usually relies on multi-lateral institutions being financed by a developed country in the long run, which is not guaranteed, making it unsustainable.

C.3. New South-South cooperation

Knowledge-sharing in agriculture within the Global South overcomes these limitations by providing solutions tailored to shared challenges. Many of these countries have similar climate and soil conditions, making their solutions more relevant to one another. Also, they often have similar levels of economic development, financial constraints, and labor-intensive production factors. This helps in spreading successful local innovations and sustainable practice while also reducing the dependency on foreign aid.

C.4. Case Study for South-South Cooperation

i. FAO-China South-South Cooperation

One example of South-South cooperation in agriculture is the FAO-China South-South Cooperation (FAO-SSC) program. This initiative was launched by the Chinese government in 2009 in collaboration with FAO, to focus agricultural development in Global South with an emphasis on Africa. Between 2009 and 2023, the program has allocated US\$130 million for capacity-building in agriculture to support food security, pest control, and sustainable practices. The program emphasizes adaptability and scalability as the two most important principles in developing agriculture, and it aims to share China's experience with those principles.

Box 1: Two main principles of adaptability and scalability of the FAO-China South-South Cooperation Program

Adaptability is making the agriculture sector adjust to new conditions by making it more resilient to economic shocks, climate change and frequent droughts. This is done by introducing new drought-resistant seeds, new water irrigation methods and rotating crops.

Scalability involves increasing crop yields and improving productivity. This is done by introducing new technology, using more productive seeds and introducing new agriculture managerial methods.

The FAO-SSC program helps overcome challenges faced by developing countries by providing technical training of sustainable agricultural practices to provide the exchange of knowledge. Below is a list of case studies where the FAO China SSC program was implemented.

Table 1. List of Countries Where FAO-SSC Programs have been Implemented

| Country | Scope | Type |
|-------------------|---|---|
| Egypt | <ul style="list-style-type: none"> • Training sessions focusing on modern agricultural techniques and sustainable practices | <ul style="list-style-type: none"> • Improved agricultural yields (scalability) |
| Ethiopia | <ul style="list-style-type: none"> • Technical assistance in irrigation management • crop diversification | <ul style="list-style-type: none"> • Increased agricultural productivity (scalability). • lower risk of droughts (adaptability) |
| Kenya | <ul style="list-style-type: none"> • Knowledge exchange on pest management • Training sessions on sustainable farming methods | <ul style="list-style-type: none"> • Enhanced resilience against pests and diseases (adaptability) • Improved agricultural yields (scalability) |
| Mozambique | <ul style="list-style-type: none"> • Technical training on using improved seed varieties • Training sessions on sustainable farming methods | <ul style="list-style-type: none"> • Improved agricultural yields • Better economic stability for rural communities |
| Brazil | <ul style="list-style-type: none"> • Knowledge exchange on agroecological practices and policies to promote sustainable agriculture • Research collaboration on rural economic development. | <ul style="list-style-type: none"> • Improved agricultural yield • Improved environmental conservation by small farmers |

Source: FAO-China South-South Cooperation Program.

Despite sharing common challenges, all of these countries have their own unique economic and environmental features. Depending on the region, the FAO-SSC offers different training programs at different scales instead of a unified program. Most of the aforementioned countries are also listed as climate-vulnerable and are located in Africa. As previously stated, traditional North-South support did not have much impact on this particular group of countries.

ii. Indian Technical and Economic Cooperation - Agriculture

India's involvement in disseminating its knowledge and expertise in Agriculture in Africa has been significant, offering technical training and financing to African farmers and agricultural institutions. These efforts include initiatives through the Indian Technical and Economic Cooperation (ITEC) program, which offers skills-based training in agricultural sciences, crop management and water conservation techniques. This initiative is described by the Indian government as "demand-driven" and of "mutual benefit," as it also benefits India's economic interests, since it is a major importer of African agricultural products, such as spices, and edible oils. This has a positive impact on food security in these African countries and contributes to rural economies in Africa, and also benefits Indian consumers by providing greater yield, better agricultural goods, and cheaper prices.

Table 2. Overview of ITEC Agricultural Training and Support Initiatives in Select Countries

| Country | Benefit |
|----------------|--|
| Kenya | <ul style="list-style-type: none">• ITEC has offered Kenyan landowners training in, water management, and food security, which have enhanced agricultural productivity and sustainability. |
| Egypt | <ul style="list-style-type: none">• Due to the similar arid climate in Egypt and regions of India, ITEC has provided Egyptian farmers training in efficient water management techniques while minimizing water evaporation loss. This was done by teaching water conservation methods and using modern irrigation systems.• ITEC delivered post-harvest management training focused on the storage and transportation of agricultural produce, aimed at minimizing losses and maximizing revenue. This often-overlooked aspect of agricultural operations supports job security and sustains employment opportunities along the rural economic value chain.• ITEC has also worked with agricultural professionals to plan and implement large scale long term agricultural projects. |
| Senegal | <ul style="list-style-type: none">• Senegalese farmers received training in modern farming techniques, to increase agricultural productivity. This training includes sustainable practices, soil health management, and the use of technology in farming.• ITEC shared best practices and successful models from India with the government of Senegal to help the Senegalese government implement agricultural policies.• ITEC has provided support to smallholder farmers, to help improve their practice and improve their income. |

| | |
|-------------------|---|
| Bangladesh | <ul style="list-style-type: none">• ITEC has supported climate-smart agriculture initiatives in Bangladesh, helping farmers use technology to increase productivity, enhance resilience, and reduce greenhouse gas emissions. This includes using straw stubbing methods in rice farming.• ITEC trained policy workers to use data-driven techniques to manage agriculture yields. |
|-------------------|---|

Source: ECES Research.

A key characteristic of the agriculture training programs described above is their emphasis on improving Human capital and knowledge. This approach lowers entry barriers for developing countries seeking to enhance their agricultural sectors, mitigating challenges faced due to financial resources. Finally, the program is sustainable in the long run as it benefits both parties; it benefits farmers in developing countries by enhancing their yields and benefits India by providing it with cheaper agricultural goods.

C.5. Key messages

Support from India and China, the two largest economies in the Global South, which are also agricultural goods consumers, is the primary form of agricultural cooperation between Southern countries. This dynamic creates significant market access opportunities for smaller nations in the region. Many of these countries share similar environmental conditions, such as arid climates and financial constraints. They also share a similar ownership structure, with most landowners being smaller ones, making shared knowledge on overcoming these challenges particularly valuable due to its relevance. However, knowledge-sharing in the Global South remains limited by its heavy reliance on support from the two major economies, highlighting a need for increased exchange of expertise among smaller nations.

D. ICT and Digital Economy

D.1. The importance of technology and knowledge in the ICT sector

Transferring knowledge and technology in the ICT industry have several advantages that can help address common challenges and leverage digital solutions for sustainable development. Numerous developing countries lack a sufficient digital infrastructure, as government institutions, small businesses, and citizens lack access to electronic devices that can connect to the Internet.

These issues faced by developing countries can be overcome by improving knowledge transfer, digital literacy, and internet access. Improving digital infrastructure and literacy will benefit many sectors around the economy such as:

- **Education and Skill Development:** Enhances educational opportunities through e-learning platforms and digital resources, reaching remote areas.
- **Healthcare:** Enables telemedicine and health information systems, improving healthcare delivery in underserved regions and giving them access to skilled health consultants.
- **Governance and Transparency:** Improves governance with e-governance initiatives, enhancing transparency and efficiency in public administration.
- **Inclusivity and Social Empowerment:** Promotes digital inclusion, empowering marginalized and underserved communities and promoting social equity.
- **Innovation and Entrepreneurship:** Stimulates innovation and entrepreneurship, allowing start-ups and small businesses to develop new products and business models.
- **Resilience and Adaptability:** Enhances resilience with tools for disaster management, climate adaptation, and crisis response. These strategies can be shared for developing better planning for recovery from emergencies to respond to disasters.
- **Global Integration:** Facilitates knowledge exchange, cultural understanding, and international collaboration; crucial for sustainable development.

The ease of sharing data in the field of ICT and digital technology significantly enhances the effectiveness of knowledge and technology transfer. Unlike other sectors that might involve physical goods or complex logistics, digital information can be transmitted much cheaper and faster.

D.2. Legacy cooperation

Traditionally, the Global North has cooperated with the Global South by transferring knowledge, experience, and technology to leverage ICT for development. Many corporations in the Global North have implemented training programs in developing countries to strengthen the digital ecosystem and equip the workforce with essential digital skills.

For instance, initiatives like Microsoft's Africa Development Center (ADC) collaborate with local African universities to provide mentorship and innovation in technology. This method facilitates the development of a more skilled workforce in ICT skills, which raises the potential of these countries in developing services and software. Kenya and Nigeria are the primary countries that the ADC supports. ADC collaborates with local institutions and technology hubs to offer mentorship, training programs and real-world experience to local talent. In the long run, this helps increase job opportunities and prepares more IT professionals for the job market.

A significant example of ADC's impact is its partnership with the Nigerian government to enhance digital skills and create employment. Through this partnership, ADC has trained thousands of students and professionals in advanced tech skills, such as cloud computing, AI, and software engineering. Moreover, ADC has developed technology solutions tailored to address Africa-specific challenges, such as optimizing healthcare delivery and improving agricultural productivity using AI.

While initiatives that promote the transfer of ICT technologies from the Global North to the South have a positive impact overall, there are also several inherent limitations to this North-South transfer that lessens their impact:

- **Dependency on External Funding and Expertise:** These programs are often funded with private financing from the Global North, making these programs unsustainable in the long-run. For example, the ADC has reduced its support funding to African institutions since 2020, which has impacted institutions that are dependent on it.
- **Mismatch with Local Needs:** Solutions and software developed by or influenced by the Global North may not always align with the specific economic, social, and cultural contexts of the Global South. This can lead to their inability to address the specific needs of developing countries. For example, software solutions tailored to the Global North do not consider infrastructure limitations in

the south such as limited internet connectivity. For example, when Google introduced Google Maps to rural India, the company assumed consistent internet connectivity. The app's heavy data requirements and reliance of constant connectivity made it impractical for local users who used simpler, offline-compatible navigation apps.

- **Skill and Brain Drain:** Many highly skilled individuals trained through these initiatives may seek better job opportunities abroad, leading to a "brain drain." This migration of talent can hamper the long-term growth of the local ICT sector. Thus such initiatives would leave little or no impact on the recipient country.
- **Digital Divide within Societies:** Digital transformation projects from the Global North often target urban areas, which means that people living in remote areas will not be able to benefit from them; as they usually have less access to the Internet.
- **Markets:** Companies from the Global North, including ADC, tend to operate within market-driven models and their areas of focus, and rely on profitable projects rather than on more important areas. For example, on-demand consumer services becoming digitized is profitable but provide limited value add to the economy.

The aforementioned challenges highlight the limitations of sharing knowledge and ICT technologies in a North-South Framework. Knowledge sharing through a South-South framework is considered more relevant and cost effective.

D.3. New South-South Cooperation

Many countries in the Global South have worse digital infrastructure than the Global North due to citizens and businesses having lower access to internet-connected devices. This means that much of the knowledge, support and software services developed in the Global North may not be utilized in the global south. This necessitates that developing countries identify specific software solutions that enable them to overcome their restricted hardware access and integrate traditional and modern solutions.

i. Indian Technical Economic Cooperation - ICT

Since the 1980s, the Indian government has addressed many of its development challenges by transforming its economy digitally, by building an ICT infrastructure and

developing a skilled workforce. Through its public and private sector, the Indian government has offered many initiatives to share its knowledge and experience in ICT with other developing countries. These efforts include capacity-building programs led by the Indian government under the Indian Technical and Economic Cooperation (ITEC) program, as well as similar initiatives undertaken by private Indian companies (Table 3).

Table 3. Overview of ICT Training and Development Initiatives by Indian Government and Private Companies

| Country | Entity | Regions Supported | Training Focus Area |
|---------------------------------|--|---|---|
| Indian Government | The Indian Technical Economic Cooperation (ITEC) program is a capacity building platform of the Indian Ministry of External Affairs. It has offered 100000 capacity building training and scholarships around the world. | Bangladesh Nepal Kenya Indonesia Uganda | <ul style="list-style-type: none"> • E-governance • Cybersecurity • Software Development |
| Private Indian Companies | NIIT and InfoSys are major Indian software and service companies that specialize in providing training support | Rwanda Kenya Nigeria Bangladesh | <ul style="list-style-type: none"> • Building digital platform for education in Rwanda • Building digital platform for e-governance in Rwanda • Cybersecurity training for government officials in Nigeria • Helped Nigerian software companies build software suited to their local needs • Developed training programs in Ghana in software development, and cybersecurity |

Source: ECES Research.



India's knowledge and experience in developing software products is being shared with other developing countries through most of these training programs. The beneficiary countries are as follows:

- **Kenya:** It helped Kenyan programmers build e-government services and improve its cybersecurity
- **Nigeria:** Many Nigeria professionals gained experience in software development and data analytics, which helped grow several businesses.
- **Rwanda:** It Helped Rwandan programmers build digital services for the country and helped attract significant investments in the ICT sector.

ii. India Stack

India Stack is a digital toolbox that the Indian government developed to help small Indian companies add features to their software to include identity verification, data services and payment. These are features that would otherwise be very costly to develop in-house or license. Although India Stack is not a service, it is a set of APIs and digital support tools to help smaller businesses develop this software.

The India Stack benefits both SMEs and small Indian software developers by:

- Making digital payments easier to implement
- It gives easier access to credit for non-bankable consumers and SMEs. It also makes it easier for them to build a credit history.
- The digital identity system that is part of India Stack (Aadhaar) helps replace paper processes by streamlining operations leading to reduced costs.
- Expands market reach for SMEs to advertise and sell their products beyond their geographical location.
- Increases overall efficiency and productivity, allowing businesses to focus on growth and innovation instead of day-to-day management.

The India Stack toolbox is shared with other countries in the Global South, and it is used as a base to help build other software services. This enables developing nations to create digital solutions for various public services and economic activities without the necessity of starting from scratch or paying substantial service fees to multinational tech companies to use them. This enables other countries to create

their own digital ecosystems, which leads to improved governance, financial inclusion, and economic growth. Countries such as Rwanda have already used this digital toolbox to develop their own digital identity system at a faster pace and without having to rely on proprietary software. Other Caribbean nations and Papua New Guinea are also in the process of utilizing this digital toolbox.

The India Stack is a unique digital toolbox that takes into account the various limitations faced by developing countries, which are not assumed by other digital solutions. These limitations include lack of access to financing, a smaller unbanked market, and lower digital connectivity.

D.4. Key messages

Within all these numerous initiatives that implement technology transfer within a South-South framework, they all possess the same common advantages. Indian sharing of ICT expertise is more cost-effective, respects the sovereignty of participating nations, and is capable of developing services and software that cater to the unique requirements of developing countries, according to the UN Office of South-South Cooperation.³

E. Renewable Energy

E.1. The importance of technology and knowledge transfer in the renewable energy sector

Transferring knowledge and technology in the field of renewable energy is crucial for developing countries due to several reasons, including economic, environmental, and social benefits.

- **Improved energy access:** Many developing countries face significant energy deficits in rural areas. Renewable energy technologies increase energy output and also improve access in remote areas. Technology transfer can help these countries build renewable energy in underserved areas.

³South-South Cooperation: Advancing Alternative Development Paradigms Indian Technical and Economic Cooperation Programme Case Study <https://southsouth-galaxy.org/publications/south-south-ideas-advancing-alternative-development-paradigms-indian-technical-and-economic-cooperation-programme-case-study/>



- **Reduced dependency on fossil fuels:** Renewable energy technologies reduce dependency on fuel imports, leading to improved energy security and reduced vulnerability to global price fluctuations and foreign currency exposure.
- **Reducing Environmental Degradation:** Traditional energy sources such as hydrocarbons lead to deforestation, air pollution and other health issues.
- **Employment and entrepreneurship:** Knowledge and technology transfer creates jobs by encouraging countries to build domestic industries that cater to their needs rather than relying on imported technologies. It also encourages domestic scientists and engineers to use their local expertise to benefit the industry.

E.2. Legacy cooperation

The Global North plays a crucial role in supporting the Global South in transferring knowledge and technology in the renewable energy sector. It benefits the global south in the following:

- **Financial Aid and Investments:** Developed countries and multilateral organizations provide financial aid and investments to support renewable energy projects in developing countries. Financing is usually a major obstacle to kickstarting these projects.
- **Technology Transfer and Capacity Building:** The Global North shares advanced technologies and provides training programs to build local capacity in renewable energy. This includes training local engineers and technicians as well as improving local manufacturing capacity in renewable energy machinery
- **Policy and Regulatory Support:** Developed countries offer legal guidance on creating policies and regulatory frameworks that promote renewable energy adoption. This includes advising developing nations on offering incentives for renewable energy investments and strategies for integrating renewable energy into their power grids.
- **Research and Development Collaboration:** Collaborative research leveraging the strengths of both parties to help develop renewable energy technologies. The Global North has greater capacity and research resources while the global south has a deeper understanding of the environment, and the specific needs of developing countries.
- **Access to Markets and Networks:** The Global North provides access to international and large markets as suppliers and consumers of energy. This

further the exchange of technology through commercial exchange in the private sector.

A notable example of technology transfer from the Global North to the Global South is the Solar Power Project in Uganda. This project was supported by several multilateral organizations and developed countries, including Germany and the United States. The aim of the project was to provide sustainable energy to rural and underserved communities in Uganda by installing solar panels and battery systems in several remote villages. The project facilitated the transfer of knowledge by training local technicians in the installation, operation, and maintenance of the solar power systems, providing them with skills for the future. It benefited Uganda by providing energy to schools and health facilities in remote locations.

Despite the benefits seen in Uganda, there are limitations to relying on expertise about renewable energy solely from the Global North. They are⁴:

- **Cost-Effectiveness:** The technology transfer relies on purchasing parts and machinery from the donor countries. For example, in the case of the Solar Power Project in Uganda it relied on the purchase of Solar Panels from Germany, which was more costly.
- **Contextual Relevance:** Renewable energy research and knowledge development is done within the context of the climate in the Northern Countries and doesn't take the difference in climate in the Global South into account.
- **Regional Cooperation:** A lot of the collaboration takes place during the building of these renewable energy projects and ends once the project funding period ends.
- **Transitioning to renewable energy:** Differences in policy and regulatory frameworks can hinder the effective transfer and implementation of renewable energy technologies
- **Technological Dependency:** Relying on technology from the Global North can create dependency, limiting the ability of developing countries to innovate and develop their own solutions.

⁴Transitioning to renewable energy: Challenges and opportunities
<https://iee.psu.edu/news/blog/transitioning-renewable-energy-challenges-and-opportunities>

To overcome many of these limitations, it's necessary to encourage the transfer of expertise on renewable energy projects in the global south.

E.3. New South-South Cooperation

The sharing of knowledge and expertise on building renewable energy projects can be beneficial through:

- **Cost-Effectiveness:** South-South exchange of knowledge is often more cost-effective, as countries share expertise by collaborating with peers who are also faced with limitations in finance.
- **Contextual Relevance:** Knowledge and experience developed within the Global South are more likely to be contextually relevant and applicable to local conditions, which will make it easier to adopt and implement these technologies in renewable energy projects
- **Joint projects:** Many neighboring countries share expertise and build large renewable energy projects that benefit both countries, which would have been financially impossible with the resources of a single country.

i. Ethiopia, China, and Sri Lanka Cooperation

A notable example of South-South cooperation is the Biogas, Biomass, and Solar Trilateral Cooperation Project involving Ethiopia, China, and Sri Lanka under the UNDP.⁵ This was one of the few instances of South-South cooperation that was done through a multilateral, rather than bilateral initiative. This project supports Ethiopia in ensuring energy access and sustainable resource consumption through trials and demonstrations of biogas and solar energy for productive uses. According to the UNDP report, the project gave an additional 12% of the population access to off grid electricity. The project has implemented five trials with the aim of attracting further private investment in the project. In Sri Lanka a smaller scale project was done by installing solar panels and greenhouses in rural areas to enhance agriculture.

The project benefited Ethiopia and Sri Lanka by enhancing their expertise in many ways:

⁵ Advancing Green South-South Trilateral Cooperation - <https://www.undp.org/ethiopia/news/advancing-green-south-south-trilateral-cooperation>



- China provided biogas and solar energy for agriculture and rural energy solutions, which were locally customized to meet the needs of Ethiopia and Sri Lanka.
- In Ethiopia, a joint research and extension center was established at Wolaita Sodo University with the China Agricultural University (CAU) to serve as a hub for knowledge sharing, research, and demonstrations of renewable energy solutions.⁶
- China provided policy support to Sri Lanka in how to utilize the renewable energy projects to support Sri Lanka's national goals to reduce greenhouse gas emissions.⁷

Overall, the project benefited Ethiopia and China not by just providing rural energy access, but by enhancing their capacity to self-develop their own renewable energy systems.

ii. Brazil-Mozambique Renewable Energy Project

The Brazil-Mozambique Renewable Energy Project is an example of South-South exchange of knowledge, where Brazil has shared its expertise in renewable energy with Mozambique to enhance Mozambique's energy capacity and promote sustainable development.⁸ The project involves the transfer of knowledge, technology, and best practices from Brazil to Mozambique. The project helped transfer expertise from Brazil to Mozambique by:

- **Training and Capacity Building:** Brazilian experts have conducted training programs for Mozambican engineers, technicians, and policymakers, to help them maintain renewable energy systems. Brazil also provided support on how to install solar panels and wind turbines.
- **Policy and Regulatory Framework:** The project has also focused on developing a regulatory framework for promoting renewable energy in

⁶ Catalyzing South-South Cooperation on RET - <https://www.undp.org/ethiopia/news/catalyzing-south-south-cooperation-ret>

⁷ Sri Lanka successfully implements trilateral cooperation project with UNDP assistance - <https://lankanewsweb.net/archives/58213/sri-lanka-successfully-implements-trilateral-cooperation-project-with-undp-assistance/>

⁸ Mozambique Signs Agreement With Brazil To Develop Biofuels - <https://360mozambique.com/development/renewables/mozambique-signs-agreement-with-brazil-to-develop-biofuels/>

Mozambique and making use of Brazil's expertise in attracting private investment in the renewable energy sector.

Since the project was initiated in June 2024, it is still too early to assess its impact on Mozambique's energy access and climate goals. However, given that both countries share knowledge, language, climate, and environment, it will likely lead to improved energy security for the country.

E.4. Key messages

South-South knowledge exchange in renewable energy is highly cost-effective, as it enables countries with similar financial constraints to share expertise and collaborate efficiently. The knowledge and experience developed within the Global South are often more contextually relevant and better suited to local conditions, facilitating the adoption of renewable technologies and the implementation of projects. Additionally, neighboring countries frequently collaborate on large-scale renewable energy projects, pooling resources and expertise to achieve initiatives that would be financially unfeasible for a single country to undertake alone.

F. Conclusion

In conclusion, the paper underscores the potential of South-South cooperation in knowledge and technology transfer across key sectors such as oil, renewable energy, agriculture, and ICT. Unlike traditional North-South models, which often face limitations in sustainability, relevance, and inclusivity, South-South initiatives are more adaptable to shared challenges, cost-effective, and focused on fostering local capacities. By leveraging shared experiences and similar socio-economic contexts, these collaborations enable developing countries to build self-reliance, reduce dependency on external expertise, and create solutions tailored to their unique conditions. The success stories highlighted in the paper, from Petrobras transferring its expertise to African countries to India's provision of training programs in ICT, demonstrate the capacity of the Global South to drive innovation and sustainable development through mutual benefits. Scaling such initiatives further will not only enhance economic growth, but also build self-reliance on technology in developing countries.