Research, science, technology and innovation in TOSSD

TOSSD Task Force Issues Paper[1]

30 January – 1 February 2019

For discussion under agenda item 7.c

I. INTRODUCTION AND BACKGROUND

1. At their 6th meeting in Stockholm, TOSSD Task Force members had an initial discussion on the treatment of research activities in TOSSD. Mr. Andrew Rogerson (ODI) presented a paper on this topic[2], using health as a case study. Several issues were discussed, including different types of support for research (e.g. direct and tax-based support), delineation between Pillar I and Pillar II, and the extent to which TOSSD should include research carried out in the provider country. The Task Force noted the particular case of basic research, which may not have a direct developmental impact, and that all research potentially benefits both advanced and developing countries. The issue of intellectual property protection (patented research) was also raised.

2. The present paper invites the Task Force to further reflect on how research, or support for "science, technology and innovation (STI)" (term used by the UN), could feature in TOSSD. It focuses on research and STI activities in provider countries (research and STI activities in TOSSD-eligible countries will be included in Pillar I and do not raise any particular issues). The paper first reviews the role and references to STI in the 2030 Agenda and the SDG targets, against which TOSSD eligibility of research and STI activities will be assessed (section II). It then provides some background information on intellectual property protection and proposes the organisation of an expert meeting to deepen understanding on this issue (section III). Finally, pending clarification of the boundaries of TOSSD in the area of research, the paper discusses what research and STI expenditures in provider countries could be collected in the upcoming TOSSD data survey (section IV).

II. Science, Technology and Innovation in the 2030 Agenda

3. **Science, technology and innovation plays a central role in the 2030 Agenda**. The achievement of many SDGs will depend on STI. STI or its components are explicitly mentioned in Goal 9 and nine sectoral targets (in agriculture, health, water and sanitation, clean energy, infrastructure and industry, and oceans and marine technology), often as a means of implementation.[3] In addition, the SDG 17 on the means of implementation includes three STI-related targets.

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[2] http://www.oecd.org/dac/financing-sustainable-development/development-finance-standards/Pillar-2-topics-Focus-on-research-WEB.pdf

[3] The following SDG targets explicitly mention the role of STI: 2.a; 3.b; 6.a; 7.a; 8.2; 9.5, 9.b; 14.4, 14.a; 17.6, 17.7, 17.8. See Annex I.

4. Given the developmental nature of the SDGs, most STI-related targets place emphasis on **applied research**. **Basic research** is not specifically mentioned, but could be considered as being covered by Target 9.5 – "*Enhance scientific research, upgrade the technological capabilities of industrial sectors in all countries, in particular developing countries, including, by 2030, encouraging innovation and substantially increasing the number of research and development workers per 1 million people and public and private research and development spending"*. The crucial role of basic science for sustainable development is also acknowledged by the United Nations Science Advisory Board[4] that refers to it as *"a principal requirement for innovation"* and calls for the provision of a *"productive scientific environment, including long-term investments, to advance fundamental knowledge about the world"*[5].

5. **Many of the STI-related SDG targets explicitly mention challenges faced by, and the need to support, developing countries[6]. The STI components of the 2030 Agenda more broadly are closely associated with the notion of international co-operation**[7]. On this basis, possible eligibility criteria for including in TOSSD STI activities undertaken in provider countries could be that they convey substantial benefits to, and are implemented in collaboration with, TOSSD-eligible countries or their institutions.

6. The 2030 Agenda has also triggered the creation of **multi-stakeholder institutions in charge of monitoring STI for sustainable development**, such as the Technology Facilitation Mechanism (TFM)[8]. The TFM has three components:

- United Nations Interagency Task Team on Science, Technology and Innovation for the SDGs (IATT)[9];
- Collaborative Multistakeholder Forum on Science, Technology and Innovation for the SDGs (also called STI Forum)[10]; and

[4] The central function of the United Nations Advisory Board is to provide advice on STI for sustainable development to the UN Secretary-General and to Executive Heads of UN organisations. See https://en.unesco.org/themes/science-sustainable-future/scientific-advisory-board-united-nations-secretary-general.

[5] See the executive summary of the "Science for sustainable development: policy brief by the Scientific Advisory Board of the UN Secretary-General" https://unesdoc.unesco.org/ark:/48223/pf0000246105

[6] For example, as regards the support to research and development of vaccines and medicines for the communicable and non-communicable diseases, the emphasis is put on those that *"primarily affect developing countries".* The objective of investment *in "agricultural research and extension services, technology development and plant and livestock gene banks"* is to *"enhance agricultural productive capacity in developing countries, in particular least developed countries".*

[7] SDG 17 calls for revitalising "the global partnership for sustainable development". Many of the STI policies included in the SDGs are linked to international co-operation (2.a, 7.a, 17.6, 17.8). The AAAA also makes a call *"to step up international cooperation and collaboration in science, research, technology and innovation, including through public-private and multi-stakeholder partnerships, and on the basis of common interest and mutual benefit, focusing on the needs of developing countries and the achievement of the sustainable development goals."* See examples of national and international initiatives that promote, or are based on, international scientific collaboration in Annex II.

[8] Paragraph 70 of the 2030 Agenda for Sustainable Development stipulates: "*The Technology Facilitation Mechanism will be based on a multi-stakeholder collaboration between Member States, civil society, private sector, scientific community, United Nations entities and other stakeholders*". See https://sustainabledevelopment.un.org/post2015/transformingourworld.

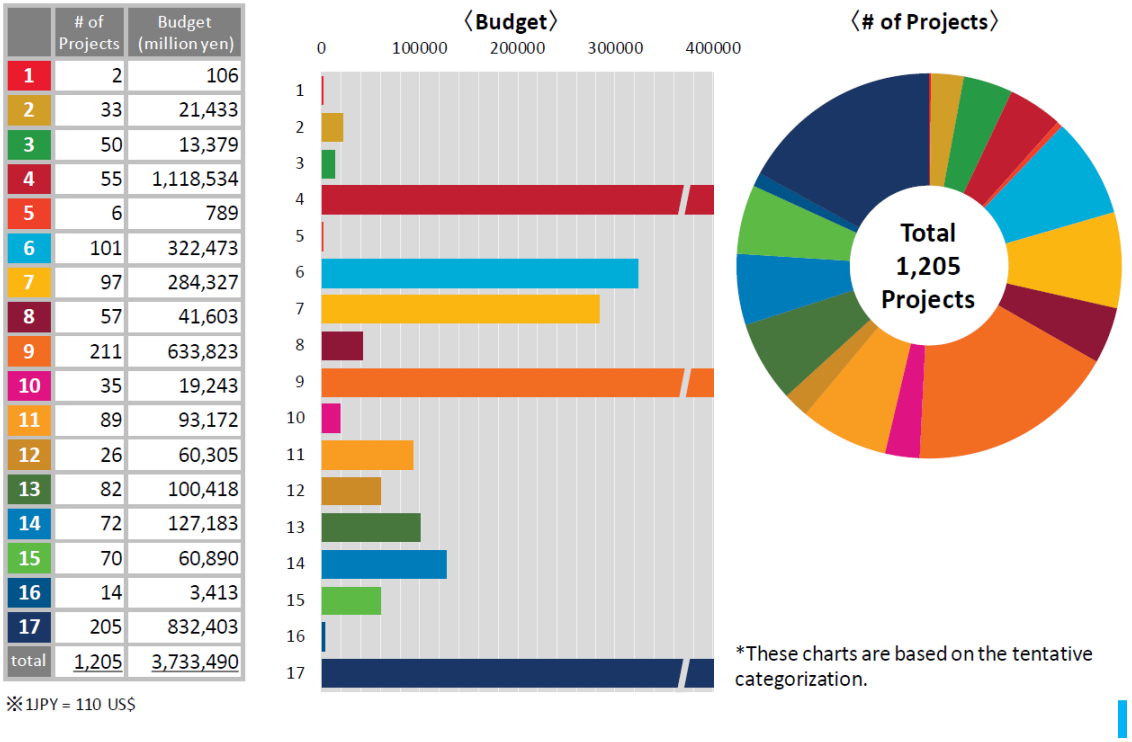
[9] The purpose of IATT is to *"promote coordination, coherence, and cooperation within the UN System on STI related matters, enhancing synergy and efficiency, in particular to enhance capacity-building initiatives".*

[10] The STI Forum is convened once a year by the President of ECOSOC to *"discuss STI cooperation around thematic areas for the implementation of the SDGs".*

- Online Platform for Technology Knowledge and Information Sharing (OPTKIS)[11].

7. The past three STI Forums have discussed the need to develop **"STI for SDGs Roadmaps"**[12] at the subnational, national and international levels. Japan is one of the countries preparing such a roadmap and has in this context mapped its STI projects to the SDGs (see Figure 1).[13] Task Force members are invited to explore if similar initiatives have been launched in their countries.

Figure 1. STI projects by Japan categorised by the 17 Goals (work in progress)



	# of Projects	Budget (million yen)
1	2	106
2	33	21,433
3	50	13,379
4	55	1,118,534
5	6	789
6	101	322,473
7	97	284,327
8	57	41,603
9	211	633,823
10	35	19,243
11	89	93,172
12	26	60,305
13	82	100,418
14	72	127,183
15	70	60,890
16	14	3,413
17	205	832,403
total	1,205	3,733,490

※1JPY = 110 US$

Source: Cabinet Office https://www8.cao.go.jp/cstp/english/egm_presentation.pdf

8. The next STI Forum (June 2019) will discuss the establishment of a Global Pilot Programme on Science, Technology and Innovation for the SDGs Roadmaps[14]. It could be of interest to present the TOSSD framework at this Forum and seek feedback on its relevance for tracking STI expenditures that support developing countries in achieving the SDGs.

[11] OPTKIS will "*be used to establish a comprehensive mapping of, and serve as a gateway for, information on existing science, technology and innovation initiatives, mechanisms and programmes, within and beyond the United Nations".*

[12] https://sustainabledevelopment.un.org/content/documents/19009STI_Roadmap_Background_Paper_pre_STI_Forum_Final_Draft.pdf

[13] Japan has also created an STI for SDGs Task Force.

[14] https://sustainabledevelopment.un.org/content/documents/21323Global_Pilot_Programme_on_Science_Technology_and_Innovation_for_SDGs_Roadmaps.pdf

Issues for discussion

- **Do Task Force members agree that research and STI activities in the provider country or in non TOSSD-eligible countries can be included in TOSSD Pillar II as long as the activities involve substantial benefit to and collaboration with TOSSD-eligible countries or their institutions?**
- **Do you agree that basic research is an important enabler of sustainable development and as such should be included in the scope of TOSSD?**
- **Are Task Force members aware of initiatives to map STI projects to SDGs in their countries?**
- **Do Task Force members see TOSSD relevant to the Global Pilot Programme on STI for SDGs Roadmaps?**

III. The issue of intellectual property protection

9. As noted in the introduction, the first Task Force discussion on research triggered the question of intellectual property protection and how this might affect the eligibility of activities in TOSSD Pillar II on international public goods. Given that intellectual property protection makes research excludable (impure public good), Task Force members' initial view was that patented research should not be included in TOSSD. This section provides additional information on intellectual property protection relevant to the discussion on TOSSD eligibility.

10. **Intellectual property protection is a tool to stimulate innovation**[15], which in turn is a central element in the SDGs. At the same time, **it can restrict access to technology and act against the interest of both consumers** (by keeping prices high) **and downstream innovators** (who cannot freely use the technology and knowledge created through their own research). Intellectual property protection is particularly controversial in the case of officially-supported research, given that the patent holder, or the financier, is accountable to the public. The public interest lies both in the creation and dissemination of knowledge, hence the need to strike a balance between protection and access. The Addis Abeba Action Agenda (AAAA) recognises *"the importance of adequate, balanced and effective protection of intellectual property rights in both developed and developing countries in line with nationally defined priorities and in full respect of WTO rules".* It also calls for *"using public funding to enable critical projects to remain in the public domain and strive for open access to research for publicly funded projects, as appropriate."*

11. **The subject of access to knowledge and technology is particularly relevant from the perspective of developing countries.** A reflection of this is the SDG target 17.7 which "*promote[s] the development, transfer, dissemination and diffusion of environmentally sound technologies to developing countries on favourable terms, including on concessional and preferential terms, as mutually agreed".* Access to medicines – a heavily debated issue – is addressed in target 3.b, which calls for the provision of *"access to affordable essential medicines and vaccines, in accordance with the Doha Declaration on the TRIPS Agreement and Public Health, which affirms the right of developing countries to use to the full the provisions in the Agreement on Trade-related Aspects of Intellectual*

[15] Otherwise there would be a tendency to under-invest in the creation of knowledge because of free-rider issues.

Property Rights regarding flexibilities to protect public health, and, in particular, provide access to medicines for all".

12. In addition to government actions that help ensure access to technology and innovation, such as the flexibilities of the TRIPS agreement (see Box 1), a number of market mechanisms facilitate technology diffusion based on intellectual property sharing. The AAAA recognises *"voluntary patent pooling and other business models, which can enhance access to technology and foster innovation*". Other examples include cross-licensing agreements, philanthropic patent pools, patent pledges and research data commons (see Annex III).

Box 1. The flexibilities of the Agreement on Trade-related Intellectual Property Rights (TRIPS) [16]

The objective of the TRIPS agreement is to protect intellectual property rights. When the agreement entered into force in 1995, all WTO members[17] were bound to provide intellectual property protection, including for pharmaceutical products. In 2001, the WTO Ministerial Conference adopted the **Doha Declaration on the TRIPS Agreement and Public health**. Recognising the implications of intellectual property rights for both the development of new medicines and the price of medicines, the Declaration identified options, also called **"flexibilities"**, for WTO members to address their public health needs, and in particular ensure access to medicines for all. These options included compulsory licensing[18], and parallel imports and exhaustion rights[19].

Initially, the use of compulsory licences was limited to the supply of the domestic market. In order to allow countries lacking drug manufacturing capacity to effectively use compulsory licences, WTO members agreed, in 2003, to remove this obstacle. The waiver allowed producing countries to grant compulsory licences to generic suppliers exclusively for the purpose of exporting medicines to countries lacking drug manufacturing capacity. In 2005 WTO members agreed to incorporate the 2003 waiver decision into the TRIPS agreement. The amendment entered into force on 23 January 2017 after having been formally accepted by two-thirds of WTO members. This additional flexibility is therefore now an integral part of the TRIPS Agreement.

The **AAAA** specifically *"urge[s] all WTO members that have not yet accepted the amendment of the TRIPS Agreement allowing improved access to affordable medicines for developing countries to do so by the deadline of the end of 2015"*. To date, 100 WTO members have accepted the amendment.

However, concerns have been raised over the applicability of the TRIPS flexibilities. Some claim that the right of WTO members to use TRIPS flexibilities is undermined by pressure exerted by pharmaceuticals and lobbies[20]. In contrast, a new study[21] has found that the use of TRIPS flexibilities to access lower-priced generic medicines is more frequent than commonly assumed. The study identified 176 instances of the use of the TRIPS flexibilities between 2001 and 2016, of which 152 (86%) were implemented. They covered products for treating 14 different diseases.

[16] https://www.wto.org/english/thewto_e/minist_e/min01_e/mindecl_trips_e.htm
[17] The Doha Declaration extended the transition period for Least Developed Countries for implementing the TRIPS obligations relating to patents and marketing rights, and data protection for pharmaceutical products from 2006 to 2016.
[18] WTO members have the right to grant compulsory licences which allow a company to produce a patented product or process without the consent of the patent owner. The Doha Declaration states that each Member has the right to grant compulsory licences and the freedom to determine the grounds upon which such licences are granted.
[19] Parallel importation means importation without the consent of the patent-holder of a product patented in another country. According to the principle of exhaustion, once a patent holder has sold a patented product, he/she cannot prohibit the subsequent resale of that product since his/her rights in respect of that market have been exhausted by the act of selling the product. Since many patented products are sold at different prices in different markets, the rationale for parallel importation is to enable the import of lower-priced patented products.
[20] See section "we can fight them" http://makemedicinesaffordable.org/en/fixing-the-broken-patent-system-from-marrakech-and-back-again/
[21] https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5840629/

13. **Intellectual property protection can thus both support and hinder sustainable development**, and the eligibility in TOSSD of patented research needs to be clarified. However, this is a complex task for the following reasons:

- It is difficult to determine a priori if a public research expenditure will lead to a patented product or not and how the patent will be managed. Given the uncertainties inherent to research activities, it is difficult to establish a link between the public funding at the moment it is provided and a potential patenting of the results of this research.
- Even if the results of a research are patented, they can be shared and disseminated.
- Although some research fields would more likely lead to patented results than others, it is difficult to make generalisations. While basic research is generally perceived as more open, it can also lead to patents.

14. Subject to the comments from Task Force members, the Secretariat suggests that **an expert meeting be organised to help set boundaries for research and STI expenditures in TOSSD**. Issues that could be discussed include:

- Should basic research be included in TOSSD, and if so, in which fields? What fields of applied research should be included? Should any safeguards be included in TOSSD for research activities? Should any fields be excluded?
- How can research and STI in provider countries help developing countries to achieve the SDGs? In the specific case of medical research, would the requirement that the provider country has accepted the amendment of the TRIPS Agreement allowing improved access to affordable medicines for developing countries be a sufficient eligibility criterion for including the activities in TOSSD?
- To what extent are the outcomes of public expenditures in research and STI kept in the public domain and accessible to developing countries? Are there methods for estimating the probability that public research is patented?

15. Experts that could be invited to the meeting include:

- **International organisations specialised in the issue of STI and patents:** Multistakeholder Forum on Science, Technology and Innovation for the SDGs; United Nations Secretary-General's High Level Panel on Access to Medicines; United Nations Scientific Advisory Board[22]; Technology Mechanism of the UNFCCC; UNESCO; WIPO; WTO; Directorate for Science, Technology and Innovation at the OECD; Sustainable Development Solutions Network.
- **International initiatives for knowledge and technology sharing:** Future Earth; International Aids Vaccine initiative; Neglected diseases initiative (NDI); Together Science Can.
- **Institutions in provider countries:** Canadian Institute for Advanced Research; European Institute of Technology; Institut de Recherche pour le Développement (IRD) ; Institut Pasteur; Stockholm Environment Institute.

[22] The Secretariat of the United Nations Scientific Advisory Board is based at UNESCO in Paris. The Director-General of UNESCO serves as chairperson of the Board.

- **Representatives of developing countries:** Indonesian Institute of Sciences; Nigerian Institute of Medical Research; Representatives of ministries of Health.
- **Representative of the TOSSD Task Force.**

Issues for discussion

- **Do Task Force members have any comments or suggestions on how to approach the issue of intellectual property protection in TOSSD?**
- **Do Task Force members support the idea of organising an experts meeting on the issue of intellectual property rights and more broadly the treatment of STI in TOSSD? Do you have any comments on the proposed content of the meeting? Do you have any comments on the proposed list of participants? Do you have any suggestion for additional experts?**

IV. How to deal with research and STI in the TOSSD data survey?

16. A TOSSD data survey will be launched in February 2019. The survey will cover both Pillar I and Pillar II activities. For the latter, a number of parameters remain to be agreed, in particular the extent to which activities need to benefit TOSSD-eligible countries and involve international collaboration, and whether research subject to intellectual property protection is included or not.

17. In order to feed future analyses and discussions on TOSSD, in particular the potential orders of magnitude of TOSSD under different eligibility scenarios, it is proposed that the data survey follows a relatively extensive approach in terms of coverage. The Task Force could then discuss the different types of research activities and whether or not they should be covered under TOSSD.

18. It is therefore proposed that respondents be invited to report in the data survey all research and development[23] activities that they deem relevant for the sustainable development of TOSSD-eligible countries, indicating if the programme or project is undertaken under open access policy or, on the contrary, is subject to intellectual property protection. Respondents should also indicate whether the activity involves collaboration with TOSSD-eligible countries or their institutions. Based on the SDG targets, the research fields that could be covered include:

- Agricultural research (target 2.a),
- Research and development of vaccines and medicines for the communicable and non-communicable diseases that primarily affect developing countries (3.b),
- Recycling and re-use technologies in water and sanitation (6.a),
- Clean energy research and technology (7.a),
- Upgrading of technological capabilities in the industrial sector (9.5),
- Scientific knowledge and research in the field of marine technology (14.a),
- Initiatives to enhance knowledge sharing (17.6).

[23] According to the recognised definition provided by the Frascati Manual, "*Research and experimental development (R&D) comprise creative and systematic work undertaken in order to increase the stock of knowledge – including knowledge of humankind, culture and society – and to devise new applications of available knowledge*." See Frascati Manual, 2015 edition. http://www.oecd.org/sti/frascati-manual-2015-9789264239012-en.htm

19. In addition, basic research could be included (target 9.5 could be considered as having a broader scientific research coverage, see section II).

Issues for discussion

- **Do Task Force members agree with the proposed approach to reporting research and STI in the TOSSD data survey?**

Annex 1. Science, innovation and technology in the SDGs

Goals	Targets
2. End hunger, achieve food security and improved nutrition and promote sustainable agriculture	2.a. Increase investment, including through enhanced international cooperation, in rural infrastructure, **agricultural research** and extension services, **technology development and plant and livestock gene banks** in order to enhance agricultural productive capacity in developing countries, in particular least developed countries
3. Ensure healthy lives and promote well-being for all at all ages	3.b. Support the **research and development of vaccines and medicines for the communicable and non-communicable diseases that primarily affect developing countries**, provide access to affordable essential medicines and vaccines, in accordance with the Doha Declaration on the TRIPS Agreement and Public Health, which affirms the right of developing countries to use to the full the provisions in the Agreement on Trade-Related Aspects of Intellectual Property Rights regarding flexibilities to protect public health, and, in particular, provide access to medicines for all
6. Ensure availability and sustainable management of water and sanitation for all	6.a. By 2030, expand international cooperation and capacity-building support to developing countries in water- and sanitation-related activities and programmes, including water harvesting, desalination, water efficiency, wastewater treatment, **recycling and reuse technologies**
7. Ensure access to affordable, reliable, sustainable and modern energy for all	7.a. By 2030, **enhance international cooperation to facilitate access to clean energy research and technology**, including renewable energy, energy efficiency and advanced and cleaner fossil-fuel technology, and promote investment in energy infrastructure and clean energy technology
8. Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all	8.2. Achieve higher levels of economic productivity through diversification, **technological upgrading and innovation**, including through a focus on high-value added and labour-intensive sectors
9. Build resilient infrastructure, promote inclusive and sustainable industrialization and **foster innovation**	9.5. **Enhance scientific research, upgrade the technological capabilities of industrial sectors in all countries, in particular developing countries**, including, by 2030, **encouraging innovation and substantially increasing the number of research and development workers per 1 million people and public and private research and development spending**
	9.b. **Support domestic technology development, research and innovation in developing countries**, including by ensuring a conducive policy environment for, inter alia, industrial diversification and value addition to commodities
14. Conserve and sustainably use the oceans, seas and marine resources for sustainable development	14.4 By 2020, effectively regulate harvesting and end overfishing, illegal, unreported and unregulated fishing and destructive fishing practices and **implement science-based management plans, in order to restore fish stocks in the shortest time feasible**, at least to levels that can produce maximum sustainable yield as determined by their biological characteristics
	14.a. **Increase scientific knowledge, develop research capacity and transfer marine technology,** taking into account the Intergovernmental Oceanographic Commission Criteria and Guidelines on the Transfer of Marine Technology, in order to improve ocean health and to enhance the contribution of marine biodiversity to the development of developing countries, in

	particular small island developing States and least developed countries
17. Strengthen the means of implementation and revitalize the global partnership for sustainable development	17.6. **Enhance North-South, South-South and triangular regional and international cooperation on and access to science, technology and innovation and enhance knowledge sharing** on mutually agreed terms, including through improved coordination among existing mechanisms, in particular at the United Nations level, and through a global technology facilitation mechanism
	17.7. **Promote the development, transfer, dissemination and diffusion of environmentally sound technologies to developing countries on favourable terms, including on concessional and preferential terms, as mutually agreed**
	17.8. **Fully operationalize the technology bank and science, technology and innovation capacity-building mechanism for least developed countries** by 2017 and enhance the use of enabling technology, in particular information and communications technology

Annex II. Examples of international and national institutions and initiatives promoting international scientific collaboration

Intergovernmental initiatives	
Group on Earth Observations (GEO)	The Group on Earth Observations (GEO) is an intergovernmental partnership that improves the availability, access and use of Earth observations for a sustainable planet.
Green Growth Knowledge Platform (GGKP)	GGKP is a global network for international organisations and research institutes that identifies and addresses major knowledge gaps in green growth theory and practice. *"By encouraging widespread collaboration and world-class research, the GGKP offers practitioners and policymakers the policy guidance, good practices, tools, and data necessary to support the transition to a green economy."*
Future Earth (FE)	Future Earth is a global, independent platform for scientific collaboration on global change research and sustainability. It notably works to *"develop the knowledge and tools that nations across the globe need to meet the United Nations' 17 Sustainable Development Goals.*" Future Earth is funded by a range of private and public foundations, government agencies, universities and other groups.
The Technology Mechanism of the UNFCCC	In order to facilitate technology development and transfer to developing countries, the Conference of the Parties established in 2010 the Technology Mechanism, which includes two bodies: the Technology Executive Committee and the Climate Technology Centre and Network.
Sustainable Development Solutions Network (SDSN)	The UN Sustainable Development Solutions Network (SDSN) is a global network that operates under the auspices of the UN Secretary-General and mobilizes global scientific and technological expertise to promote practical solutions for sustainable development, including the implementation of the Sustainable Development Goals (SDGs) and the Paris Climate Agreement.
Public-Private partnerships	
Consultative Group for International Agricultural Research (CGIAR)	The CGIAR is the largest global agricultural innovation network working towards "*a world free of poverty, hunger and environmental degradation*". CGIAR includes 3000 partners from national governments, academic institutions, global policy bodies, private companies and NGOs. Its research activities include food security, environment, health, climate and prosperity.
Gavi, the Vaccine Alliance	Created in 2000, Gavi is an international public private partnership bringing together public and private sectors with the shared goal of creating equal access to new and underused vaccines for children living in the world's poorest countries. Members of Gavi include national governments, both from advanced and developing countries, international organisations, private foundations, CSOs.
International AIDS Vaccine Initiative	The International AIDS Vaccine Initiative (IAVI) is a non-profit scientific organisation whose mission is to develop vaccines and other biomedical innovations that prevent HIV infection. IAVI works with more than 100 academic, industry, government, civil society, clinical, and community partners in more than 25 countries. IAVI is committed to supporting the broad field of HIV vaccine research and to fostering collaborations that accelerate the development and availability of new prevention products.
Other international partnerships and initiatives	
Neglected diseases initiative (DNDi)	Drugs for Neglected Diseases initiative (DNDi) is a collaborative non-profit drug research and development (R&D) organisation that develops new treatments for neglected diseases. DNDi aims to deliver safe, effective, quality products that are affordable to poor populations.

Global Antibiotic research and Development Partnership (GARDP)	The Global Antibiotic Research & Development Partnership (GARDP) is a non-profit research and development initiative that was established in May 2016 as a joint initiative by the World Health Organization (WHO) and the Drugs for Neglected Diseases initiative (DNDi). The initiative addresses global public health needs by developing and delivering new or improved antibiotic treatments while endeavouring to ensure sustainable access.
Medicines for Malaria venture (MMV)	The mission of MMV is to reduce the burden of malaria in disease-endemic countries by discovering, developing and delivering new, effective and affordable antimalarial drugs.
Together Science Can	Together Science Can is an international campaign that has been started by organisations from across the world to celebrate and protect international collaboration science in science.
Institutions in provider countries	
Canadian Institute for Advanced research (CIFAR)	Established in 1982, CIFAR is a Canadian-based, international research institute with nearly 400 fellows, scholars and advisors from 18 countries. CIFAR brings together researchers from across disciplines and borders to address important challenges facing the world. CIFAR supports research with the potential for global impact. In 2017, CIFAR was chosen by the Canadian government to lead the $125 million Pan-Canadian Artificial Intelligence Strategy.
Horizon 2020 (European Union)	Horizon 2020 is the largest European Union research and innovation programme. It has been endowed with almost EUR 80 billion of funding over the period 2014-2020. In most of the calls of Horizon 2020, participants from all over the world can participate. In addition, "*several topics strongly encourage or require cooperation with non-EU partners in collaborative projects, target a certain country/region or refer to global initiatives, like the Global Alliance for Chronic Diseases or the Belmont Forum.*"
Institut de Recherche pour le Développement (IRD)	The IRD (French National Research Institute for Sustainable Development) is a French public institution that carries out research on sustainable development. Its model is based on equitable scientific partnership with developing countries, primarily those in the intertropical regions and the Mediterranean area. 35% of agents working of agents working for IRD are based outside mainland France.
SATREPS	SATREPS is a Japanese government program that promotes international joint research targeting global issues and involving partnerships between researchers in Japan and developing countries. The program is structured as a collaboration between the Japan Science and Technology Agency (JST), which provides competitive research funds for science and technology projects, the Japan Agency for Medical Research and Development (AMED), which provides competitive research funds for medical research and development, and the Japan International Cooperation Agency (JICA), which provides development assistance (ODA). Based on the needs of developing countries, the program aims to address global issues and lead to research outcomes of practical benefit to both local and global society.
Stockholm Environment Institute (SEI)	The Stockholm Environment Institute is non-profit research and policy organization working on sustainable development and environmental issues. The Swedish International Development Cooperation Agency (Sida) is the largest single donor of SEI. SEI has offices in five continents around the world, and works locally, regionally and globally.

Annex III. Market mechanisms for diffusing technologies through intellectual property sharing

Cross-licensing agreements. Patent owners license patented inventions to other parties generally without monetary royalties. These agreements are subject to anti-trust and competition law are generally used when each party's patents covers different aspects of a given commercial product. Cross-licensing allows each party to maintain freedom to commercialise inventions in their respective markets.

Patent pools Patent pools allow firms to combine their patents, share them with other patent holders and, in some cases, license them to other firms as a package. They are subject to close scrutiny by competition authorities to ensure that they do not hinder access to the market by hindering competition. Patent pools generally operate when the patents are complement rather than substitutes. Despite the commercial success and broad market adoption of patent pools in fields such as consumer electronics and semiconductors, commercial patent pools have not achieved similar levels of success in other industries (Reynolds et, 2017[24])

Philanthropic patent pools A number of pooling arrangements organised principally to achieve humanitarian ends have achieved some success. For example golden rice, a genetically-engineered Vitamin A-rich rice variant that was developed by researchers in Europe to address issues of malnutrition in the developing world was the subject of a patent pool. Another example of philanthropic patent pooling for global public health is the Medicines Patent Pool (MPP), which was launched in 2009 to improve access to affordable HIV/AIDS medications in the developing world. The MPP offered royalty-free licenses from pharmaceutical patent holders and in turn granted low- or no-cost sublicenses to manufacturers that committed to produce and sell drugs to users in low-income countries. The success of the pool owed must to the participation of public research patent holders (e.g. NIH in the US) and private firms.

Patent pledges are the voluntary disclosure and non-assertion of patents whereby the assignee retains ownership but pledges not to assert patent rights. The EcoPatent Commons (EPC) for green technologies, formed by coalition of large industrial firms including IBM, Nokia, Sony, DuPont, Dow, HP, Sony, and Xerox is the most prominent example to date. In contrast to cross-licensing and patent pools, patent owners in the EcoPC committed to maintain ownership of their patents, which is costly, while making those patents freely accessible to third parties, including competitors. Each EPC member firm had to identify specific environment-related patents and commit not to assert those patents against any technology that reduces/eliminates natural resource consumption, reduces/eliminates waste generation or pollution, or otherwise provides environmental benefit(s). A post-mortem evaluation of the EPC by Contreras, Hall and Helmer (2018)[25] found that lack of the lack of information on patent usage meant that it was difficult to gauge the success of the initiative and thus to attract other firms; make adjustments to its structure and management and improve performance. The authors concluded that effective technology diffusion requires more than patent non-assertion, especially in the developing world.

Research data commons. Sharing of research data offers another way to facilitate innovation and development is through the sharing and dissemination of research data. When data sharing is conducted in a systematic manner and data is made available through a broadly accessible

[24] Reynolds, J., Contreras J. and Sarnof, J. *Solar Climate Engineering and Intellectual Property: Toward a Research Commons*, 2017), Minnesota Journal of Law Science and Technology, 2017, Volume I, Issue 18, Article 2.

[25] (Contreras, J, Hall B., and Helmers, C. 2018)
Assessing the Effectiveness of the Eco-Patent Commons A Post-mortem Analysis .CIGI Papers No.161 — February 2018

repository or set of repositories, this structure is often referred to as a data commons. Many important data commons have arisen as a result of government-procurement and research-funding requirements such as The European Bioinformatics Institute Repository. Data commons can also be initiated by private firms and non-profits. In 1999, as the public Human Genome Project was nearing an end, several large pharmaceutical and information technology companies and the Wellcome Trust formed a non-profit consortia referred to as the SNP Consortium whose aim was to identify and map genetic markers referred to as SNPs and to contribute the resulting data to the public domain. The consortium ultimately mapped approximately 1.5 million SNPs and created a genome-wide SNP-based human linkage map. The consortium adopted a multi-prong approach to ensure that the SNP data it discovered would not be patented. At the same time, the consortium model permitted follow on patenting for diagnostics and other inventions generated from the research. In this way, data was a public commons on which research public and private could advance but still allow downstream innovation.

Source: OECD 2018, based on the Background Paper for the 37th Round Table on Sustainable Development.