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# POLICY BRIEF

## Key points

- By building and sharing the global stock of knowledge, a centralized repository of open-source technical information can help developing countries leapfrog to sustainable, inclusive and resilient recoveries in line with the 2030 Agenda
- The United Nations is well-placed to take the lead in setting up such a database, given its established role in advocating open-source technologies through various intergovernmental forums and in various publications
- The success of such a database will depend on solid support from Member States of the United Nations, as well as on collaboration and cooperation among United Nations agencies, including UNCTAD

## Facilitating access to open-source technologies

Ensuring easy and affordable access by developing countries to appropriate technologies is critical in achieving the 2030 Agenda for Sustainable Development. Open-source technologies can provide a means of effective technology transfer. Countless open-source designs and technologies are shared by innovators worldwide, yet there is currently no central repository of such technologies and this makes it difficult for producers or consumers in developing countries to locate and access them. The Economic and Social Council of the United Nations recently adopted resolution 2021/30 on open-source technologies for sustainable development. In this policy brief, an explanation of why developing countries need access to such technologies and proposals of ways to move forward in implementing the resolution are provided.

### A new resolve on open-source technologies

Open-source technologies support the production of goods based on publicly shared designs. The source code is generally available free of charge, including the software bill of materials, schematics, computer-aided designs and other information needed to produce a physical item. Anyone can study, modify, make, distribute or sell the design or goods based on the design. Unlike open-source software, open-source hardware technologies have only recently begun to emerge, yet may be a game changer in the dissemination of technology among developing countries and the most vulnerable.

UNCTAD has been promoting the use of open-source technologies for many years. In a report in 2003, UNCTAD examined the advantages of promoting a policy to support a positive environment for open-source software and technologies to build, maintain and change the rules governing information flows.<sup>1</sup> At the fifteenth session of the Commission on Science and Technology for Development in 2012, participants highlighted that technical information available via open-source methods could overcome barriers to building the global stock of knowledge, particularly in developing countries.<sup>2</sup>

<sup>1</sup> UNCTAD, 2003, *Electronic Commerce and Development Report 2003* (United Nations publication, Sales No. E.03.II.D.30, New York and Geneva).

<sup>2</sup> See <https://unctad.org/meeting/commission-science-and-technology-development-fifteenth-session>.

Note: All websites referred to in footnotes were accessed in December 2021.

Open-source technologies are increasingly seen as key in supporting digital transformation. Under traditional technology transfers, commercially available technologies are acquired through the payment of intellectual property royalties. As a result, such transfers are often too costly for many users in developing countries or too difficult to adapt and adopt locally. Financial and intellectual property constraints make traditional technology transfer a significant challenge in developing countries. However, without better access to appropriate technologies in developing countries, the 2030 Agenda is unlikely to be achieved worldwide. The open-source approach to technology diffusion is a fast-developing model of providing such access.

On 22 July 2021, the Economic and Social Council adopted a resolution on open-source technologies for sustainable development.<sup>3</sup> Substantive inputs from UNCTAD contributed to the related discussions and to the evolution and adoption of the resolution. The Economic and Social Council, in the resolution, noted the availability of open-source technologies that can contribute to the Sustainable Development Goals and decided to invite the Secretary-General of the United Nations to develop specific proposals on ways to better leverage open-source technologies for sustainable development.

### **Open-source appropriate technologies are crucial in achieving sustainable development**

Technologies that meet the needs of developing countries in achieving sustainable development are urgently needed. One area particularly ripe for open-source development is appropriate technology. Such technology encompasses technological choices and applications that are small-scale, affordable, decentralized, energy-efficient, environmentally sound and easily and economically utilized from readily available resources by local communities to meet their needs. Appropriate technologies can contribute to achieving the Sustainable Development Goals and are designed with free and open-source software and hardware. Examples of appropriate technologies that can contribute to achieving particular Goals are as follows:

- Goal 2: An automatable field camera track system, which measures the performance of plants in their environment and quantifies crop lodging and movement under field wind conditions<sup>4</sup>
- Goals 2 and 7: Technology for making solar cookers, for cooking or baking, the advantages of which include the mitigation of carbon dioxide emissions, the improvement of indoor air quality and the promotion of equitable access to energy<sup>5</sup>
- Goal 4: A three-dimensional printed laboratory-grade optical microscope that, for less than \$100, can replace commercial tools that can cost over \$30,000<sup>6</sup>
- Goal 15: Open-source image processing and analysis software, initially developed for examining microscopic organisms, that can also be used for remote-sensing via drones due to its high level of adaptability<sup>7</sup>

An ever-increasing number of organizations, groups and individuals have adopted open-source appropriate technologies. Many such technologies are being shared, ranging from those intended for making consumer goods to those intended for making scientific and medical equipment. Access to relevant knowledge and

<sup>3</sup> E/RES/2021/30, available at <https://www.un.org/ecosoc/en/documents/resolutions>.

<sup>4</sup> AQ Susko, F Gilbertson, DJ Heuschele, K Smith and P Marchetto, 2018, An automatable, field camera track system for phenotyping crop lodging and crop movement, *HardwareX*(4).

<sup>5</sup> See <https://www.ctc-n.org/technologies/solar-cooking>.

<sup>6</sup> See <https://openflexure.org/projects/microscope>.

<sup>7</sup> See <https://imagej.nih.gov/ij>.

technology can significantly help developing countries improve quality of life and address sustainable development challenges. For example, the open-source model has proved effective during the ongoing pandemic, with a significant increase in the number of open-source designs and solutions related to, for example, ventilators and personal protective equipment.

### **Useful information about open-source appropriate technologies is challenging to find**

Thousands of appropriate technologies have been developed to respond to local needs but there are difficulties in broadly sharing such technologies with other communities. Many technologies are either not included in databases or found only in databases focused on specific technologies. This makes it difficult for producers or consumers in developing countries to locate and access open-source technologies and databases, such as the following:

- Digitally manufacturable low-cost carbon filter to provide clean drinking water<sup>8</sup>
- Appropriate technology library, maintained by a non-profit organization that helps to achieve sustainable community-based development by connecting communities with global resources through training and by consulting and networking with organizations worldwide<sup>9</sup>
- Wiki-based website that stores collaborative solutions for challenges related to sustainability, poverty reduction and international development, used by, for example, an organization that aims to redesign concepts, tools and methods to make them accessible to everyone worldwide<sup>10</sup>

Some databases, including in the United Nations system, help facilitate the transfer of technologies, yet the information included is not always linked to specific Sustainable Development Goals. Such databases include the following:

- 2030 Connect, a United Nations online technology platform for the Goals, launched in 2020 as a gateway to existing science, technology and innovation resources within and beyond the United Nations system; the 2030 Connect platform is an integral part of the Technology Facilitation Mechanism of the United Nations<sup>11</sup>
- Technology Access Partnership, launched by the Technology Bank for the Least Developed Countries; the partnership is aimed at addressing critical shortages of essential health products and technologies to address the pandemic, while facilitating the acceleration of the distributed manufacturing of protective gear<sup>12</sup>
- World Intellectual Property Organization database of innovative technologies and needs that provides a catalogue of sustainable solutions and needs worldwide, including technologies, from prototype to marketable product, available for licencing, collaboration, joint venture and sale; and a free online tool used to match seekers of specific intellectual property-related development solutions with potential providers of resources<sup>13</sup>
- Global Technology Transfer and Knowledge Management Partnership<sup>14</sup>

<sup>8</sup> See <https://faircap.org>.

<sup>9</sup> See <https://villageearth.org/home/appropriate-technology-library/>.

<sup>10</sup> See <https://www.appropedia.org/> and <https://www.demotech.org/>.

<sup>11</sup> See <https://tfm2030connect.un.org>.

<sup>12</sup> See <https://www.un.org/ldcportal/tech-access-partnership-for-ldcs-amid-covid-19>.

<sup>13</sup> See <https://wipogreen.wipo.int/wipogreen-database/database> and <https://www.wipo.int/wipo-match/en>.

<sup>14</sup> See <https://sustainabledevelopment.un.org/partnership/?p=1541>.

The variety of databases makes it challenging to identify appropriate technologies that could address the specific development needs of a community. In general, the existing databases do not offer a straightforward way to classify technologies in terms of needs with regard to achieving the Sustainable Development Goals. Considerable work is therefore required to ensure that these databases enable some form of categorization according to the Goals and to record such technologies in a central and easily searchable database.

A centralized United Nations database could therefore serve as a one-stop shop that anyone could access in order to solve local challenges.

### **A global and centralized repository is a way forward**

It is increasingly clear that open-source technical information can help in the building and sharing of the global stock of knowledge, particularly in developing countries. A centralized repository of such information could help developing countries leapfrog to sustainable, inclusive and resilient recoveries.<sup>15</sup> It could potentially accelerate innovation and discovery across sectors associated with the Sustainable Development Goals, while minimizing legal or financial impediments.

The private sector could provide a technical solution in this regard. For example, search engines for three-dimensional designs, such as Yeggi, as well as private companies such as Amazon and Google, are well-positioned to create a search engine for open-source designs for achieving the Goals. However, a centralized database of such technologies run by a single operator, particularly a commercial one, may not ensure complete inclusiveness. Moreover, even an open-source champion company can be vulnerable to policy changes if there are conflicts with funders. For this reason, a trusted global and centralized open-source database that includes wide-ranging technologies, with specific technical information on designs that could help achieve particular Goals, could fill the gap (see box).

#### **Features of the proposed global and centralized open-source technologies database**

- Freely available provision of all of the information, data, plans, full digital designs and manufacturing files and instructions for assembly and use
- one-stop shop, global in scope, for anyone to be able to find an open-source appropriate technology to help solve a particular problem in the area of sustainable development
- Inclusion of public-domain technologies, to accelerate innovation and discovery across all sectors associated with the Sustainable Development Goals; each time a technology is used, it may be improved and this could lead to new uses and/or discoveries, while minimizing legal or financial impediments
- Assistance in solving problems far beyond the scope of the intended use of open-source technologies, as the database would not be limited to specific sectors or applications

*Source:* UNCTAD.

When examining possible set-ups for the proposed repository, some of the features of 2030 Connect may be considered. In addition to its cross-platform search function, 2030 Connect provides a single entry point for existing repository initiatives. Complementing some of the features of 2030 Connect, the proposed

<sup>15</sup> UNCTAD, 2021, Note on a proposed United Nations centralized database of open-source appropriate technologies, available at <https://unctad.org/webflyer/note-proposed-united-nations-centralised-database-open-source-appropriate-technologies>.

centralized open-source technologies database would include information about the manufacturing processes of products and other relevant user-friendly and Goals-specific information. The database would offer a level of specificity similar to that provided for the emergency ventilator developed by the Massachusetts Institute of Technology and in the guide to local production of the handrub formulation recommended by the World Health Organization.<sup>16</sup>

### Policy recommendations

Much remains to be done to help local communities address needs through a broader range of available technological choices and applications, yet it is evident that the establishment of a global and centralized database of open-source technologies would be a critical step in achieving this ambitious objective. The following actions are therefore recommended:

- A global and centralized open-source technologies database should have a clear Goals-related dimension, with all entries classified according to the Goals, to enable developing countries, particularly the least developed countries, to access the relevant knowledge and technology adequate to addressing particular development challenges
- The database should cover all technical areas without being limited to specific sectors or applications, as open-source technologies can often help solve problems far beyond the scope of their intended use
- The database should be operated by a non-profit entity from an international and highly trusted organization, and the United Nations is well-placed to take the lead in setting up such a database, given its established role in advocating open-source technologies through various intergovernmental forums and in various publications
- Multi-stakeholder engagement is a prerequisite for the success of such a database and it is essential for Member States of the United Nations to offer strong support, with collaboration and cooperation among United Nations entities, including UNCTAD; private sector engagement is equally necessary

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### Contact

**Ms. Shamika N. Sirimanne**

Director

Division on Technology  
and Logistics

41 22 917 5510

shamika.sirimanne@un.org

Press Office

41 22 917 5828

unctadpress@unctad.org

www.unctad.org



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<sup>16</sup> See <https://emergency-vent.mit.edu/> and <https://www.who.int/publications/i/item/WHO-IER-PSP-2010.5>.