# Feasibility Study for a United Nations Technology Bank for the Least Developed Countries

United Nations Secretary-General's High-Level Panel
on the Technology Bank for the Least Developed Countries

UNITED NATIONS

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# Acknowledgements

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# Executive Summary

Science today is a global enterprise involving some 7 million researchers drawing upon a worldwide research and development (R&D) spending of over US$1,000 billion and publishing their findings in some 25,000 specialized journals per year. Significantly, increased investments in R&D by more-advanced developing nations have enabled several of them to scale the heights historically held by the global science, technology and innovation (STI) triumvirate of Japan, North America, and Europe – with outsized returns in terms of their economic performance. Emblematically, those developing countries which constitute the so-called emerging markets are the same ones identified by the Royal Society as "new emergent scientific nations." [1]

Against this encouraging trend, UNESCO has remarked: "By contrast, the group of least developed countries […] still plays a marginal role."[2] Indeed, by any measure – research spending, articles/citations in peer-reviewed journals, or patents applied for – LDC activity in the STI arena barely registers, and would be within the margins of a rounding error of the leading scientific nations. It is telling that the combined average of annual patent filings of all LDCs for which data is available is well below those of many individual developing countries. Left unaddressed, this striking STI disparity could leave LDCs perennially at the margin of the global economy. All the while, broader environmental and societal challenges -- climate change; water, food and energy security; loss of biodiversity; and demographic issues -- seem to have coalesced into an ominous storm cloud over their future.

Without rapidly building up national capacities in STI, the goals of eradicating widespread poverty and removing daunting structural constraints on their economies and unleashing sustained growth and sustainable development will remain a distant dream for the nearly a billion people living in LDCs. Building STI capacities will not be enough; it should to be coupled with transfer of much needed technologies to LDCs on voluntary and mutually agreed terms and conditions. Dedicated and coordinated actions on these two fronts, building on and scaling up ongoing initiatives, will help initiate in LDCs a virtuous cycle of high growth, sustained social progress, and robust resilience against natural and human-

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[1] "Knowledge Networks and Nations: Global scientific collaboration in the 21st century," The Royal Society, London, 2011, p. 5.
https://royalsociety.org/~/media/Royal_Society_Content/policy/publications/2011/4294976134.pdf
[2] "UN Science Report 2010: The Current Status of Science around the World," p. 5.

induced episodes and, in the process, beneficially mainstream these countries into the world economy and the international trading, financial and technological systems.

This is what the Technology Bank, a seminal initiative in the annals of the United Nations, will seek to contribute to. This feasibility study concludes that the Technology Bank is feasible with the expected benefit from its work far outstripping the cost of its operations. It will be a key instrument in ensuring that the LDCs are no longer left behind in achieving internationally agreed development goals, especially the Sustainable Development Goals (SDGs).

With the offer of the Government of Turkey to host the Technology Bank, this initiative has already made a very auspicious start. This Feasibility Study recommends that the Technology Bank should be headquartered in Istanbul. Improved prospects of Official Development Assistance (ODA) to LDCs as reflected in the outcome of the Financing for Development Conference in July 2015, coupled with the opportunity provided by the Technology Bank to channel increased ODA to LDCs in the area of STI, also augur well for the funding prospects of the Bank.

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To their credit, LDC policymakers generally appreciate the dire implications of their countries' structural deficit, and their need to acquire sufficiently robust (and inherently expensive) STI capacities to address their plight, but without the financial means to do so. Likewise, virtually every LDC can claim world-class scientists who know what needs to be done; but they are too few and under-resourced to constitute a critical mass capable of addressing the complex and intertwined "global challenges" confronting most LDCs today.

It is testimony to their perceptivity that LDC delegations at the Fourth UN Conference on the Least Developed Countries (LDC-IV), held in Istanbul in May 2011, instinctively seized upon the Turkish government's offer to host a center dedicated to LDCs and their unmet STI exigencies. By the conference's conclusion, they and their development partners had conceived of a UN-affiliated "technology bank and science, technology and innovation supporting mechanism dedicated to the least developed countries, building on existing international initiatives" – an objective subsequently enshrined in the Istanbul Programme of Action (IPoA) and endorsed by the United Nations General Assembly (UNGA) at the end of 2011. As mandated by the General Assembly, the UN-OHRLLS is leading the activities related to the establishment of the Technology Bank.

Following a requisite capacity and gap analysis, undertaken by the UN-OHRLLS, conducted and debated during 2013, the UNGA endorsed the concept of an LDC-focused Technology Bank and Science, Technology and Innovation-supporting mechanism. It also welcomed Turkey's offer to host such an institution. Full approval, however, was contingent on the UN

Secretary-General constituting "...a high-level panel of experts drawn from the least developed countries and their development partners, the United Nations system and other relevant stakeholders to carry out a feasibility study...in order to examine its scope, functions, institutional linkage with the United Nations and organizational aspects." Moreover, such work was to be carried out within existing resources and funded entirely by voluntary contributions. The UNGA "...further requested the Secretary-General to transmit the report and the recommendations of the high-level panel of experts to the General Assembly at its sixty-ninth session for its consideration, with a view to operationalizing a Technology Bank during its seventieth session, if so recommended by the panel."

The Secretary-General in November 2014 constituted a High-level Panel which reflected an equitable balance between LDCs and their development partners from the global North and South, as well as gender symmetry. The Panel met in Istanbul, Turkey in February 2015 to review its terms of reference, while broadly examining the state of LDC STI and the current intellectual-property (IP) landscape. Considering that the overriding goal of the IPoA is to prepare one-half of the 48 LDCs for graduation by 2020, the Panel conducted its proceedings on the premise that substantial investments in STI are imperative to meet this ambitious target.

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The Panel members considered existing and relevant international programmes upon which an STI initiative for LDCs could be built. Notably, they examined the UN Research4Life Public Private Partnership (PPP) with global scientific publishers. This PPP affords eligible LDC researchers no-cost access to otherwise prohibitively expensive technical journals, books and databases. The Panel also studied the European Union/World Bank partnership supporting National Research and Educational Networks (NRENs) in the developing world. This initiative empowers researchers with the broadband connectivity necessary to join an increasingly multipolar scientific world.[3]

The Panel observed that many international agreements, conventions and protocols include provisions governing the transfer of technology; but associated transfer arrangements and mechanisms typically have been fragmented and ad-hoc by way of objectives, content, and country coverage. None have enabled LDCs to meaningfully build their technological base.

[3] NRENs are independent of and considerably more capable than the commercial Internet. GÉANT, the European-wide NREN, has been bankrolled by the EC's development arm to coordinate this global assistance effort.

Reviewing STI more broadly, the Panel weighed remedial strategies, and drew up an appropriate work plan to examine the overall feasibility of a Technology Bank incorporating these and other elements. The High-level Panel advised that, should such a mechanism be created, progress should be incremental and should seek to capture "low-hanging fruits" in its initial phase. Moreover, many development partners – multilateral, bilateral, and non-governmental – exist to help tailor assistance to LDCs. Regarding management structures, the Panel opined that the Technology Bank should operate as a lean organization, with as little bureaucratic overhead as possible. As to governance, Panel Members advised that the institutional arrangements of the UN University in Tokyo, which has a multi-stakeholder governance arrangement, should be looked into.

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Prepared for the consideration of the second and final meeting of the High-level Panel in Istanbul during 2-4 September 2015, this feasibility study, on the basis of careful analysis, concludes that the Technology Bank is indeed both feasible and desirable. Nothing quite like it has been attempted before, but the thinking behind it has been sound and planning to-date suggests that it could be launched on an exceptionally firm foundation.

Regarding the UN Research4Life PPP, 13-years of steady growth obviates the need to establish its feasibility. From an initiative launched with the WHO in 2002 by the six largest publishers of online medical journals, the PPP today includes over 160 publishers covering every field of science, technology, engineering, and medicine. While Research4Life has far from reached its full potential, it nonetheless includes more than 8,000 educational and research institutions in over 100 developing countries – nearly half of them (3,796 as of June 2015) in LDCs.

Eligible institutions in LDCs automatically qualify for free access to the publishers' online offerings, as do those in many developing countries substantially above the LDC income threshold. Thus, LDCs need never worry that their eventual graduation from least-developed status will terminate this benefit. The Research4Life secretariat estimates the latter's value at over US$10 million annually for each participating institution.

Existing Research4Life partners have concluded that they would benefit from an additional, LDC-focused UN partner which could help their PPP expand its reach among underserved research communities. Besides its singular focus on LDCs, the new approach would be cross-cutting – a uniquely appropriate response to contemporary global challenges which

defy solutions from a single discipline – whereas the existing four UN institutional partners are all specialized agencies.[4] Reflecting this broader approach, the Research4Life secretariat suggested that the new UN partner programme might be called DARTT – Digital Access for Research Transfer and Transformation.

While this feasibility study was underway, the possibility of DARTT membership in Research4Life was discussed at the latter's annual General Partners Meeting in Geneva on 21-22 July 2015. Assuming commensurate funding commitments from Technology Bank donors to roll out DARTT,[5] the General Partners conditionally welcomed the addition of DARTT to Research4Life. In the coming year, the Research4Life Executive Council will stay abreast of the Technology Bank's implementation and, assuming that it develops as envisioned, DARTT could apply to convert its provisional affiliation into Full Programme status within the Research4Life PPP at the end of its first year.[6]

Similarly, the Technology Bank's close association with GÉANT and the EU/World Bank effort to expand NREN global connectivity throughout the developing world means that the Technology Bank initiative could leapfrog organizational, technical and geographic hurdles that might otherwise stymie an early and orderly roll out of service to LDCs.

Of 110 NRENs globally, 16 are in LDCs (9 fully operational, and another 7 in development). Obviously, much more work is required to reach the full LDC complement, but the necessary physical infrastructure (undersea fibre-optic cables) has been largely laid. GÉANT calculates that a fully operational Technology Bank could help advocate with pertinent governments (especially their telecom regulators) and other donors to accelerate NREN build-out to LDCs. Meanwhile, GÉANT has just launched (July 2015) AfricaConnect2, which seeks to replicate in West Africa that which was achieved by GÉANT's original (2005-2015) AfricaConnect project in Eastern and Southern Africa.[7] Underwritten primarily by the EC, AfricaConnect2 is programmed to spend €26.6 million over the coming 3.5 years, a timeframe which aligns well with that which a Technology Bank might seek to accomplish in its first few years.

Regarding proposed IP assistance, the High-level Panel's further review found that while no global framework, agreement, or mechanism exists to comprehensively facilitate technology transfer, help is available from a variety of sources. Accessing the latter, however, has proven difficult for LDCs. A single point-of-contact in the form of the IP Bank representing

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[4] The WHO ("HINARI"), FAO ("AGORA"), UNEP ("OARE"), and WIPO ("ARDI").
[5] Research4Life estimates that DARTT's initial buy-in would amount to less than US$2 million, largely for physical infrastructure to handle the extra demand that expanded LDC access would likely generate.
[6] The Research4Life Executive Council's conditional approval now means that the Technology Bank will not have to wait until the PPP's next General Partner's meeting in July 2016 to seek UN partner affiliation.
[7] The UbuntuNet Alliance, the regional network of 15 NRENs, many of them in LDCs.

LDC interests can help catalyze a sound and viable technology base while addressing issues of market imperfections, market failures, and missing markets.

As a development tool, the IP Bank should help build domestic capacities to absorb transferred patented-IP to LDCs. It should act as a conduit between IP rights holders in developed economies and relevant actors in the LDCs. The IP Bank should support negotiated agreements by providing expertise (directly, or indirectly via volunteers[8]) to LDC participants, while ensuring that the respective interests of all parties are reconciled. It would be entirely voluntary and use conventional licensing of existing or expired patents and know-how and other knowledge (such as access to training, manuals, supply chain for purchase or donation of parts, etc.)

Besides capitalizing on existing pathways for technology transfer, the IP Bank should also create new opportunities for the dissemination of key technologies. These involve: direct transfers of protected IP – as well as the know-how to implement it – to LDC recipients, including entrepreneurs and SMEs; maximum transfer of technical knowledge through Foreign Direct Investment (FDI), including supporting LDCs in complex contract negotiations; support of IP protection in LDCs; and, training to IP-enforcement officials as well as strengthening IP Offices in LDCs.

While the IP Bank is intended to scale up capacity in LDCs, it would itself be a start-up in its initial phase. To avoid overreach, the IP Bank during its first few years should be oriented toward strengthening fundamental LDC capacities, and offerings that do not require a level of sophistication outside the capabilities or absorption of a start-up programme.[9]

Ultimately, the IP Bank's goal should be that LDCs beneficially integrate themselves into the worldwide IP system and in so doing overcome decades of structural barriers that have denied them full inclusion and standing in the global trading system. More broadly, the whole range of Technology Bank capacity-building services will also help LDC researchers generate their own IP, thereby forging a new frontier of innovation. Concomitantly, the IP Bank should work with IP owners to modify existing technologies to create new markets for existing products and new products for existing markets – the two sources of high return-on-investment (ROI) growth – yielding disproportionately positive results.

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[8] The International Intellectual Property Institute (IIPI) in Washington, DC has found that many highly qualified IP attorneys are willing to offer *pro bono* assistance to developing-world counterparts under the rubric of corporate social responsibility (CSR).

[9] Subsequently, the IP Bank might introduce more sophisticated instruments such as patent pools, standards-essential patents (SEPs), or fair, reasonable and non-discriminatory (FRAND) licensing.

Backstopping all of these Technology Bank initiatives should be a lean science, technology and innovation-supporting mechanism (STIM) that will build on the whole gamut of existing and planned development assistance programmes to help LDCs articulate their STI policies and priorities as part of their overall development strategy; assist them in finding and accessing those programmes that are most appropriate to their STI aspirations; and then act as their advocate with other institutional development actors. A variety of technology and STI-related initiatives – often as subsets of broader programmes – populate the entire UN and intergovernmental system, but are often difficult for the LDCs to access. Likewise, myriad bilateral aid programs offer assistance, but with no roadmap to actually point LDCs toward promising sources of STI capacities tailored or particular to an individual LDC's situation and needs.

The STIM could also offer an array of other services, ranging from instructing LDC researchers how to craft convincing grant proposals and write for peer-reviewed journals, to helping principal investigators (PIs) patent their research before submitting their findings for publication.[10] More fundamentally, however, a STIM should help LDC researchers find appropriate collaborators in neighbouring countries and around the globe.

As noted earlier, nearly every LDC can claim world-class scientists, but usually too few to coalesce around a common discipline. Fortuitously, the past two decades have witnessed a seismic shift wherein scientific exploration and innovation today are quintessentially global and collaborative. A Technology Bank would be perfectly timed and positioned to ensure that LDC researchers participate accordingly. Associated elements such as Research4Life, NRENs, and an IP Bank can give them the tools to do so most convincingly.

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This feasibility study proposes that the governance arrangement for the Technology Bank should entail a multi-stakeholder approach in line with that of the UN University. It also envisages that the Technology Bank should grow incrementally, building on the experience gained and lessons learned from its work. To that end, this study makes proposals on staffing requirements during the first biennium of its operations, as well as provisional cost estimates. Recognizing that technology is a dynamic field and the needs and requirements of LDCs vary from country to country, it proposes that the Technology Bank should try to strike a prudent balance between core staff and personnel on short-term contract performing specialized activities. Within the core staffing, the emphasis should be more on programme delivery and less on administrative overhead. The Bank should be based on

[10] A distressingly large number of PIs in the developing world do not appreciate that, if already published, their research is no longer patentable.

voluntary resources and use both in-kind and financial support by Member States of the UN and other stakeholders.

In designing and delivering its programmes, the Technology bank should put the LDCs in the driver's seat so that the support provided by it truly responds to aspirations and priorities defined by the countries themselves. Moreover, the Bank should strive to ensure full coordination with the UN system by making use of the existing coordination mechanisms at different levels. This will engender synergy, help avoid duplication, improve impact and facilitate leveraging of ongoing and planned initiatives by UN system organizations in areas that are relevant to the work of the Bank. It should also collaborate closely with the growing number of organizations affiliated with or outside the UN system, including NGOs and foundations that are active in the STI field.

This study concludes that the expected benefit to LDCs from the Bank should be manifold. The potential benefit from Reasearch4Life alone can be as high as $10 million per year per user. Viewed against the operative expenses of the Bank exclusive of cost of infrastructure and related support, which are estimated to be under $10 million per year during the first biennium, the Technology Bank is an eminently feasible enterprise.

The United Nations General Assembly foresaw operationalization of the Technology Bank by its seventieth session (2015-16). In the SDGs, the UN Member States have set the target to "fully operationalize" the technology bank and science, technology and innovation capacity-building mechanism for least developed countries by 2017 (Target 17.8). It is proposed that the High-Level Panel recommend to the Secretary-General necessary follow-up actions to operationalize the Bank within this time frame, and preferably in time for the Mid-term Global Review of the IPoA in Antalya, Turkey in June 2016.

By serving as an engine of transformation, the United Nations Technology Bank for the Least Developed Countries can help these countries unleash a virtuous cycle of high growth, sustained social progress and robust resilience against natural and human-induced catastrophes and, in the process, beneficially mainstream them into the world economy and the international trading, financial and technological systems. It is a win-win proposition for all. Equity, global partnership and even long-term global progress and stability demand it. Our world collectively has the means to support it.

# Chapter 1: Introduction

## A. Background and legislative mandate

A decade ago, Rwandan President Paul Kagame, in addressing the Royal Society of the United Kingdom, offered a sobering assessment which applies across all 48 Least Developed Countries (LDCs) today: "We must either begin to build our scientific and technological training capabilities or remain an impoverished appendage to the global economy."[11] Economic history tells us that science, technology and innovation (STI) are fundamental drivers of sustained economic growth and sustainable development. Yet it is a matter of continued concern that the LDCs, the poorest and most vulnerable segment of our global society, continue to face formidable gaps compared to the rest of the world in the critical areas of science, technology and innovation.

Without rapidly building up national capacities in STI, the goals of eradicating widespread poverty and removing daunting structural constraints on their economies and unleashing sustained growth and sustainable development will remain a distant dream for the nearly a billion people living in these countries. Building such capacities will not be enough; it should to be coupled with the transfer of much needed technologies to LDCs on voluntary and mutually agreed terms and conditions. Dedicated and coordinated actions on these two fronts will help initiate in LDCs a virtuous cycle of high growth, sustained social progress, and robust resilience against natural and human-induced episodes and, in the process, beneficially mainstream these countries into the world economy and the international trading, financial and technological systems. By serving as an engine of transformation, the United Nations Technology Bank for the Least Developed Countries will help these countries realize this overarching goal. It is a win-win proposition for all. Equity, global partnership and even long term global progress and stability demand it. Our world collectively has the means to support it.

The Post-2015 development agenda has already been agreed upon by the Member States. Crafting this agenda, however, is not an end in itself, but the beginning of a new phase in the efforts of the international community under the banner of the United Nations to usher in a better world where people~~s~~ in all parts of our planet can sustainably enjoy the bounties of nature and the wonders of human creativity. The LDCs were largely left behind in the realization of the Millennium Development Goals (MDGs). The post-2015 Agenda, and the Sustainable Development Goals articulated by the UN member States, will be of little

[11] Speech by Paul Kagame, President of Rwanda, at the Royal Society, London, 18 September 2006. http://news.ahibo.com/spip.php?article198.

meaning to the women, men, youth and children in LDCs if they do not translate into tangible gains. By articulating a development agenda for a better future for all, the international community has also concomitantly undertaken to help those that are least able to realize these goals if left to themselves. Dedicated action in favour of LDCs must therefore be at the front and centre of the collective efforts to realize the post-2015 agenda and the SDGs.

This new development agenda is much broader in its scope, covering a wide range of complex and interrelated issues -- economic, social and environmental – thereby making STI an even more important instrument to effectively realize its goals. Without a viable STI base, how can the LDCs realize the goals relating to sustainable management of water and sanitation for all; ensure access to energy for all while promoting renewable energy; inclusive and sustainable economic growth; build resilient infrastructures, including of cities and human settlements; combat climate change; conserve and sustainably use the oceans, seas and marine resources; and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss?

Without the ability to acquire new technologies and to develop domestic capacity in research and development, how can these countries achieve the overarching goal of the Istanbul Programme of Action (IPoA), adopted by UN Member States at the Fourth UN Conference on the Least Developed Countries, of enabling half of the LDCs to meet the criteria for graduation by 2020?

By scaling up the LDCs' STI capacity in an integrated manner, the Technology Bank can be a game-changer for the realization of the objectives and goals of the new UN development agenda and those of the IPoA.

**Legislative background**

The genesis of a multilateral effort to advance and accelerate science and technology among the least developed countries grew out of the Fourth UN Conference on the Least Developed Countries (LDC-IV), which met in Istanbul, Turkey in May 2011. The Conference adopted the IPoA for the current decade and set a goal that one half of the LDCs would be able to meet the criteria for graduation from the group by 2020.

To accomplish this ambitious target, the IPoA recognizes the importance of science, technology and innovation as key drivers of productive capacity building in LDCs. It calls for the improvement of the scientific and innovative capacities of LDCs as a vehicle for structural transformation. It is within this framework that UN member States, in UN General Assembly resolution A/67/220, requested the Secretary-General to "undertake a joint gap and capacity analysis with the aim of establishing a Technology Bank and a science,

technology and innovation-supporting mechanism dedicated to the least developed countries".

Accordingly, the Secretary-General submitted a report to the 68th Session of the Assembly, entitled "Technology Bank and Science, Technology and Innovation Supporting Mechanism Dedicated to the Least Developed Countries".[12] It confirmed that the current state of STI among least developed countries remains poor. Notably, LDCs remained well behind other developing countries in terms of share of STI expenditure in GDP, annual filing of patent applications, and number of publications in peer-reviewed journals.[13] Moreover, a review of global initiatives which feature science and technology found that LDC participation was hit or miss, and that there was no dedicated mechanism to address the particular problems of the LDCs in a comprehensive and integrated manner.[14]

The report of the Secretary-General opened up the opportunity to remedy the technology gap, including the intellectual property (IP) capacity gap faced by LDCs vis-à-vis developed and more-advanced developing countries by proposing the concept of a Technology Bank for the LDCs as a concrete and practical mechanism with three interrelated functions aiming to improve the scientific research and innovation base of least developed countries; help LDCs access and utilize technologies relevant to their development; and facilitate knowledge access and networking among LDCs' STI community.

Following consideration of this report, the General Assembly adopted resolution A/RES/68/224 on 20 December 2013 with, inter alia, the following provisions (see Annex-II) [15]:

- "noted with appreciation the offer of Turkey to host a Technology Bank and science, technology and innovation supporting mechanism dedicated to the least developed countries under the auspices of the United Nations;
- requested the Secretary-General, on the basis of voluntary contributions, to constitute a high-level panel of experts drawn from the least developed countries and their development partners, the United Nations system and other relevant stakeholders to carry out a feasibility study, with secretariat

[12] United Nations General Assembly document A/68/217, Sixty-eighth session Item 22 (a) of the preliminary list: Groups of countries in special situations: follow-up to the Fourth United Nations Conference on the least developed countries.
[13] See annex II of A/68/217 - Report of the Secretary-General on Technology bank and science, technology and innovation supporting mechanism dedicated to the least developed countries.
[14] A/68/217 - Report of the Secretary-General on Technology bank and science, technology and innovation supporting mechanism dedicated to the least developed countries.
[15] UNGA, A/RES/68/224, para 25, 20 December 2013.

support provided, within existing resources, by the Office of the High Representative for the Least Developed Countries, Landlocked Developing Countries and Small Island Developing States, in order to examine its scope, functions, institutional linkage with the United Nations and organizational aspects,

- further requested the Secretary-General to transmit the report and the recommendations of the high-level panel of experts to the General Assembly at its sixty-ninth session for its consideration, with a view to operationalizing a Technology Bank during its seventieth session, if so recommended by the panel."

The 2030 agenda for sustainable development underlines the critical need of technology development, research and innovation in developing countries. It aims, among other things, to provide universal and affordable access to the Internet in the least developed countries by 2020. The new development agenda has set a target to "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."[16]

The Addis Ababa Action Agenda, adopted at the Third International Conference on Financing for Development (FfD), recognizes that the creation, development and diffusion of new innovations and technologies and associated know-how, including the transfer of technology on mutually agreed terms, are powerful drivers of economic growth and sustainable development.

In the new FfD agenda, the international community stated: "we look forward to the recommendations of the Secretary-General's High-level Panel on the Technology Bank for Least Developed Countries […] We will take into account the High-level Panel's recommendations on the scope, functions, institutional linkages and organizational aspects of the proposed bank, with a view to operationalizing it by 2017, and will seek to promote synergies with the Technology Facilitation Mechanism".[17] In the same agenda, the international community promised to "enhance international cooperation, including ODA, in these areas, in particular to least developed countries".

At the High-level meeting on Global Partnerships for a Transformative Agenda for the Least Developed Countries, which took place during the Third International Conference on

[16] Target 17.8 of Transforming Our World: The 2030 Agenda for Sustainable Development.
[17] Paragraph 124, of the Addis Ababa Action Agenda contained in the UNGA resolution A/69/L.82.

Financing for Development[18], political leaders adopted a declaration, wherein they recognized that bringing about structural transformation in the economies of LDCs will require the transfer, acquisition and upgrading of technologies, including new technologies, domestic capacity and a knowledge base. They also underscored that the Technology Bank for the LDCs is a timely and critically important initiative to speedily bridge the technology gap faced by LDCs, and looked forward to the full operationalization of the Technology Bank during the 70th session of the UNGA, which starts on 15 September 2015.

The LDC leaders called upon the donor countries to make sufficient contributions to the Technology Bank by providing it with at least 0.1 per cent of their ODA to the LDCs to ensure its effective functioning.[19] They commended the Government of Turkey for its generous offer to host the Technology Bank and to support the work of the Secretary-General's High-level Panel, and urged Turkey to continue its support to the Technology Bank. They also requested the Secretary General of the United Nations to make expeditious arrangements for effective and timely realization of the recommendations of the High-level Panel.

**The High-Level Panel**

On 26 November 2014, the United Nations Secretary-General Ban Ki-moon announced the formation of a High-Level Panel to study the scope and functions of the proposed Technology Bank dedicated to helping the world's least developed countries lift themselves out of poverty. In announcing the composition of the Panel, the Secretary-General indicated that it should "prepare practical recommendations on this important matter, which can provide a strong impetus to accelerating the structural transformation and sustainable development of the LDCs."

The High-Level Panel – which is to advise on the organizational and operational aspects of the planned Technology Bank and Science, Technology and Innovation Supporting Mechanism – is chaired by Prof. Romain Murenzi (Rwanda), Executive Director of The World Academy of Sciences (TWAS) in Trieste, Italy. The Panel includes five women and five men from LDCs and their development partners from the global North and South.

The other panel members (see Annex – III for brief biographies of the panel members) are Mohamed Hassan (Sudan), Bruce Lehman (United States), Tebello Nyokong (South Africa), Dorte Olesen (Denmark), Posh Raj Pandey (Nepal), Michèle Duvivier Pierre-Louis (Haiti), Firdausi Qadri (Bangladesh), and Fang Xin (China). Gyan Chandra Acharya, UN Under Secretary-General and High Representative for the Least Developed Countries, Landlocked

[18] Addis Ababa, 14 July 2015.

[19] As noted in Table 1, ODA currently devoted to STI among LDCs amounts to around 0.4 percent. This 0.1 percent would be in addition to that figure.

Developing Countries and Small Island Developing States and Hakan Karatas, International Coordinator of the Scientific and Technological Research Council of Turkey (Türkiye Bilimsel ve Teknolojik Araştırma Kurumu, TÜBİTAK) representing the host country Turkey were appointed ex-officio members

The High-Level Panel held its first meeting in Istanbul, Turkey, on 16-17 February 2015 and was hosted by TÜBİTAK. At this meeting, the Panel agreed to prepare a feasibility study that articulates an ambitious and forward-looking proposal for the establishment of the Technology Bank and Science, Support and Innovation Mechanism for the Least Developed Countries. During the meeting, members provided guidance for the scope and methodology of the feasibility study and advised on the functions and institutional linkage with the United Nations and other organizational aspects.

The members of the Panel indicated that there has been a long history of extensive expectations from LDCs for the Technology Bank. Further, members expressed concern over the dearth of institutions dealing with science in the LDCs, which creates serious constraints for training researchers and scientists in these countries.

The members agreed that the ultimate goal of the Technology Bank should be to ensure a sound and viable technological base in LDCs that supports poverty eradication, sustainable development and structural transformation. To this end, acquiring and adapting technologies that are appropriate to the particular development needs of each LDC was considered essential. It is important that transfer of technology be carried out in an orderly manner, and that coherence and synergy are created with existing initiatives.

It was suggested that the operationalization of the Bank could be done in a phased manner, and the initial activities could address “low hanging fruits” to gain momentum and valuable knowledge and experience. Its activities should be further developed over time as the Technology Bank advances along its learning curve.

The members also offered their views on the proposed functions of the Technology Bank. The role of national STI policies was highlighted. These strategies need to demonstrate buy-in from both governments and development partners. National-level leadership and strong international support are both imperative. Moreover, country-specific STI policies and plans need to be fully integrated in national development strategies. It was also highlighted that

the overall objective of these national policies should link science with commercial markets (applied science), rather than just producing scientific papers.[20]

The members agreed that LDCs need improved and scaled up access to scientific literature and that the Technology Bank could support free access to quality science and technology journals.[21] Fostering the presence of researchers and scientists from LDCs in existing global and regional journals was also stressed by the Panel.

A key aspect of accessibility to journals and other knowledge products in today's world occurs primarily through information networks, thus the essential importance of connectivity. Currently, a large amount of resources is spent by universities in LDCs to gain access to the Internet at subprime quality and speed. In fact, greater connectivity is the key to better access to journals. Members of the panel indicated that the fundamental idea of research is not only to create a network, but to also create something original out of it. LDCs, and especially African LDCs, need increased and enhanced connectivity.[22]

Additionally, panel members posited that efforts should be made to mobilize the diaspora of highly qualified LDC scientists and provide them with a channel through the Technology Bank in order to facilitate their contribution to the development of their home countries.

The discussion on technology transfer underscored the large asymmetry between LDCs and intellectual property-holding countries, and also highlighted the fact that countries with a large concentration of patented intellectual property tend to be the wealthiest. Facilitating the transfer of technology on voluntary and mutually agreed terms and conditions that are adequate and have the potential to transform the economies of the LDCs requires addressing the concerns of all stakeholders. In this connection, building an intellectual property enforcement infrastructure in the LDCs will be essential to secure the delivery of technology from patent holders to the least developed countries. The Intellectual Property Bank should act as an intermediary mechanism that facilitates the transfer of technology from patent holders to an LDC that needs it, ensuring at the same time that the technology will not be transferred to a third party.

Facilitating access to patenting services for inventions from LDCs will be an important dimension of the work of the Technology Bank. The Panel stressed the importance of

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[20] As a Hungarian science minister once remarked, "All scientific research is commendable; but if we cannot apply it, we cannot afford it." Seminar at the U.S. Center for Strategic and International Studies (CSIS), Washington, DC, Fall 2004.

[21] Such access obtained through Research4Life, the UN's public-private-partnership (PPP) with global scientific publishers, is discussed at length in this study.

[22] National Research and Education Networks (NRENs) and a vital partnership with GÉANT, the European NREN, is discussed at length in this study.

education and awareness-raising in intellectual property matters, including evaluating whether ideas and innovations are patentable, how the patenting process works, and the general need for LDCs to develop capacity in all areas of intellectual property, which suggests the importance of reflecting this broader need in the Intellectual Property Bank.

## B. Overall approach and orientation

As noted above, this feasibility study responds to the request made by Member States to the UN Secretary-General pursuant to resolution A/68/224, approved by the General Assembly on December 2013, as well as the aforementioned decision of the first meeting of the High-level Panel. It aims to facilitate discussions and decisions of the High-level Panel of the Secretary-General on the Technology Bank, especially as regards the structure, activities and institutional issues such as governance, staffing and costs by:

(i) providing a detailed account of how the notion of an institutional mechanism for technology transfer, acquisition and absorption evolved through the UN intergovernmental mechanisms leading to the General Assembly resolutions referred to above;

(ii) proposing recommendations for how a Technology Bank and STI supporting mechanism could be structured in terms of activities, governance, staffing, costs, and related considerations that might bear on its operationalization;

(iii) mapping the institutional environment in the UN system within which the Technology Bank will function, including ongoing and planned interventions that might be leveraged through the proposed initiative;

(iv) providing a statement on the feasibility of a Technology Bank for least developed countries, taking into account the full scope of data and analyses undertaken throughout the examination process.

Given that the Technology Bank will be a new institution, it is expected that its activities will be developed over time as it moves along a learning curve by gaining experience and expertise through an initial set of activities. Experience accumulated in implementing these activities will be crucial. Recognizing this, the High-level Panel, at its first meeting, expressed the view that the Technology Bank should be operationalized incrementally. Accordingly, the feasibility study proposes activities during an initial start-up phase spanning two biennia, i.e., four years. It is noted that the UN General Assembly provided for operationalizing the Technology Bank during its 70$^{th}$ session.

It is envisaged that activities in the initial phase should respond to immediate needs of the LDCs. It should also serve as an opportunity to demonstrate the benefits to LDCs from its efforts to improve their capacities in the areas of STI, including diffusion and transfer of technology and adopting a more systematic approach to science, technology and innovation. This phase should facilitate the consolidation of the financial base of the

Technology Bank, and help in building partnerships with stakeholders in LDCs and other developing and developed countries.

At the conclusion of the initial phase, an assessment will be carried out, which will serve as a basis for consolidating the activities conducted during the first phase. Likewise, it will consider expansion of activities through greater country-coverage and assumption of new activities.

The Technology Bank should adopt a multi-stakeholders approach in its work. To that end, the governance arrangement of the Bank should to be of a multi-stakeholder nature, with the participation of Member States, the global STI community, the private sector, philanthropic foundations and civil society. Ensuring the voice and participation of the LDCs will be crucial.

The Technology Bank should leverage North-South, South-South and Triangular cooperation arrangements in the design and delivery of its activities. Besides support to individual LDCs through country-led activities, it will also make use of regional, sub-regional and interregional approaches to STI development.

Although the Technology Bank should be dedicated to technology transfer and to the promotion of science, technology and innovation in the LDCs, countries that graduate from the category should also be able to access its services on a case-by-case basis to ensure that their progress is not abruptly disrupted.

Mainstreaming women and youth in the work of the Technology Bank should be of high priority. The nexus of youth, entrepreneurship, and high-tech fields is pervasive in the developed world. Most global efforts to engage such youth have focused on more-advanced "emerging market" countries, but there are some programmes from which LDC youth and women receive benefit. The Technology Bank, at its initial phase, should build on such initiatives.

Equally important is the involvement of UN-system organizations which, as indicated below, already carry out a series of activities in the STI arena. The Technology Bank should leverage the existing initiatives of UN Agencies, Funds and Programmes at the regional and national level to implement its programme of work. An ad-hoc UN Interagency Task Team led by UN-OHRLLS was established in in 2012 to contribute to the work of the High-level Panel.[23] Such an interagency mechanism should support the work of the Technology Bank.

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[23] The members of UNTT are WIPO, WTO, UNCTAD, ITU, UNIDO, UNESCO, World Bank, UN Women, ECA and ESCAP.

The activities undertaken by the Technology Bank should be aligned and be coherent with national development priorities and consistent with programming principles. Initiatives undertaken by the Technology Bank, in partnerships with relevant UN Agencies, Funds and Programmes, should be integrated with the United Nations Development Assistance Framework in consultation with United Nations Country Teams and other relevant stakeholders.

# Chapter 2: State of STI in LDCs and support by development partners

The Istanbul Programme of Action established the aim of enabling half of the least developed countries to meet the criteria for graduation by 2020 (see A/CONF.219/3/Rev.1, para. 28). Achievement of that ambitious goal will require structural transformation, including technological leapfrogging by LDCs. However, building endogenous science and technology capacities of a high standard takes many years.[24] Thus, the compressed graduation timeline of the Istanbul Programme of Action suggests an even steeper learning curve and significant additional resources and focus to enable science and technology to fulfil its potential of equipping least developed countries with the means to develop their economic base on a firm footing and to better compete in the wider global economy.

No country has been able to embark on rapid economic growth without technological change. It could take many decades for the least developed countries to overcome their structural constraints unless they are able to substantially strengthen their science, technology and innovation base and capacity. Thus, technological transformation holds the key to the accelerated growth and development of the least developed countries and, in the process, their graduation from that category. The design and purpose of the technology bank must be structured to best help meet this formidable challenge of technological leapfrogging by the least developed countries.[25]

## A. State of science, technology and innovation in LDCs

The state of science, technology and innovation in LDCs remains poor. Disparities between the least developed countries and the rest of the world in the capacity to generate and apply S&T knowledge have been growing. While members of the Organization for Economic Cooperation and Development (OECD) spent on average 2.4 per cent of GDP on research

[24] The late Argentine physicist Jorge Sabato observed that it takes about 15 years to build a world-class research institute capable of generating its own scientific breakthroughs. Cited by the Global Knowledge Initiative; see www.globalknowledgeinitiative.org/aboutus/index.html.

[25] See the report of the Secretary-General on options for a facilitation mechanism that promotes the development, transfer and dissemination of clean and environmentally sound technologies (A/67/348).

and development in 2013, the amount dedicated to research and development in the least developed countries, where data is available, was negligible.[26]

Limited resources, including a narrow base of scientific literacy, have contributed to scant generation, diffusion and application of scientific knowledge in the least developed countries. Similarly, the limited endogenous research and development capabilities in those countries render them dependent on the acquisition of new technologies from abroad.

Conversely, a number of developing countries with fast growing economies have in recent years made substantial investments in science and technology and related research and development. In so doing, they have also challenged the global S&T/R&D triad of Japan, North America and Western Europe. The United Nations Educational, Scientific and Cultural Organization (UNESCO), in its Science Report 2010, noted the dramatic increase of investments in science and technology by leading nations in the developing world and their positive impact on global economic growth, while observing that, "by contrast, the group of least developed countries … still plays a marginal role".[27]

An illustrative way to depict science, technology and innovation in the least developed countries is perhaps to look at the number of articles published in scientific and technical journals by those countries. Using data from the Institute for Scientific Information's Science Citation Index and Social Sciences Citation Index, all of the least developed countries combined published 1,538 scientific and technical journal articles in 2011, up from 874 in 2001. This meagre production contrasts starkly with what is happening in other countries.[28] Today, some 20 per cent of all science articles published in peer reviewed international journals are authored by researchers in the developing world. Although encouraging, those statistics disguise the lopsided influence of five countries (Brazil, China, India, Mexico and Turkey), whose scholars contribute over half of the South's science publications. On the other hand, the number of articles in scientific journals per 1 million people for LDCs averaged under 2 during 2001-2011.

The total number of scientific and technical articles published in journals worldwide in 2011 was 842,756, of which a mere 0.185 per cent were from LDCs. The least developed countries, with around 12 per cent of the world population, produced an almost

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[26] For instance, Burkina Faso spent 0.20 per cent of GDP on research and development in 2009; Ethiopia, 0.24 per cent in 2010; Gambia, 0.133 per cent in 2011; Lesotho, 0.013 per cent in 2011; Madagascar, 0.106 per cent in 2011; and Uganda, 0.56 per cent in 2010.

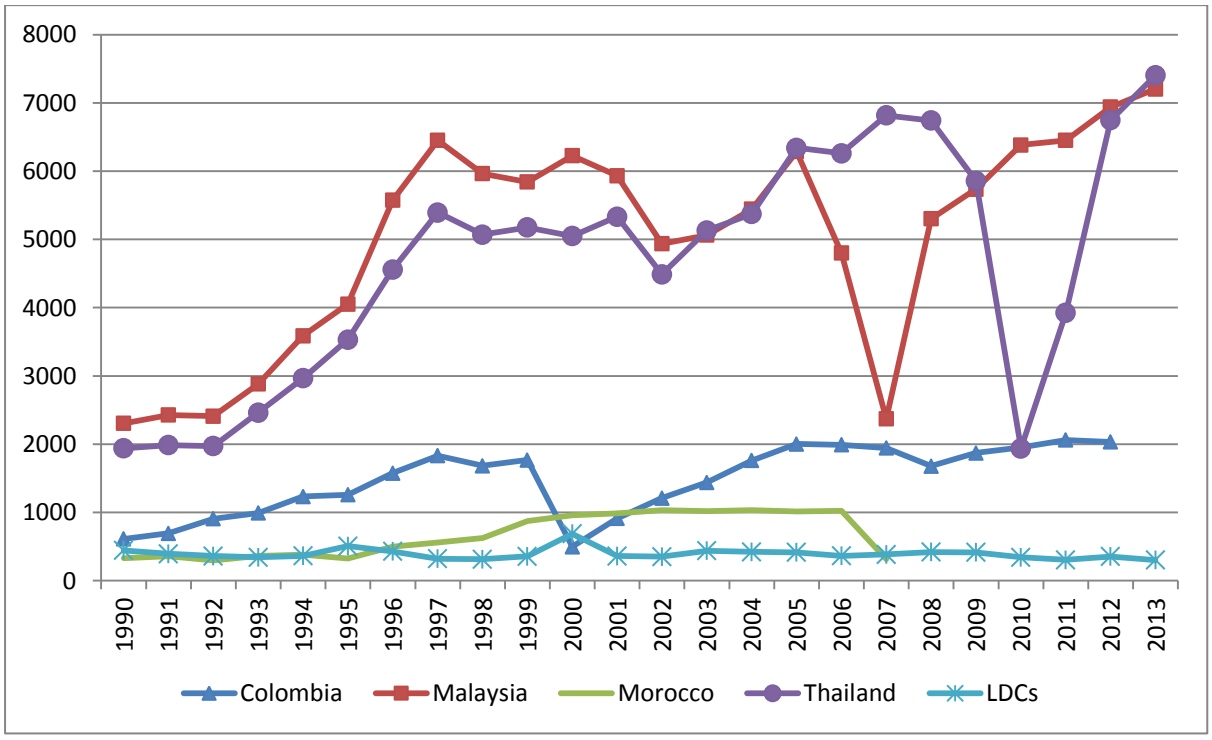
[27] See United Nations Educational, Scientific and Cultural Organization, Science Report 2010: The Current Status of Science around the World, p. 5. UNESCO reviews the state of global science every five years. The next edition will be released on 10 November 2015.

[28] For instance, in 2011, Argentina published 3,863 scientific articles, India 22,481.

imperceptible share of scientific and technical articles, while the United States, with roughly 4.5 per cent of the world population, produced 26.3 per cent of all scientific and technical papers. In addition, such disparities are becoming more accentuated as the number of articles published appears to be growing faster in other developing countries than among LDCs.

The LDCs also lag significantly behind other countries in terms of the scientific impact of the research undertaken by them. This is apparent from the Citable Documents H Index quantifying scientific productivity and impact, which is a part of the Global Innovation Index.[29] In terms of this index, LDCs perform much worse than other developing countries, let alone the developed countries. For example, LDCs' index scores range between 18 and 99, well below those of Turkey (210,) India (301), Brazil (305) and China (385), and far behind Switzerland (569), the U.K. (851) and the U.S. (1,380).

**Chart 1 Number of patents filled by residents and non-residents in LDCs and selected developing countries**




*Source: The World Bank. World Development Indicators 2015.*

[29] http://www.globalinnovationindex.org/content.aspx?page=gii-full-report-2014.

The low number of patents filed by residents of LDCs in their own countries and abroad displays another dismal scenario. The combined annual average number of applications filed by residents and non-residents in 19 LDCs for which data was available during the period 2001-2011 amounted to 383 per year — quite meagre compared with other countries. For instance, in the same year, Colombia filed 2,061, Malaysia 6,452 and Thailand 3,924 (see Chart 1).[30] It is important to build the capacity of relevant institutions in the LDCs to intensify research on endogenous and natural resources and to file patents. In this regard, South-South cooperation is also vitally important.

It is important to note that there are many provisions governing the transfer of technology in international agreements, conventions and protocols. However, existing arrangements and mechanisms for the transfer of technology have not enabled LDCs in a meaningful way to overcome their severe weakness in the area of STI and build their technological base.

Various studies suggest that existing mechanisms for technology transfer are fragmented and often ad-hoc in terms of objective, content and country coverage. There is no global framework, agreement, or mechanism that is comprehensive and all-encompassing for STI capacity building in the least developed countries.

Substantial investments of time, effort and money are required to build the capacity of indigenous science, technology and innovation and integrate that capacity into productive activities in order to drive greater and more rapid economic growth. Building a research institution of international standard requires long-term investments that stretch over a decade and a half or more. Over that period, considerable effort must go into attracting human resources of the highest quality, building cutting edge facilities, procuring essential equipment, developing relationships with universities, firms and markets globally, and securing online connectivity to ensure that researchers can readily interact with their global peers, and access current, online publications. This developmental model, of course, assumes the existence of institutional capacity and funding commensurate to the achievement of such an ambitious goal.

The chronic underdevelopment of S&T/R&D systems in the least developed countries makes the adaptation and absorption of existing technologies necessary, especially in the early stages of industrial upgrading. In fact, many newly industrialized countries started adapting technologies from abroad to their own nascent industrial base before being able to generate their own scientific and technical knowledge. Absorptive capacities require a

[30] Based on data from the World Development Indicators, the World Bank.

certain degree of internal technological expertise to be able to assimilate external knowledge and integrate it into a local context.

Imports and foreign direct investment are among the major channels of technology transmission. The structural constraints on the balance of payments of LDCs, and thus their severely restricted ability to import, have dampened the transfer of technology to them. Their marginalization in global flows of foreign direct investment (FDI) further exacerbates the lack of transmission of technology. Furthermore, the limited capacity of the least developed countries to integrate foreign technology into their particular circumstances reduces their ability to realize the full potential of such technology.

Strengthening the innovation capacities of LDCs to foster the adaptation and absorption of foreign technology could greatly accelerate the development of their productive capacities, in addition to fostering endogenous research and development. This is the crux of the problem in the least developed countries.

The underlying premise of the Technology Bank is the existence of complementary facets of the same science and technology ecosystem. As such, they should work in tandem and mutually reinforce one another in a fully integrated way through careful planning and implementation. In addition, they require high bandwidth Internet connectivity, both to advance research and to enable researchers in the least developed countries to participate in the worldwide scientific collaboration that characterizes science, technology and innovation today.

Concomitantly, science, technology and innovation in this context presuppose that its practitioners in the least developed countries will seek to harness S&T to solve practical problems. Where this might involve the application of patented science or technology, practitioners in least developed countries need an efficient gateway to access relevant intellectual property on voluntary and mutually agreed terms and conditions, with credible policies and mechanisms to implement the IP thus transferred. Likewise, when rights holders[31] in the least developed countries generate new or added value of their own, they should have the means and advice on how to derive due benefit from such intellectual property.

[31] Rights holders are individuals or groups who hold patents, copyrights, trademarks, trade secrets, or geographic indicators. Under the WTO, the latter category has emerged as protected IP. For example, Ethiopian coffee growers are seeking a "geographic indication" for their highly regarded coffee beans so that they can capture the price premium currently claimed by foreign coffee brokers.

At the most fundamental level, this implies applied science and the utilization of the legal rights established by IP ownership and technology transfer to serve as a pathway. A supporting mechanism should help commercialize science and technology where research conducted in the least developed countries develops new science or adds value to existing technologies. This is not to suggest that basic scientific research is not a worthy goal in and of itself; but the economies of most of the least developed countries can hardly afford science if they cannot apply it through codification. Building science, technology, engineering and mathematical capacities for practical applications also requires deep and long-term investments in education at both the secondary and tertiary levels. There is also the need for an extensive education of the public to understand the fundamental benefits of these activities to society as a whole.

As an adjunct to applied science, a supporting mechanism should offer fundamental training in entrepreneurship and marketing, since most technical researchers cannot be expected to innately display parallel business skills. Moreover, given the inherently weak bargaining position of practitioners in the least developed countries, a supporting mechanism should provide direct marketing and patent assistance when they engage with counterparts from countries with more advanced economies. Finally, a science, technology and innovation supporting mechanism in the form of the Technology Bank should seek investment capital and donor funding to help take to market the most promising science and technology/research and development generated by the least developed countries.

## B. Support by development partners

The IPoA identified actions by development partners to support LDCs in the area of the STI, including building or expanding strategic partnerships with a broad range of actors in order to support innovation; ensuring that science and technology are mainstreamed into least developed country national development and sectoral policies; promoting investments and engagement in innovative solutions for the development of modern and cost-effective technologies that could be locally adapted, particularly in the fields of agriculture, information and communication, finance, energy, health, water and sanitation and education; setting up and strengthening institutions and expanding the knowledge base to support local, national and regional research and development, science and technology; and facilitating cooperation and collaboration between research institutions and the private sector.

The data from OECD-DAC do not have a dedicated category for ODA going to STI per se, but instead provide detailed information on several sectoral allocations of ODA which are related to STI. Some of these sectoral areas are consistent with the above provisions of the IPoA. Table 1 below shows the total and breakdown of ODA flows from all donors to both LDCs and all developing countries in the last three years for which data were available.

**Table 1 ODA for STI to developing countries and LDCs[32]**

| | All Developing Countries | | | Least Developed Countries | | |
|---|---|---|---|---|---|---|
| | 2011 | 2012 | 2013 | 2011 | 2012 | 2013 |
| **Agricultural research** | 601 | 581 | 684 | 103 | 102 | 117 |
| **Educational research** | 63 | 23 | 34 | 44 | 7 | 16 |
| **Energy research** | 7 | 93 | 30 | 1 | 1 | 1 |
| **Environmental research** | 162 | 227 | 155 | 17 | 21 | 15 |
| **Fishery research** | 12 | 7 | 9 | 4 | 2 | 2 |
| **Forestry research** | 16 | 14 | 22 | 1 | 1 | 1 |
| **Medical research** | 256 | 332 | 349 | 32 | 44 | 29 |
| **Research/scientific institutions** | 372 | 343 | 528 | 38 | 36 | 52 |
| **Technological research and development** | 59 | 55 | 47 | 8 | 5 | 6 |
| **Total Bilateral Aid To STI:** | 1,548 | 1,673 | 1,858 | 239 | 213 | 233 |
| **Total Bilateral Aid To All Sectors:** | 155,996 | 151,533 | 166,990 | 49,850 | 46,054 | 53,571 |
| **ODA for STI as % of Total ODA:** | 1.0% | 1.1% | 1.1% | 0.5% | 0.5% | 0.4% |

The data above illustrate several important points. First, the proportion of ODA directed towards STI hovers around 1% for developing countries as a whole, while the same proportion for LDCs is merely at 0.5% of total ODA. Secondly, the total bilateral aid for STI given to LDCs is about 15% of the aid for STI given to all developing countries. Third, the largest category of STI for both LDCs and other developing countries is agricultural research, followed by medical research, ODA to scientific institutions and environmental research. The last category in the table, technological R&D, accounts on average for merely 3% of total ODA spent on STI.

As noted above, the capacity of LDCs in the area of STI is severely limited, which appears to be a proximate reason for the scanty ODA allocation to technological research and development. Both stronger national actions and external support, including ODA support, are sine non qua for speedily strengthening national STI capacity of LDCs.

A bright spot in the development cooperation landscape of STI in LDCs is the offer of Turkey to host the Technology Bank and its commitment to provide additional support in terms of financing and human resources. Turkey has emerged as an increasingly important

[32] OECD DAC Aid Statistics Database. (Accessed in August 2015).

development partner for LDCs and is implementing an ambitious development cooperation programme for them. At the Istanbul Conference for LDCs in 2011, President Recep Tayyip Erdoğan, announced a package that envisaged the allocation of $200 million annually for technical cooperation projects and programs in the LDCs. The latest statistics show that Turkey is successfully meeting this goal.

# Chapter 3: UN system activities in support of LDCs in the area of STI

This chapter provides a brief account of the current landscape of UN-system technology-related initiatives in support of LDCs. There are a variety of technology-related initiatives at the global and regional levels. Chart 2 provides a snapshot of some of the key initiatives in the area of environment, health and safety.

**Chart 2 International Agreements and Conventions with Technology Provisions**

In the areas of environmental, health and safety technologies, at least 18 international agreements, conventions, and protocols contain technology provisions, including the following:

- Convention on Biological Diversity
- United Nations Framework Convention on Climate Change
- United Nations Convention to Combat Desertification in Those Countries Experiencing Serious Drought and/or Desertification, Particularly in Africa
- Cartagena Protocol on Biosafety to the Convention on Biological Diversity
- Vienna Convention for the Protection of the Ozone Layer
- Montreal Protocol to the Vienna Convention for the Protection of the Ozone Layer on Substances that Deplete the Ozone Layer
- Convention on the Transboundary Effects of Industrial Accidents
- Protocol to Abate Acidification, Eutrophication and Ground-level Ozone to the Convention on Long-range Transboundary Air Pollution
- Protocol on Persistent Organic Pollutants to the Convention on Long-range Transboundary Air Pollution
- Protocol on Heavy Metals to the Convention on Long-range Transboundary Air Pollution
- Convention on the Protection and Use of Transboundary Watercourses and International Lakes
- Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal
- Convention on Nuclear Safety
- Convention on the Law of the Sea
- International Undertaking on Plant Genetic Resources
- International Treaty on Plant Genetic Resources for Food and Agriculture

*Source: UN SG's report: Options for a facilitation mechanism that promotes the development, transfer and dissemination of clean and environmentally sound technologies, A/67/348., 2012.*

Based on responses to a survey and a desk study, the following activities by UN-system organizations as relevant for LDCs are noted, although the list is not exhaustive. Generally, in terms of institutional arrangements, technology-related initiatives can be categorized into:

- global/regional initiatives supporting/related to specific treaties, conventions or other agreements between/across Member States. They relate to environment, trade, investment, intellectual-property or other policy areas affecting technology needs;
- institutional partnerships, established, governed and/or maintained by multiple UN agencies not related to specific treaties, conventions or agreements; and
- initiatives managed solely by a UN agency with time-bound tasks without partnership arrangement.[33]

An analysis of the existing measures undertaken by UN-system entities indicates the following typologies:

- Support national STI policy framework, analysing ICT trends and ICT policy review
- Access to scientific and technical information
- Supporting integration into global IP and innovation database
- Stocktaking of technology transfer measures
- Technical support to build human and institutional capacities through training and workshops
- Technical assistance for the transfer of climate technologies
- Matchmaking in technology transfer among developing countries

The initiatives and measures by UN-system organizations to facilitate technology transfer are geared to provide benefits to developing countries and LDCs. However, given their very limited absorptive capacities, it is very difficult for LDCs to access a multiplicity of discrete facilities. Therefore, they need an easily accessible and coordinated one-stop arrangement. The Technology Bank can meet this goal by working closely with the UN-system entities as well as with other stakeholders by building synergy, coherence and collaboration, and avoiding duplication and overlap to provide dedicated support for technology transfer and STI capacity-building in LDCs.

[33] An Overview of the UN Technology Initiatives, United Nations Inter-Agency Working Group on a Technology Facilitation Mechanism, July 7th, 2015.

In addition to the UN system initiatives, this chapter also provides an illustrative account of actions by some organizations outside of the UN.

## A. United Nations system activities

### World Intellectual Property Organization (WIPO)

Innovation and technological capacity building remain at the core of WIPO development programs for LDCs. Building innovation capacity to strengthen national knowledge bases remains in strong focus in WIPO. Specific programmes for the benefit of LDCs include: (i) Strengthening National Policy Framework for Promoting Innovation; (ii) Building Skills to Access Scientific and Technical Information for Technological Capacity Building; (iii) Supporting LDCs' Integration into global intellectual property and innovation databases; and (iv) Appropriate Technology for Development.

WIPO supports LDCs in mainstreaming IP into national development policy in areas that are critical for their development, such as health, trade, education, research, technology transfer and competition policies. It also provides advice on instruments and flexibilities available under international IP treaties, including the TRIPS agreement.

WIPO's Member States established the Development Agenda for WIPO.[34] This agenda adopted 45 recommendations structured across six clusters:

- Cluster A: Technical and capacity building
- Cluster B: Norm-setting, flexibilities, public policy and public domain
- Cluster C: Technology transfer, information and communication technologies (ICT) and access to knowledge
- Cluster D: Assessment, evaluation and impact studies
- Cluster E: Institutional matters including mandate and governance
- Cluster F: Other issues

WIPO activities are demand-driven and include, specifically for LDCs, training in awareness – building and human resources development for IP officials in LDCs; assistance in building up or upgrading IP offices in LDCs with adequate institutional infrastructure and resources, qualified staff, modern management techniques and access to information technology support systems; advisory missions to the IP offices in LDCs to give advice on modernizing

[34] WIPO. *Development Agenda for WIPO*. 2007. http://www.wipo.int/ip-development/en/agenda/ (Retrieved on 14 August 2015).

management systems and streamlining administrative procedures; sponsoring study visits for officials from the LDCs; organizing study tours for officials from many LDCs to offices in industrialized countries to study various aspects of modernization; assisting LDCs with legislation in the areas of industrial property, copyright and neighbouring rights and geographic information system (**GIS**)and enabling LDCs to assess the conformity of their existing national legislation vis-à-vis the provisions of international agreements and to build national IP organizations and institutions; advising in the setting-up or strengthening of collective management societies in the LDCs; organizing, in close cooperation with other international organizations, national, regional and interregional meetings for the LDCs on integrating IP into national development policy and assisting LDCs in the establishment of Intellectual Property Advisory Services and Information Centre .

Until 2014, WIPO extended its support to twenty (24) LDCs out of which four (4) (Mozambique, Rwanda, Senegal and Zambia) have approved draft IP policies prepared with WIPO assistance. Cooperation in this area has contributed towards taking IP to the level of national development planning. WIPO works with LDCs to contribute to the development and strengthening of institutional infrastructure in STI through facilitating their integration into global innovation and greater access to the rich source of S&T and IP information. Intellectual property offices (IPO), universities, R&D institutions, chambers of commerce and industry are some of the major beneficiaries of such support. Modernization and automation of innovation institutions and IP offices, strengthening connectivity and integration to global knowledge systems – in particular IP databases – are given high attention in the context of infrastructure development and strengthening national innovation institutions in LDCs.

WIPO is also implementing specific projects on appropriate technology transfer for development in LDCs. These projects contribute to strengthening national capacities in the area of need analysis, transfer, development, and adaptation of appropriate technology to address nationally identified development challenges in areas such as environment, infrastructure development, agriculture production, health, green technology, renewable energy, and land degradation.

**United Nations Conference on Trade and Development (UNCTAD)**

UNCTAD provides intellectual leadership and serves as a source of expertise on STI and information and communication technology (ICT) policies for development. UNCTAD's activities in this arena seek to bring the development perspective to international discussions, supporting consensus-building and capacity-building for sound, evidence-based, and development-oriented policy in relevant areas.

In the area of STI, UNCTAD prepares Science, Technology and Innovation Policy (STIP) Reviews which are considered by the United Nations Commission on Science and

Technology for Development (CSTD). UNCTADs STIP Reviews support the development of effective national innovation systems in developing countries by identifying critical issues and proposing actions by STI stakeholders to support the development of technological capabilities and to strengthen innovation linkages. In the past fifteen years, four LDCs have been reviewed (Angola Ethiopia, Lesotho and Mauritania).

UNCTAD also provides regular policy analysis and advice to countries on pressing issues of STI through its Technology and Innovation Report series, which has addressed agricultural innovation for LDCs in Africa, better use of renewable energy technologies and South-South technological collaboration.

In the field of ICTs, the Measuring ICT Programme aims at enhancing the ability of developing countries to engage in more effective ICT policy making by building their capacities to produce information economy statistics and core indicators, including on ICT access and use by businesses, on international trade in ICT goods and services, and on the workforce and value added of the ICT sector.

UNCTAD's Electronic Commerce and Law Reform Programme aims at enhancing knowledge of e-commerce legal issues and prepare policy and law makers for the drafting of legal frameworks. UNCTAD provides assistance for the preparation and enactment of compatible regional e-commerce legal frameworks. It also provides advice to countries through its regional cyber laws harmonization studies. Twenty LDCs benefitted from UNCTAD's assistance in this area. UNCTAD also offers ICT Policy Reviews to countries upon request and depending on the availability of resources.

Many LDCs also benefit from UNCTAD's ASYCUDA programme, a computer-based customs automation and management system which aims at speeding up customs clearance through the introduction of computerization and simplification of procedures and thus minimizing administrative costs to the business community and the economies of countries.

UNCTAD, through its Development Dimensions of Intellectual Property programme, provides technical assistance to requesting countries on cross-cutting issues of intellectual property and development, and is one of the organizations specifically named by WIPO to assist it in the implementation of its 2007 Development Agenda.

**World Trade Organization (WTO)**

The WTO does not have a distinct, all-embracing technology programme on transfer mechanisms; but technology transfer is taken up under a number of existing processes. Technology transfer is considered a part of the technical assistance package on regulatory issues and sanitary and phytosanitary issues under the specific agreement concerns such as health related regulations, food related regulations, and broader application of standards.

The WTO has a specific working group on trade and transfer of technology, which was set up at the Doha Ministerial Conference (2001) to determine the relationship between trade and technology, and to develop recommendations to increase the flow of technologies to developing countries. Under Article 66.2 of the TRIPS agreement,[35] the WTO collects a great deal of material on technology-transfer measures that have been reported to it. At the Doha Ministerial Meeting, Ministers specifically mandated an improved reporting mechanism.

In 2003, the TRIPS Council adopted a decision on "Implementation of Article 66.2 of the TRIPS Agreement" that put in place a mechanism for ensuring the monitoring and full implementation of the obligations in question. Under this Decision, developed county Members submit annual reports on actions taken or planned in pursuance of their commitments under Article 66.2.

Since 2008, upon the request of the LDC group, the WTO Secretariat has been organizing an annual workshop on the implementation of Article 66.2 with the goal of facilitating the understanding and exchange of information between LDC Members and the Members reporting on their implementation of Article 66.2. The TRIPS Agreement recognizes the need for developed countries to support LDCs in their efforts to implement its provisions through technical and financial co-operation provided on request and on mutually agreed terms and conditions. Nine LDC Members have reported to the TRIPS Council on their individual priority needs, which include vital information concerning the specific areas of technology transfer and the operation of intellectual property systems in those nine countries.

**United Nations Educational, Scientific and Cultural Organization (UNESCO)**

UNESCO has been actively supporting LDCs, mainly in Africa, to formulate, review or provide methodologies to monitor and evaluate the implementation of their STI policies. To date, 14 African LDCs have received technical support in this area (Benin, Burkina Faso, Burundi, Democratic Republic of Congo, Gambia, Malawi, Mauritania, Mozambique, Niger, Rwanda, Senegal, Tanzania, Togo, and Zambia). A number of these countries also participated in the UNESCO Global Observatory of STI Policy Instruments (GO-SPIN) project - an open access database helping countries to reform and upgrade their national STI systems and to enable policy makers and researchers to monitor and evaluate their policies and programmes. UNESCO also conducts Science, Technology and Innovation Policy (STIP) baseline country reports, but only two (Burundi and Lesotho) have been undertaken on LDCs.

[35] Trade-Related Aspects of Intellectual Property Rights. The TRIPS Agreement is Annex 1C of the Marrakesh Agreement Establishing the World Trade Organization, signed in Marrakesh, Morocco on 15 April 1994.

Technical support is provided to the LDCs to build their human and institutional capacities to improve the governance of their STI systems. Furthermore, UNESCO is also working with universities in the LDCs to establish sustainable STI policy training and research programmes that can address the lack of human expertise and institutional capacities in STI policy and innovation management, and is supporting the establishment of international inter-university networks for capacity-building in STI policy. UNESCO sponsors the International Science, Technology & Innovation Centre for South-South Cooperation (ISTIC). Created in 2008, the ISTIC is co-located with the Malaysian Academy of Science in Kuala Lumpur.

**International Telecommunications Union (ITU)**

The ITU is committed to fulfil its mandate and strive to reach its commitments under the IPoA in regard to Information Communication Technologies (ICTs). The ITU's field of actions in the implementation of the IPoA include a strong emphasis on technological innovation and technology transfer to LDCs, including development partners' commitment to provide enhanced financial and technical support.

ICTs/broadband are today a vital economic sector in their own right. They play a fundamental role in giving people voice and access to knowledge, information and education and supporting the development of new skills and employment opportunities. The ITU helps LDCs achieve their developmental goals through harnessing the power of information and communication technologies/broadband. Examples include institutional and human capacity building on various development initiatives related to ICTs, bridging the digital divide, supporting the LDCs for their graduation and smooth transition by providing concentrated and special assistance through developing telecommunication policy/legislation, roadmaps for broadband and helping countries liberalize mobile telephony markets.

**United Nations Industrial Development Organization (UNIDO)**

In 1986, UNIDO introduced the very first Investment Promotion Services, which would become the UNIDO Network of Investment and Technology Promotion Offices (ITPOs). Located in both hemispheres, the ITPOs guide potential investors from their host countries and from developing countries at each stage of the investment cycle -- from project identification through appraisal to implementation. ITPOs host officials from developing countries and economies in transition to give them hands-on training in investment promotion techniques so that delegates are able to promote portfolios of screened investment and technology opportunities from their own countries.

UNIDO has a Science, Technology and Innovation (STI) programme, which involves strengthening the innovation capabilities of developing countries, including LDCs. The program in particular focuses on strengthening a) the support infrastructure for innovation

(so called innovation systems, be it at the national, regional or sectorial levels), including the functioning of its internal linkages and efficiency and b) firms' capabilities to innovate which also involves making the right innovation choice. Knowledge and capacity to undertake such work is transferred to governments by establishing an STI Observatory and UNIDO supports the activity the first years and thereby transfers the knowledge through a learning-by-doing mechanism.

UNIDO also promotes South-South cooperation in the area of STI. UNIDO has undertaken a project to launch UNIDO South-South Industrial Cooperation (UCSSIC) Centres in some of the more advanced developing countries like India and China. These centres identify and mobilize the technical, financial, managerial, and other resources required for projects and programmes.

**The World Bank Group**

The World Bank Group has undertaken substantial research on IP issues related to developing countries. It has also provided specific advice in the form of a guidebook published in 2010 on innovation policies, which also included IPR matters pertaining emerging developing countries and LDCs.[36]

The World Bank has partnered with GÉANT and the European Union in an effort to expand national research and education networks (NRENs) across developing countries facilitating researchers with the broadband connectivity necessary to join an increasingly multipolar scientific world.

The ICT Unit of the World Bank provides support to innovation ecosystem at the request of member countries.

[36] The World Bank Group. Innovation Policy: A Guide for Developing Countries. 2010.

**Technology Facilitation Mechanism**

The Addis Ababa Action Agenda and the Post-2015 Development Agenda have decided to establish a Technology Facilitation Mechanism. The Mechanism, which will be launched at the United Nations summit for the adoption of the post-2015 development agenda in order to support the sustainable development goals, will be composed of a United Nations inter-agency task team on STI for the sustainable development goals, a collaborative multi-stakeholder forum on STI for the sustainable development goals and an online platform. The multi-stakeholder forum on STI for the sustainable development goals will be convened once a year, for a period of two days, to discuss science, technology and innovation cooperation around thematic areas for the implementation of the sustainable development goals, congregating all relevant stakeholders to actively contribute in their area of expertise. An online platform will be used to establish a comprehensive mapping of, and serve as a gateway for, information on existing STI initiatives, mechanisms and programmes, within and beyond the United Nations.

**Food and Agriculture Organization of the United Nations (FAO)**

FAO, together with WHO, implements a joint programme providing scientific advice on food safety risks (with its first meeting held over 50 years ago in the chemical risk-assessment field). It focuses on safety assessments, and risk assessment of chemical and microbiological hazards in food (e.g. food additives, veterinary drug residues, contaminants, and microbiological hazards in food). This programme is the unique provider of scientific advice to the FAO's *Codex Alimentarius* Commission and therefore directly contributes to the setting of international Codex food standards. This scientific advice is also directly available for use by member countries.

At the country level, there are many ongoing activities to improve scientific and technical capacities and generation and use of data on a range of food safety issues. Examples include the development of a global database on food consumption data - FAO/WHO GIFT (FAO/WHO Global Individual Food consumption data Tool).[37] In the context of its

[37] More information is available at http://www.fao.org/food/nutrition-assessment/foodconsumptiondatabase/en/. FAO (through the Joint FAO/IAEA Programme) supports a number of laboratory networks – e.g. RALACA (Red Analitica de Latinoamérica y el Caribe).

cooperation with the European Union, the Fisheries Department of FAO is increasingly involved in research and innovation consortia that are funded from the EU's Horizon 2020 funding instrument. In this context, FAO's role is typically the translation of the findings and results of the research and innovation projects into concrete actions and policies, especially in countries outside the European Union, as well as the facilitation of the involvement of academic and research institutions in the South in the implementation of the actions concerned.

FAO has also been involved in providing assistance in drafting legislation on plant varieties as well as issues related to IPR, food production, plant varieties and genetic resources.

**United Nations Environment Programme (UNEP)**

UNEP facilitates policymaking at the global, regional and national levels through the development of integrated assessments that provide sound science as a basis for decision-making through the Global Environment Outlook (GEO) series of reports. UNEP Live, launched in early 2014, provides a system-wide approach to keeping the environment under review and facilitates the exchange and sharing of latest data into an integrated tapestry that supports assessments of the state, trends and outlooks of the environment. The platform allows countries, researchers, communities of practice and other UNEP stakeholders to access and share data and knowledge from global, regional and national sources. Near real-time data of air quality indexes, volcanic activity, sea-level rise as well as spatial visualization of red-list species and freshwater treaties are already available. National data-sets from over 100 countries are also online. Country contributions are particularly important, as ministries, especially in LDCs and other developing countries, often hold vast and useful amounts of data that are not easily accessible.

**United Nations Framework Convention on Climate Change (UNFCCC)**

Among its many climate-related initiatives, the UNFCCC created the Least Developed Countries Fund (LDCF) to help LDCs prepare and implement national adaptation

programmes of action (NAPAs). The Global Environment Facility (GEF), as an operating entity of the Financial Mechanism of the Convention, manages the LDCF. The UNFCCC also hosts an "LDC Portal," providing links to information of specific interest to LDCs, including the work on NAPAs, the LDC work programme, the national adaptation plan (NAP) process, the work of the UNFCCC's Least Developed Countries Expert Group (LEG), databases of relevance to the LDCs, the Least Developed Countries Fund (LDCF) and other sources of funding.

**Climate Technology Centre & Network (CTCN)**

The Climate Technology Centre & Network facilitates the transfer of technologies through three core services: (i) Providing technical assistance at the request of developing countries to accelerate the transfer of climate technologies; (ii) Creating access to information and knowledge on climate technologies; and, (iii) Fostering collaboration among climate technology stakeholders via the Centre's network of regional and sectoral experts from academia, the private sector, and public and research institutions. Through these services, CTCN aims to address barriers that hinder the development and transfer of climate technologies, and to thereby help create an enabling environment for:

- Reduced greenhouse gas emissions and climate vulnerability
- Improved local innovation capacities
- Increased investments in climate technology projects

Launched in February 2013, the CTCN is administered by UNDP on behalf of UNFCCC, to which it reports. It aims to provide "tailored capacity building services to least developed countries (LDCs)." So far, the following LDCs have accessed CTCN for support: Afghanistan, Bhutan, Mali, Senegal and Uganda.

**The South-South Global Assets and Technology Exchange (SS-GATE)**

SS-GATE was set up in 2008 by the United Nations Office for South-South Cooperation (UNOSSC) to promote the identification, sharing and transfer of innovations and technologies between developing countries. Through 2014, SS-GATE has listed 7,087 new projects, matched 2,304, and successfully facilitated the transfer of 1,023 technology solutions along a South-South corridor. There are two basic components to the matchmaking system, namely: (i) a website where Southern governments, institutions and companies can list specific needs or offer goods and services; and, (ii) local facilitation and transactional support provided by SS-GATE country centres, regional hubs and the SS-GATE secretariat in Shanghai, China.

A South-South Technology Transfer Facility for least developed countries was co-launched by UNOSSC and UN-OHRLLS, in collaboration with local partners and other stakeholders, at the ministerial meeting held in Cotonou, Benin, from 28 to 31 July 2014 on "New

partnerships for productive capacity-building in least developed countries," whereby the SS-GATE global platform will be utilized.

**UN Women**

UN Women engages widely with other multilateral agencies and NGOs on a wide range of activities to encourage more women to pursue careers in science, technology, engineering and math (STEM). For example, it used this year's "Girls in ICT Day" (an ITU initiative) on 23 April 2015 to announce a new partnership with a leading NGO, Technovation, to expand young women's technological innovation around the globe. Together, UN Women and Technovation are committed to ensuring that young women are at the forefront of technology and innovation, so that their talents and interest in using technology to solve problems and unleash opportunity are not just sparked, but actively supported.

**United Nations Capital Development Fund (UNCDF)**

In 2014, UNCDF expanded Mobile Money for the Poor (MM4P) programme by increasing mobile-enabled delivery channels for financial services to serve 17.75 million active digital financial clients, representing a net increase of 11.58 million users across eight LDCs (Benin, Lao-PDR, Liberia, Malawi, Nepal, Senegal, Uganda, and Zambia). The Better than Cash Alliance (BTCA) was launched in September 2012 in response to public and private sector demand for more strategic advocacy, research and guidance on digitizing these cash payments. The Better than Cash Alliance is an alliance of governments, private sector firms, foundations and development organizations committed to accelerating the shift from cash to electronic payments.

**Enhanced Integrated Framework (EIF)**

The "Enhanced Integrated Framework for trade-related assistance for Least Developed Countries" (EIF) finances IP-related diagnostics and interventions and updates Diagnostic Trade Integration Studies (DTIS) developed by international organizations on IP-related needs. Some of these updated identified key areas for interventions related to IP that range from changes to national legislation to ensure TRIPS compliance to establishing new IP enforcement mechanisms.

**World Health Organisation (WHO)**

WHO's work on intellectual property is informed by its "Global strategy and plan of action on public health, innovation and intellectual property",[38] which was adopted by the World

[38] WHO. Global Strategy and Plan of Action on Public Health, Innovation and Intellectual Property. 2011.

Health Assembly in 2008. [39] WHO has undertaken work related to training, capacity building as well as workshops on national legislation and policy aimed at stimulating local production of pharmaceuticals in collaboration with other UN entities mainly through regional country offices. Research4Life, which is taken up later in this study, is hosted by the WHO.

**UN Regional Commissions**

*Economic Commission for Africa (ECA)*

ECA undertakes rigorous analytical policy research in various areas of STI to inform science, technology and innovation policy making on the continent. A large science and technology data bank was acquired in 2014. The data bank covers a wide range of research and development outputs from mainstream as well as emerging field subjects in pure and applied sciences, mathematics, engineering, technology and related areas. It also covers data on innovation. Policy advocacy is provided to the African Union to improve its science, technology and innovation strategic plans and enhance in its agencies (NEPAD, AOSTI) the capacity to monitor progress in science and technology development. The Climate Policy Centre provides telecommunication facilities for the collection and exchange of climate data both at country and regional levels as well as upgrading upper air and surface networks. Automated hydrological equipment and software are provided to countries to monitor their hydrology systems.

*Economic and Social Commission for Asia and the Pacific (ESCAP)*

ESCAP has five regional centres, four dealing with transferring knowledge from which countries of the region, including LDCs, benefit. The Centre for the Alleviation of Poverty through Sustainable Agriculture (CAPSA) located in Bogor, Indonesia, focuses on technologies that can support sustainable agricultural practices in member states. The Asian and Pacific Centre for Transfer of Technology (APCTT), based in New Delhi, India, focuses on capacity development based on best practices and the information that is available. The Centre in the Republic of Korea deals with ICT to reduce the digital divide between developed and developing countries through training programmes for the purposes of socio-economic development. The Centre in Beijing focuses on the mechanization of the agricultural sector.

*Economic and Social Commission for Western Asia (ESCWA)*

ESCWA has organized capacity building and training workshops in some key areas that benefitted Yemen (the sole LDC in this region), such as sustainable energy; economic and

[39] Resolution WHA61.21.

feasibility of use of solar energy; appropriate mechanisms to promote investment in renewable energy and energy efficiency projects and developing renewable energy and energy efficiency markets.

## B. Other international organizations and initiatives

**International Union for the Protection of new Varieties of Plants (UPOV)**

UPOV was established in 1961 in Paris and is currently headquartered in Geneva, Switzerland. Its goal is to provide and promote effective systems of plant variety protection.

UPOV provides legal and administrative support for international cooperation in plant variety protection and assists states with policy drafting and implementation of plant variety protection systems. It organizes workshops and training on plant variety protection and promotes the establishment of national frameworks for the protection of plant varieties.

**South Centre**

The South Centre, an intergovernmental organization comprising 52 developing countries, provides policy advice, policy analysis and capacity building and training on IP and access to knowledge to its Member States, many of which are LDCs. The South Centre's programme on Innovation and Access to Knowledge address intellectual property issues from various perspectives, including innovation and access to pharmaceutical products. It also advises developing country governments on standard-setting and legislation in relation to IP and provides analysis of the main international treaties and ongoing negotiations relating to intellectual property issues.

**World Customs Organization (WCO)**

The WCO was established in 1952 as the main intergovernmental body to enhance the effectiveness and efficiency of customs administration. It undertakes technical cooperation and capacity building projects in relation to anti-counterfeiting and anti-smuggling. Among its main functions is to enhance the cooperation between custom bodies and IP right holders. WCO has conducted a number of regional training services and diagnostic missions to several LDCs, including Burkina Faso (2011), Cambodia (2009) and Senegal (2009).

**African Regional Intellectual Property Office (ARIPO)**

ARIPO provides training on a diverse range of areas related to IP legislation and technology transfer. In 2008, ARIPO launched the Master in Intellectual Property as an effort to address the shortage of professionals in the area of intellectual property in the continent. The programme is jointly offered by WIPO and the Africa University.

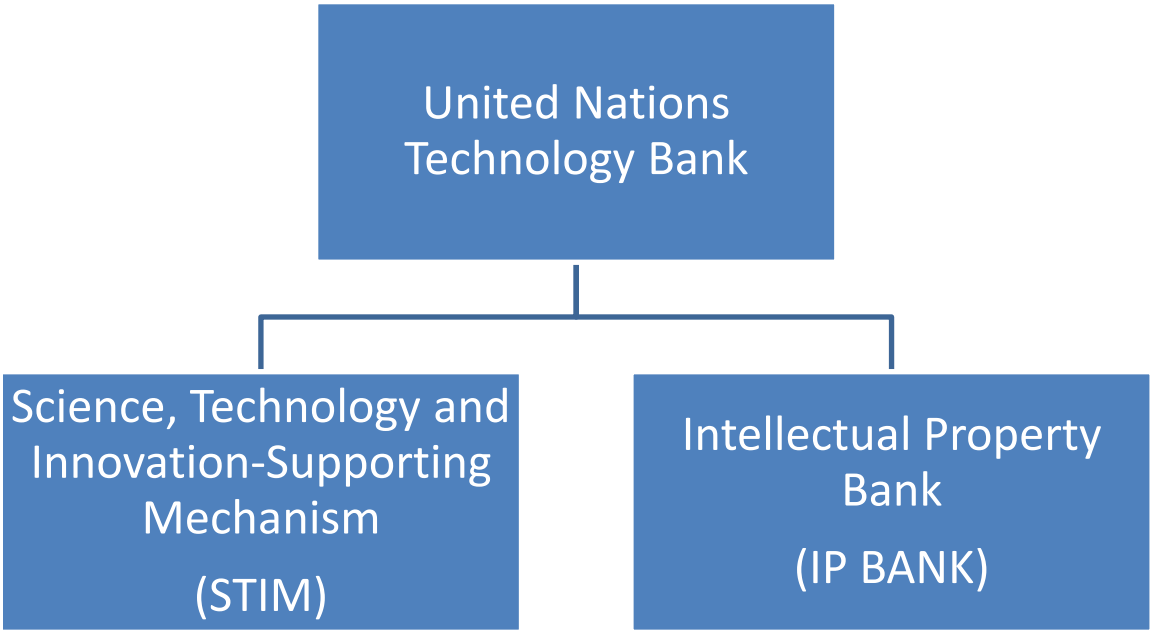
# Chapter 4: Overall Structure of the Technology Bank

Technological leapfrogging by the least developed countries warrants the speedy bridging of their technology gaps which were illustrated above through: (a) the development of an endogenous science, technology and innovation knowledge base and capacity; and (b) the transfer and diffusion of appropriate technologies. This, in turn, requires that attention is paid simultaneously to three interrelated goals: first, the facilitation of technology transfer; second, the promotion of robust, endogenous science, technology and innovation capacity-building; and third, the mobilization of strong global support.

The development of endogenous science, technology and innovation capacity includes two main elements: (a) the building of effective national science, technology and innovation policies and institutions; and (b) the substantial broadening of access for LDCs to global S&T communities and to related research conducted worldwide. To be effective, a technology facilitation mechanism should address these issues in a practical, flexible and collaborative manner that involves all relevant stakeholders.

The first meeting of the High-level Panel discussed the structure and functions of the Technology Bank taking into account the report of the Secretary-General. Based on a review of the deliberations of the meeting, it is proposed that the Technology Bank should be composed of two interrelated organizational units, namely STIM and IP Bank (see Chart 3).

**Chart 3 Organizational structure of the Technology Bank**



It is recalled that the High-level Panel recommended that the Technology Bank should evolve in a phased manner beginning with "low hanging fruits" in the initial phase. Therefore, these functions should be developed over time as the Bank gains experience and expertise. Accordingly, a number of activities are identified in Chapter 5 for the initial period of four years, which is in line with the strategic planning cycle of the UN system.[40]

## A. Science, Technology and Innovation-Supporting Mechanism

The overarching objective of the Science, Technology and Innovation-Supporting Mechanism (STIM) is to help LDCs strengthen their national STI capacities, which are essential for the development, acquisition, adaptation and absorption of technologies for sustainable development. Development-driven STI necessarily entails directed policies to create domestic innovation ecosystems that can attract outside technology, generate home-grown research, and take it to market.

Productive capacity building entails both the human capital necessary to absorb technology (absorptive capacity) and the ability to adapt technologies (adaptive capacity) to local conditions and processes. In this sense, the activities of the IP Bank and the STIM are complementary since harnessing the benefits of newly available technology is inextricably linked to the ability of local actors to absorb and integrate it into an indigenous context.

The STI mechanism should help alleviate a critical constraint for the development of the LDCs as identified by Member States in the IPoA, namely the creation of a sustainable basis for research and development that can enhance productive capacities. In this regard, national STI policies, feeding directly into national development strategies, should be a key mechanism for LDCs to set relevant priorities and objectives.

The nexus of youth, entrepreneurship, and high-tech fields is pervasive in the developed world, but equally attractive to the youth of the developing world when afforded the opportunity, especially to those recent graduates holding science, technology, engineering, and math (STEM) diplomas. Not surprisingly, most global efforts to engage such youth have focused on more-advanced "emerging market" countries, but worldwide programmes exist

[40] This document does not represent a strategic plan of the Technology Bank. Such a plan should be drawn-up in the course of operationalizing the Bank.

for LDC youth as well, such Global Entrepreneurship Week,[41] which has evolved into a year-long Global Entrepreneurship Network (GEN) in which a number of LDCs participate.[42]

Concerning women in science, the most relevant opportunity may be a partnership with the Organization for Women in Science for the Developing World (OWSD). With funding from the Swedish government (SIDA), the OWSD grants fellowships for young women postgraduates to pursue a PhD in the natural sciences at participating universities in China, Malaysia, and South Africa – a sterling example of Triangular North-South-South cooperation. More recently, the OWSD has launched *GenderInSITE* – Gender in science, innovation, technology and engineering (SITE) – as an international campaign to promote the role of women in science, innovation, technology and engineering.[43] The STIM could help OWSD raise funds and awareness with donors for LDC women in scientific, technological, and engineering disciplines. Likewise, the STIM could be an ally and advocate for the OWSD among LDC governments, research institutions, and civil-society groups.

The STIM should also foster knowledge networks and worldwide partnerships between researchers, innovators and entrepreneurs in LDCs and their global peers. It should build on existing mechanisms such as *Research4Life* (www.research4life.org), which is an innovative public-private partnership among four United Nations agencies and global publishers of online scientific, medical and technical publications. Negotiated in 2001 by the WHO with the six largest global publishers of online medical journals, their "Statement of Intent" encouraged other partners and publishing houses to join their initiative.[44] Today, the PPP includes four UN specialized agencies, two prominent U.S. universities (Yale and Cornell), and over 160 global publishers.

Currently, four UN specialized agencies take part:

- World Health Organization (WHO), with HINARI (Access to Research in Health ), since 2002;

[41] Entrepreneurship Week was conceived by former UK Prime Minister Gordon Brown, when he was Chancellor of the Exchequer (circa 2006), as a way to encourage recent high-tech and business graduates in Britain to launch their own innovative ventures. He approached the then-president of the Kauffman Foundation ("the foundation of entrepreneurship") in the USA to suggest a bilateral partnership, and in the end they took the concept global in 2007. The GEW president has said that he would welcome engagement with a UN-affiliated LDC initiative. Conversation with GEW President Jonathan Ortmans, Washington, DC, 19 August 2014.

[42] In fact, the first 18 countries to commit to a Global Entrepreneurship Week included two LDCs: Nepal and Uganda.

[43] http://genderinsite.net/.

[44] http://www.who.int/hinari/statementofintent/en/.

- Food and Agriculture Organization (FAO), with AGORA (Access to Global Online Research in Agriculture), since 2003;
- UN Environment Programme (UNEP), with OARE (Online Access to Research in the Environment), since 2006; and,
- World Intellectual Property Organization (WIPO), with ARDI (Access to Research for Development and Innovation), since 2009.

The International Association of Scientific, Technical, and Medical Publishers, the industry's leading global trade association[45], also participates. Publisher participation has gone from strength to strength[46], while Research4Life has never had a week since its launch in January 2002 when new researchers have not registered for access.

The STIM should work with National Research and Educations Networks (NRENs), which are high-speed data-communications networks that are independent of the commercial Internet and are dedicated to meeting the needs of the academic and research communities. Worldwide, 110 countries have an NREN, including 16 LDCs. NREN infrastructure allows researchers, teachers and students to share information electronically in a reliable and timely fashion and to collaborate effectively across the globe.

The existence of Regional Research and Education Networks (RRENs) in all regions of the developing world should form the basis for further interaction between the Technology Bank and those LDCs where NRENs do not yet exist. Here, the Technology Bank, together with existing activities undertaken by the European Union and the World Bank, should coordinate the support to the creation of NRENs to ensure that in the long term, scientists in all LDCs can reap the full benefit of the Technology Bank.

NRENs typically interconnect research and scientific institutions, as well as universities and tertiary education institutions within their national boundaries. Typically, the NREN provides the national backbone for the connected campuses, and then interconnect on a regional level into Regional Research and Education Network (RRENs) backbones, which, in turn, connect to each other on a global scale. In addition, NRENs provide a consistent federated approach to trust, identity and authentication infrastructure, allowing authenticated access to services such as roaming.

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[45] Headquartered in the UK and the Netherlands, STM includes over 120 members in 21 countries who each year collectively publish roughly two-thirds of all journal articles and tens of thousands of monographs and reference works. STM members include learned societies, university presses, private companies, start-ups and long-established publishers.

[46] Elsevier (Anglo-Dutch) contributed 7,000 e-books in 2011-2012, taking the Research4Life total inventory of journals, books and databases from 10,000 to 17,000. Not to be out-done, Wiley (USA) added 12,200 on-line books in 2013, raising the R4L inventory to almost 30,000 entries.

The STIM should, among other things, identify and work with existing NRENs to disseminate information and facilitate the onward communication to connected institutions, campuses and scientists. It should also actively support the roll out of Trust, Identity and Authentication Services in NRENs located in LDCs to ensure that scientists will have ready access to the services and platforms offered by the Technology Bank.

## B. Intellectual Property Bank

The overarching objective of the Intellectual Property Bank (IP Bank) is to help build LDCs' national IP capacity and facilitate technology transfer on voluntary and mutually agreed terms and conditions and, in the process accelerate LDCs' beneficial integration into the global IP system. To this end, among other functions, it should assist in the realization of the promise of technology transfer under the WTO's 1994 Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS). [47] Article 66.2 of this agreement states: "Developed country Members shall provide incentives to enterprises and institutions in their territories for the purpose of promoting and encouraging technology transfer to least-developed country Members in order to enable them to create a sound and viable technological base."[48]

Responding to LDC views that this provision had not resulted in overcoming entrenched structural and systemic gaps due to lack of capacity, early Doha Round ministerial negotiators in 2001 agreed that the WTO's TRIPS Council would "…put in place a mechanism for ensuring the monitoring and full implementation of the obligations." Thus, in 2003, the Council enacted an annual reporting requirement, with full updates required every three years.

As subsequent reports to the WTO testify, technology transfers to LDCs do occur through bilateral assistance agencies. But donor-government accounting typically is a list of diverse activities that are either incidental to specific country and regional projects, or component parts of a targeted technical objective (providing clean water, combating AIDS and malaria, eradicating crop pests, etc.) While useful, such efforts rarely constitute a coherent tech-transfer plan or purpose. Moreover, to the extent that development programs focus on STI, IP capacity and technology transfer training are typically not included or are given incidental

[47] "Technology transfer" conveys two very different, widely used, and easily confused meanings. Among Western universities and research institutions, tech transfer describes the process for facilitating the commercial application of applied science, or "lab-to-market" – as with an engineering school's business incubator. In the current context, however, it refers to the transmittal of advanced technical knowledge from developed countries to the developing world.

[48] www.wto.org/english/tratop_e/trips_e/t_agm7_e.htm.

as opposed to primary focus. Both the IP Bank and the STIM must work together to fill this gap.

Because STI is customarily incidental to broader developmental objectives, its value as a percentage of ODA is inherently difficult to quantify. Nonetheless, as has been pointed out in chapter 2, the amount of ODA to LDCs for R&D-related activities is both marginal and stagnant. Within these flows, the number of LDCs benefitting from TRIPS-related technical assistance under Article 67 of the WTO TRIPS Agreement and the number of cooperation partners providing such assistance appear to be declining rapidly (see Chart 4 and Chart 5).

**Chart 4 Number of LDC members of WTO reported as receiving TRIPS related assistance**

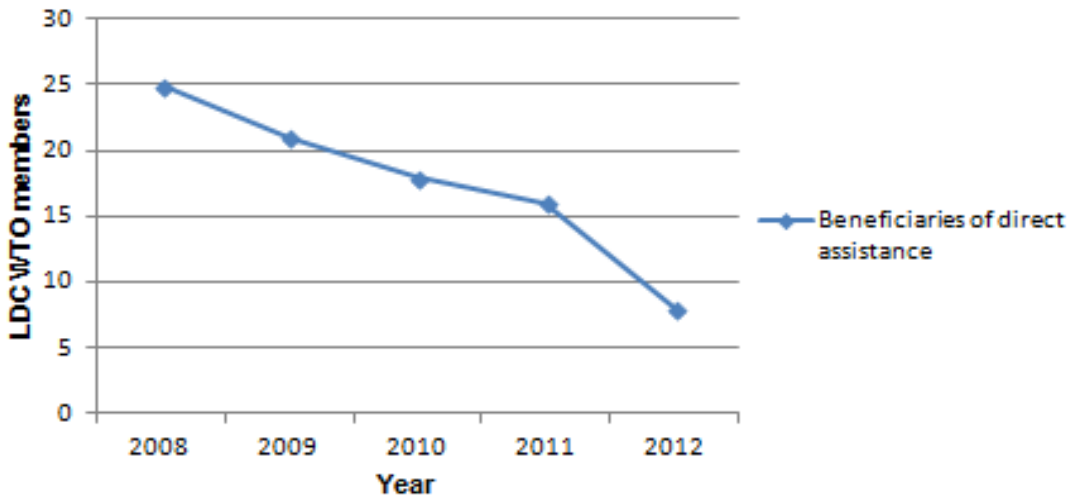
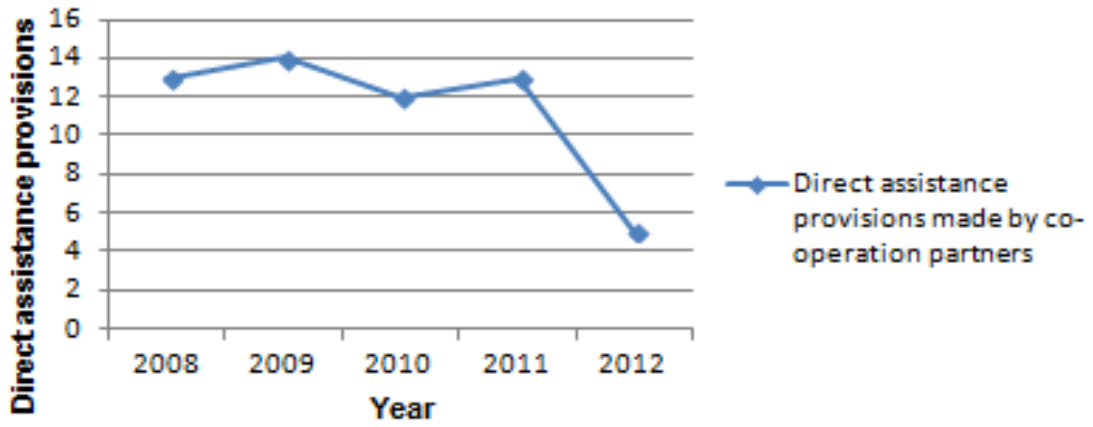



**Chart 5 Number of cooperation partners providing TRIPS related assistance**




*Source: Factual overview on technical & financial cooperation for LDCs related to the TRIPS Agreement: Identifying and responding to individual priority needs of LDCs Final Report (May 2013) https://www.wto.org/english/tratop_e/trips_e/ldc_overview_08.05.2013_full.pdf*

Thus, in 2008, 25 LDCs were reported in TRIPS Article 67 submissions as being direct beneficiaries of technical assistance. This number steadily decreased to only 8 countries in 2012. Similarly, the number of co-operation partners (developed countries and international organisations) that reported provision of direct assistance to LDC members decreased from over a dozen partners during 2008-09 to only five partners in 2012. It should be noted that none of these five partners were international organisations.[49]

Significantly, most reporting WTO Member States add the caveat that their private sectors, not their governments, are the primary drivers of technology transfer. As a recent EU TRIPS report (covering major European donor governments) observed: "In their efforts to encourage and promote technology transfer, developed country governments are usually limited by two factors: (1) they do not own the vast majority of such technologies; (2) they cannot force the private sector to transfer its technologies. Incentives can therefore only take the form of encouragement, promotion and facilitation of projects which are part of a global and comprehensive approach to development….Finally, it should be borne in mind that *no technology transfer programme is specifically dedicated to least developed countries as such*"[50](emphasis added).

The Secretary General's report to the United Nations General Assembly in 2013[51] undertook the initial responsibility to identify capacity gaps and make recommendations. That report and the subsequent review of the initial meeting of the High Level Panel confirmed the need to help LDCs fill a gap in organizational capacity to address the TRIPS structural deficiency. In light of the mandate of the HLP, the IP Bank should strive to fill this gap. The IP Bank should act as a conduit between patent holders and relevant actors in LDCs in order to facilitate access and use of appropriate technologies on affordable or concessionary terms while respecting IP rights (IPR). Among its main functions should be facilitating the protection of property rights of the former while improving access to key enabling technologies for the latter.

In doing so, the IP Bank should also bear in mind Article 67 of the TRIPS Agreement on Technical Cooperation which states the following: "In order to facilitate the implementation of this Agreement, developed country Members shall provide, on request and on mutually agreed terms and conditions, technical and financial cooperation in favour of developing and least-developed country Members. Such cooperation shall include assistance in the

[49] Factual overview on technical & financial cooperation for LDCs related to the TRIPS Agreement: Identifying and responding to individual priority needs of LDCs Final Report ( May 2013). https://www.wto.org/english/tratop_e/trips_e/ldc_overview_08.05.2013_full.pdf
[50] WTO, IP/C/W/580, 2 November 2012.
[51] A/68/217.

preparation of laws and regulations on the protection and enforcement of intellectual property rights as well as on the prevention of their abuse, and shall include support regarding the establishment or reinforcement of domestic offices and agencies relevant to these matters, including the training of personnel."

The "on request" provision means that countries that need help must ask. If an LDC must submit a request or assistance, how is it to know, in the absence of the level of sophistication in this regard, exactly what its needs are and what requests to submit? This is a void that the IP Bank should seek to fill. Secondly, the provision of assistance must be "on mutually agreed terms and conditions." The IPoA and the UN General Assembly also provide for technology transfer on the same conditions, and the IP Bank should pursue its work on this same basis.

The IP Bank should also seek to capitalize on existing pathways for technology transfer as well as create new opportunities for the dissemination of key technologies for the LDCs. These include direct transfer of protected intellectual property – as well as the know-how to implement it – to actors in LDCs, including entrepreneurs and SMEs; maximization of transfer of technical knowledge and technology adoption through FDI in LDCs; and support of IP protection in the LDCs through, inter-alia, training to IP enforcement officials and strengthening IP Offices in the LDCs.

From the LDC perspective, the IP Bank should add considerable value as a one-stop shop for coordinated support to national IP capacity building and facilitating technology transfer. From the developed-country perspective, the IP Bank can also serve as a focal point to help LDCs effectively communicate and work with the outside world. The IP Bank can upgrade communications and requests for IP technical assistance and financial cooperation. By providing more sophisticated communications coming out from LDCs, the assistance and cooperation that result will yield a more focused return on investment.

The IP Bank should facilitate a win-win dialogue and technically sophisticated allocation of resources to use IP as a tool for development and will act to instil the required capacity for participating LDCs to begin beneficial integration into the global IP system.

# Chapter 5: Activities of the Technology Bank during the Initial Phase

As noted in Chapter 1, the High-level Panel at its first meeting advised that the Technology Bank should be developed incrementally and during its initial phase focus on "low hanging fruits" with quick impact, building on existing initiatives wherever possible. In line with this, the activities of the Bank during the initial period of four years are elaborated below.

## A. Science, Technology and Innovation-Supporting Mechanism

In the initial phase, this programme should consist of two sub-programmes, namely:

(i) Digital Research Access and Networking; and
(ii) STI Policy and Capacity Building Support.

### i. Digital Research Access and Networking (DRAN)

This sub-programme should have two components: (a) Digital Access for Research Transfer and Transformation (DARTT) and (b) National Research and Educations Networks (NRENs) Facilitation.

#### a. Digital Access for Research Transfer and Transformation (DARTT)

*Background and orientation*

This programme should build on the successful Research4Life Public-Private Partnership in contemporary international development, enabling online access to costly scientific journals, books, and databases at little or no charge for more than 8,000 educational and research institutions in over 100 developing.

*Opportunities for LDCs*

Eligible LDC institutions automatically qualify for free access, as do those in many countries above the LDC threshold (e.g., Nicaragua, Nigeria, and Viet Nam). Another 39 countries (e.g., Peru, Tunisia, and Ukraine) are charged a nominal fee of $1,500 per institution per annum, and those monies are ploughed back into local capacity building. Thus, LDCs need never

worry that their eventual graduation from least-developed status will terminate this benefit.[52] The Research4Life secretariat estimates the annual value of such access at over $10 million for each participating institution.

Research4Life's most obvious attraction to STIM is that it already represents an enormously successful and fully operational PPP. Over the past thirteen years, it has grown in both size and scope to become the premier S&T knowledge-transfer mechanism for low-income countries in the developing world. Given the UNGA's original 2011 mandate that an eventual LDC STI mechanism should build "...on the existing international mechanisms,"[53] such a linkage would more than satisfy that exhortation. At the same time, Research4Life itself offers much greater promise than existing resources have permitted it to deliver. An LDC STI initiative should bring additional funding to help Research4Life unlock its full potential. Both can benefit by:

- Linking the LDC STI initiative to an existing and well-respected global brand;
- Partnership and cooperation extending across several UN agencies;
- Providing a proven partnership framework for private-sector engagement;
- Enabling higher visibility and integration with other UN initiatives across the UN system;
- Including cross-cutting activities in Research4Life;
- Expanding the Research4Life initiative to encompass all development-relevant content;
- Increasing coordination with country offices of UN agencies; and,
- Engaging with senior government officials, and national and regional universities and research councils.

Institutional users and focal points in LDCs can have stronger and more direct channels to information content and related services, and also to provide feedback on how services and content can be improved. Infrastructure and hardware installations can be improved in institutions, both by the STI supporting mechanism and by the centre's partners.

*Risks and constraints*

As impressive as Research4Life may appear, it has grown up piecemeal over the past decade – cobbled together with each participating agency committing both financial and in-kind

[52] The Istanbul Plan of Action, negotiated at the UN's decennial least-developed-countries conference (LDC-IV) in May 2011, and subsequently endorsed by the UNGA, set a goal to prepare at least half of the LDCs for graduation by 2020.
[53] UNGA, A-RES-66-213, 22 December 2011.

contributions – during an era of extremely limited funding.[54] It was not designed nor intended to possess industry-level strength and redundancy. Moreover, while its back-office practices are adequate to existing demands, they are not scalable. Thus, Research4Life's technology "backbone" cannot embrace a full-blown DARTT partnership in its current configuration. UN agency partners have expressed concern that should DARTT succeed in significantly raising LDC data-intensive downloads, the Research4Life web service would become a victim of its own success and would likely crash.

Conversely, bringing DARTT on board with a full system upgrade (and re-design where necessary) would afford Research4Life an opportunity to boost its infrastructure to commercial and enterprise-level robustness and maturity – notably, according to present-day "disaster recovery" and "business continuity" standards. On the plus side, this would include updated IT architecture and exponentially greater bandwidth required for Research4Life to match a full roll-out of National Research & Education Networks (NRENs) in the developing world.[55]

Research4Life estimates that upgrades to accommodate and maximise DARTT services could be delivered for under $2 million. Given expenditures that the existing four UN agencies have made over the past thirteen years, this would seem a modest investment by the STIM in order to buy into a fully functioning knowledge-transfer system with enormous publishing-industry assets. Most importantly, DARTT could immediately start to deliver on its promise of significantly greater access to global science and technology for its LDC clients.

*Strategy*

As envisioned by this feasibility study, Research4Life would embrace the creation of a fifth UN partner, a cross-cutting, multi-disciplinary programme tailored expressly for LDCs under DARTT. In Research4Life secretariat discussions with current agency partners, the latter expressed agreement that LDCs have the greatest need, and confront the highest barriers, to access relevant science, technology and medical information. DARTT would seek a

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[54] For example, WHO manages the secretariat and hosts all four agency Internet portals on a WHO server, with considerable assistance from that agency's IT staff. The WHO's technical "authentication" system also collects data on user logins (compiled as usage statistics by Cornell University as an in-kind contribution), while the actual registration web page is hosted in the UK and paid for by WIPO. The umbrella Research4Life website was designed by and originally hosted by UNEP. The FAO, for its part, hosts the Customer Relationship Management (CRM) system in the Microsoft "cloud," supported by a Microsoft-certified developer.

[55] GÉANT, the European-wide NREN, is helping to create high-capacity, ultra-high-speed NRENs in Africa, Southeast Asia, South Asia, and the Americas with considerable funding from the EC's external assistance arm, DG DEVCO.

correspondent librarian in every LDC, so this would also help those agencies publicize their own Research4Life offerings.[56]

The DARTT envisions a small cadre of librarians centrally based within the STIM, led by a chief librarian possessing in-depth knowledge of the global publishing industry and scholarly publishing environment and with commensurate experience in managing online science and technology information services. For at least the initial phase, a DARTT technology manager could work with the Research4Life secretariat at the WHO in Geneva, both to accelerate DARTT's integration into Research4Life and to manage upgrades of Research4Life systems to enhance service delivery to LDC users.

Once DARTT has some experience of service delivery (e.g., after its first budget biennium), it might also explore with the science, technology and medical publishers association the creation of an annual Fellowship position embedded in the STIM as an extension of the Research4Life PPP. The publishing industry could second an executive to DARTT as a Fellow, both for liaison to the global publishing industry and to help LDC institutions better utilize publisher offerings under the Research4Life PPP. The Fellow's employer would pay salary and benefits, while the STIM could cover local costs.[57]

DARTT and Research4Life could also approach governments and foundations to seek their support for the secondment of appropriately skilled university librarians for a sabbatical term or year to help expand DARTT's outreach and training. Longer-term, it would be equally worthwhile for LDC librarians to spend a fellowship term or year with DARTT, both to build indigenous LDC capacities but also to provide feedback to those at the STI mechanism delivering services to LDCs.

Progressively (eventually reaching every LDC), DARTT and Research4Life would seek to identify a correspondent librarian to help publicize Research4Life availability, coach users in appropriate search techniques, and coordinate general training courses and seminars aimed at helping researchers and educators realize the importance of access to scientific and technical information. Such an arrangement should deliver the fastest and most relevant uptake of DARTT services. Typically, such "Country Focal Points" would be enlisted from a local university that appreciates the reciprocal benefit of contributing staff time to Research4Life outreach. DARTT would fund all local expenses, and could offer a stipend to

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[56] Of the four participating agencies, only the WHO has a country office in every LDC.

[57] The U.S. government created a similar programme, the Jefferson Science Fellows, in 2003. Tenured university professors from science and engineering faculties spend a year at the U.S. Department of State or with the U.S. Agency for International Development (USAID). Their universities pay full salaries and benefits, while the government covers per diem living expenses and official travel.

reflect the librarian's additional workload. Acting as an in-country reference point, such an individual could also help leverage local expertise to support a broad range of activities.

*Activities in the initial phase*

Every review undertaken or commissioned by Research4Life has concluded that a great deal more advocacy is required in eligible countries.[58] This includes institutions that still do not know about Research4Life's programmes, as well as those that have registered but have yet to access the content. Even where institutions have signed on, not every relevant faculty has registered its interest. Still, the fact that Research4Life has been able to reach so many institutions – driven primarily by grass-roots demand and sustained over more than a decade – testifies to the importance national governments and eligible institutions place on accessible research information. Concerted advocacy and publicity focussed on LDCs should draw many more institutions into the Research4Life and DARTT orbit.

Likewise, Research4Life surveys consistently reveal an unmet desire for considerably more familiarization and training, institutionally and individually. Users routinely express frustration at not being able to find what they are looking for, and a wish to exploit Research4Life more effectively.

In fact, users need to learn how to navigate the complex ways that S&T is organized online in order to obtain their best search results. But Research4Life is not currently funded to provide relevant guidance to all users. Moreover, while eligible researchers can make free use of extraordinarily powerful S&T search engines, Research4Life has not been able to afford systematic instruction on how to use them.[59] As a result, LDC researchers still tend to rely on the Internet's more popular, but considerably less capable, search engines.

DARTT could adopt a phased approach, beginning with countries where Research4Life has particularly strong local champions (e.g., Bangladesh, Mozambique, Nepal, Senegal, Tanzania, and Uganda). These initial focal points could act as mentors as more country focal points are added – eventually becoming regional and/or subject/language specialized hubs for South-South support to other LDCs. Special emphasis needs to be placed on

[58] Likewise, the High Level Panel's review of National Research & Education Network (NREN) ICT and IP programmes demonstrated that advocacy across the full spectrum of the proposed LDC initiative must feature prominently and should be coordinated.

[59] Elsevier offers LDC researchers gratis use of its proprietary search engine, *SciVerse Scopus*, whose underlying algorithms are infinitely more powerful than those found on the regular Internet. Moreover, with *SciVerse Scopus*, researchers can obtain highly targeted access to peer-reviewed literature of some 20,000 titles from 5,000 publishers. Collectively, it totals more than 41 million records. But Research4Life has little funding to instruct researchers how to employ it most effectively.

francophone and lusophone environments, where many LDCs are located and which Research4Life recognizes have been underserved.[60]

All four UN agency partners of Research4Life have developed training modules, in consultation with each other, so that these are largely interchangeable.[61] Collectively, they have expended considerable effort to produce a range of training materials and have organized many training workshops. Due to insufficient funding, however, they have been unable to field a systematic and sustained approach to training. DARTT, with adequately funded focal points in each LDC and advised by the four specialized agencies, could fill that gap by offering coordinated training programmes attuned to the specific needs of each country.

Each Research4Life agency has its own Help Desk. Without duplicating their efforts, a STIM Help Desk could operate as a common reference point, directing researchers to the most appropriate agency assistance, but also fielding and coordinating queries that cut across multiple disciplines.

Participating publishers, in order to preserve the integrity of their copyrighted material, insist that eligible users must access Research4Life offerings through each publisher's web site. Backed by the STIM, in-country focal points could help LDC researchers learn to plumb the individual publishing house libraries, both for knowledge gathering but also to ensure that their own scholarly writings (and, eventually, patent applications) comprehensively cite other research.[62] Liaising with in-country focal points, STIM could also offer instruction and guidance on writing for peer-reviewed science and engineering journals.

As noted above, the possibility of DARTT membership in Research4Life was raised at the latter's annual General Partners Meeting as well as its Executive Council in Geneva in July 2015 and the partners (notably, the publishers whose online content would be accessed under this PPP extension) were reassured that the organizational structure proposed above – with librarians in charge of DARTT in Istanbul, and the strong interweaving of DARTT with Research4Life's secretariat at the WHO through staff secondments – would provide necessary professional and copyright safeguards and enable DARTT to begin operating

[60] English is the *lingua franca* of global science journals, but Research4Life offers access to many journals in other languages.

[61] Commendably, the four specialized agencies have also structured their portals to share similar arrangements and functionality. Once users have mastered one portal, they can access all four.

[62] A hallmark of peer-reviewed journal articles is that they are replete with citations of related research, a pre-condition to claiming that their own contributions are seminal. Without such citations, LDC authors cannot garner credibility however original their insight or discoveries might be.

quickly and effectively. Once DARTT is ready to "go live," it can apply for full programme membership within the Research4Life PPP.[63]

**b. National Research and Educations Network (NREN) Facilitation**

*Background and orientation*

As noted above, National Research and Educations Networks (NRENs) are high-speed data-communications networks that are independent of the commercial Internet and are dedicated to meeting the needs of academic and research communities. As the scientific community pushes the boundaries of our knowledge, researchers rely on dedicated data communications networks to provide greater speeds, timely delivery, seamless global reach and a very high level of resilience. This is what NRENs deliver.

A recent paper posited that a reduction in the current isolation of Africa-based researchers from the global information infrastructure will lead to increased intellectual property output.[64] While the report only set a base-line, and comparative data is not yet available, it is equally visible to the insider that through the creation of the regional UbuntuNet network in Africa – as the regional research and education networks (RREN) for South and East Africa – has already led to improved scientific exchange between researchers connected to existing NRENs in Southern and Eastern Africa and their counterparts both in Europe and the U.S., Asia, as well as Brazil.

There are successful examples of NREN creation in LDCs under difficult conditions. A case in point is that of Zambia, which is both an LDC and a landlocked developing country (LLDC). The development of the Zambian NREN over the past nine years shows how the typical obstacles of institutions in these countries can be successfully overcome through national and international leadership and collaboration.

For scientists across LCDs to actively participate and draw benefit from the Technology Bank, they will need to have affordable access to data communications infrastructure nationally, regionally and globally. In the majority of countries across the globe this access to data communications infrastructure is provided to scientists through the hierarchy of Campus Network, NREN, RREN and global interconnections. Collaboration with NRENs can support the Technology Bank at the following levels:

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[63] Significantly, the Research4Life Executive Council's conditional approval means that the Technology Bank will not have to wait until the next General Partner's meeting in July 2016 to secure its approval.

[64] "The Impact of Improved Access and Connectivity on Intellectual Property Output: Baseline Report," UbuntuNet CEO Francis F Tusubira et al, UbuntuNet Alliance annual conference, 2011 http://www.ubuntunet.net/sites/default/files/tusubira.pdf.

- Dedicated and interconnected data communications capacity;
- Authentication of users through federated identity services offered seamlessly by NRENs;
- Strong RRENs in the developing world made to "spread the word" about the Technology Bank to scientists, even in LDCs where NRENs do not yet exist; and,
- Community and established human relationships between NRENs and scientists in the respective country.

As stated above, NRENs offer direct, dedicated data communications infrastructure on a national scale, interconnected regionally as well as globally. Building on this NREN infrastructure, the Technology Bank should be able to deliver immediate data communications connectivity to the scientists it means to reach.

In addition, NRENs offer federated identity management (FIM) to its connected institutions, allowing for authenticated access to services. While this is mainly the case in NRENs throughout the developed world, there are many NRENs in LDCs in the process of or planning to establish a federated identity organisation. Such federated identity, if implemented also on the side of the Technology Bank, will ensure that the Technology Bank services can be used by users authenticated in the home institution and university where they are based.

The NREN organization in a country is in direct contractual and collaborative contact with its connected universities and institutions, and thus in a position to act as a bridge between the Technology bank and scientists in the field. The direct human relationships NRENs across the world have with scientists connected via the NREN will allow the Technology Bank to directly disseminate its information to the end user its wants to reach.

*Opportunities for LDCs*

Of the 48 LDCs, nine LDCs have fully established and globally interconnected NRENs, an additional seven have NRENs that are organizationally set up but not yet fully operational or globally interconnected, and another three LDCs are currently in the process of creating NRENs.

In those LDCs where an NREN is in existence, the Technology Bank will be able to have an immediate impact, in that existing NREN connectivity and access can facilitate the delivery of services offered by the Technology Bank. In addition, the Technology Bank can use existing NRENs and their direct contact with the scientific community of their country for the dissemination of Technology Bank information.

In the case of LDCs where the NREN is established but not yet fully operational or globally interconnected, the Technology Bank can support the development of the NREN through

advocacy with governments and their regulators, allowing for the extra push that is often needed to get an NREN fully interconnected globally.

Where an NREN development is not yet in place, the Technology Bank should work in concert with existing efforts from the World Bank and European Commission towards the creation of NRENs, following established blue-prints.

*Risks and Constraints*

As noted above, the Technology Bank should be able to bring immediate positive benefits to those LDCs where NRENs are established and interconnected globally. Typically, these are also the NRENs that are at this moment engaging in the creation of a national federation of identity, which will allow the seamless authentication of Technology Bank-provided services.

Constraints are evident in those countries where an NREN is established on paper, but has so far not yet been able to actually deliver capacity services nationally or internationally. The reasons for the lack of connectivity vary from country to country, and include unaffordable national or international data-communications capacity pricing, heavily regulated markets, weak ICT policies on a national level or implementation thereof, a lack of engineering capacity, etc. The EC-funded projects have attempted to address these issues in the countries where they operate, albeit with varying success, often depending on the presence or absence of local champions.

The last group of LDCs is that in which there is no effort towards the creation of NRENs at all. Here, universities and research institutions are working in complete isolation and continue to be further and further cut off from the ICT developments and advancements in the rest of the developed as well as developing world. It will be necessary to identify champions in these countries and provide continuous dedicated support to the creation of NRENs. This support will have to be organizational, financial and technical. Adequate funding and dedicated expert and consultancy support will be necessary to ensure that these countries make sufficient progress.

The risk of doing nothing for the LDCs is, however, not just a problem which the Technology Bank might face. Today, when technological innovation at all levels of society is driven through access to data-communications, those LDCs which have a general Internet penetration of less than 50% of their population are losing out daily. They are the world's "digital have-nots". Any government and any international organization need to recognize that data-communication infrastructure is no longer a "nice to have", but an absolute necessity for the development of any country.

*Activities in the initial phase*

In keeping with the overall strategic approach of the Technology Bank to develop its activities in an incremental manner, the Bank should work initially with the NRENs already existing in the LDCs to:

- Identify and work with NRENs already established in LDCs, disseminate information to NRENs in LDCs on Technology Bank's services and allow onward communication to connected institutions, campuses and scientists;
- Actively carry out gap analyses of existing national infrastructure, and support the NREN build-out through interaction and advocacy with national governments and regulators – which should be done in collaboration with the World Bank, in such countries where the World Bank is already active or has plans;[65]
- Actively support the roll out of Trust and Identity and Authentication Services in NRENs located in LDCs, to ensure that scientists will have easy access to the services and platforms offered by the Technology Bank;
- Actively support the creation of NRENs in LDCs. This will require active engagement with government and regulatory bodies to ensure that reliable data communications capacity reaches the countries, as well as close coordination with already existing activities funded through the European Union (GÉANT) and the World Bank;
- Ensure that the Technology Bank itself is seamlessly connected to the global NREN fabric through interconnection agreements at the point of physical presence of the Bank (e.g., Istanbul) and its server locations.

**ii. STI Policy and Capacity Building (SPCB)**

*Background and orientation*

Science, technology and innovation are key instruments for the socio-economic transformation of LDCs. However, as has been indicated earlier, these countries share a common deficit in that their science, technology and innovation (STI) capacities lag substantially behind those of the more-advanced developing countries that are closing the gap with leading-edge economies. The STI Policy and Capacity Building Programme (SPCB) can play an important role in bridging these gaps by providing policymaking and capacity-building support.

[65] In the EC/World Bank partnership, the Bank works to establish national (NREN) entities, while the EC (through GÉANT) helps create the associated regional (RREN) alliance.

At the initial stage, by creatively building on existing initiatives, especially those undertaken by Member States, UN-system organizations, academia, and non-governmental and non-profit entities, the STIM can commence across a wide range of capacity-building.

The SPCB is premised on the notion that virtually every LDC possesses world-class scientists and technologists, but usually too few to coalesce around a common discipline. In any event, the contemporary challenges which LDCs confront (climate change, environmental challenges, food insecurity, water scarcity, public-health issues, energy, communications, transport and logistics, etc.) are typically multi-sectoral and do not lend themselves to solutions from a single expertise. Thus, a fundamental objective of the SPCB would be to help craft what has been termed "collaborative innovation networks"[66] which enable LDC scientists and technologists to connect and collaborate with their global STI peers.

*Opportunities for LDCs*

The scientific world has become "...increasingly interconnected, with international collaboration on the rise...an increasingly multipolar world in which the distribution of scientific activity is concentrated in a number of widely dispersed hubs."[67] This seismic shift benefits LDC researchers who have disproportionally more to gain from collaborating with their peers, whether in a neighbouring country or around the globe.

The role of National Research and Educations Networks (NRENs) is vital. This connectivity has created opportunities for global collaboration that were unimaginable for LDCs just a decade ago. While many LDCs remain to be NREN-connected, requisite undersea fibre-optic cables fully encircle Africa, and reach down to Bangladesh from Asia.[68] The STIM presupposes that at the initial phase of its operation there will be adequate connectivity with the LDCs it intends to serve.

As noted above, the EC and World Bank are funding regional and country-specific NRENs in Africa, led by GÉANT, the European NREN. Similarly, the Research4Life PPP affords LDC researchers everywhere the opportunity to stay abreast of contemporary scientific

[66] A term coined by the Global Knowledge Initiative (GKI), arising from its research funded by the World Bank and the Rockefeller Foundation. http://www.globalknowledgeinitiative.org/programs/index.html.
[67] "Knowledge, networks and nations: Global scientific collaboration in the 21st century," The Royal Society, London, March 2011, p. 6.
https://royalsociety.org/~/media/Royal_Society_Content/policy/publications/2011/4294976134.pdf
[68] None of the LDCs in Southeast Asia are yet connected; but current regional NREN planning includes them all.

literature, accessing the world's leading (and very expensive) online S&T publications at no charge.[69]

While STI programmes for the developing world are only now beginning to gain traction in the broader multilateral arena, and remain relatively obscure among most bilateral development agencies, NGOs and academically focused institutions have pioneered this field for decades. Collaboration with such institutions should help the Technology Bank to enhance and expand STI service delivery to LDCs.

Foremost among these is "The World Academy of Sciences for the advancement of science in developing countries" (TWAS, 1983), housed at the Abdus Salam International Centre for Theoretical Physics (ICTP, 1964) in Trieste, Italy. Similarly, the independent Organization for Women in Science in the Developing World (OWSD, 1993) operates out of TWAS offices, as does the Inter Academy Partnership (IAP, 1993), the global consortium of more than 100 science academies worldwide.[70] TWAS, the ICTP and the OWSD provide numerous research grants, PhD programmes, and post-doctoral fellowships – all of which afford special attention to LDCs.

Similarly, the Carnegie Corporation of New York has funded long-standing efforts to raise academic science capacities in Africa, while the U.S. National Academy of Sciences and the German National Academy of Sciences Leopoldina are working to help create and empower more national science academies in Africa. Likewise, The Royal Society (UK), the Royal Netherlands Academy of Arts and Sciences, The Royal Swedish Academy of Sciences, and The French Academy of Sciences have supported development projects with the Network of African Science Academies (NASAC), as well as with individual academies.

Given the global and collaborative nature of contemporary STI, the ideal LDC knowledge network will be Triangular: North-South-South. That said, there is also a special attraction to South-South linkages in that more advanced economies of the global South display a level of development to which LDCs might reasonably aspire (from "frontier markets" to "emerging markets"). Moreover, the obstacles that these more advanced economies have overcome are the same ones that LDCs face today. South-South cooperation, including bilateral, regional and interregional initiatives will be an important aspect of STIM activities. To that end, it will leverage existing South-South cooperation arrangements at different levels.

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[69] NREN connectivity is not required to access Research4Life; but the latter's ease of use and utility is greatly enhanced via a high-bandwidth research pipe.

[70] The Italian government funds the IAP secretariat, but the latter is staffed by and operates from TWAS. The current IAP co-chairs are the immediate past president of the German Academy of Sciences and the immediate past Executive Director of TWAS (Prof. Mohamed Hassan).

An exemplar is the TWAS South-South PhD and post-doctoral fellowship programme. TWAS helps early-career Fellows gain education and experience at top science institutions in the global South, especially in Brazil and China. TWAS currently has over 460 PhD fellowships with 12 partners in seven countries, and over 150 postdoctoral fellowships with 15 partners in eight countries – all of them in the global South. Special attention is devoted to those countries most lagging in S&T advancement, typically LDCs.

Finally, expatriate science communities remain an "untapped resource" for the developing world.[71] Not only do LDCs produce fewer S&T-qualified professionals than the developing world at large, their "brain drain" is far more pronounced.[72] Thus, it is imperative that this diaspora debit be converted into an asset.

*Risks and constraints*

STI limitations among LDCs collectively are severe and well-documented. Unfortunately, very few baseline studies exist of individual countries. Both UNCTAD and UNESCO produce comprehensive and well-regarded Science, Technology and Innovation Policy (STIP) reviews. But funding constraints have seriously limited their production to no more than one or two a year for the entire world. Over the past fifteen years, STIP reviews of only five LDCs have been carried out. This calls for a speedy scaling up of national STIP strategy papers with commensurate funding in collaboration with UNCTAD and UNESCO.

LDC governments for their part routinely acknowledge that their STI funding is insufficient, but competing budget priorities almost always deflect well-intentioned efforts to remediate this shortcoming. Most LDC government science budgets barely cover salaries and institutional running costs, let alone research grants. Likewise, tertiary education involving high-cost STI and engineering programmes remains problematical for most LDC universities, despite considerable efforts to the contrary.[73]

More fundamentally, a culture celebrating STI advances need to be mainstreamed in many LDCs. Most LDCs do not host independent academies of science – among the most valuable indigenous allies to advance a greater appreciation of STI as essential to accelerated economic development, and to ably advise their governments accordingly. Concerted donor

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[71] "Knowledge, networks and nations," Royal Society, p. 107.

[72] Nearly twice as many professionals emigrate from LDCs (18.4%) as from other developing countries (10%), according to the UN Least Developed Countries Report 2012. http://unctad.org/en/PublicationsLibrary/ldc2012_en.pdf, p.92.

[73] For example, the Carnegie Corporation of New York allocated $15 million to the African Regional Initiative in Science and Education (RISE) from 2008, and many LDC institutions benefitted. But its third grant of US$5 million (2014-2016) is its last under this programme.

efforts to establish national academies in Africa have been remarkably effective where targeted – but few African LDCs have been identified for such assistance.[74] Among LDCs outside Africa, science academies are found in Afghanistan, Bangladesh, and Nepal.

While LDC expatriates are numerous, connecting with any STI diaspora has proven especially difficult for most countries. These expatriate communities need to be tapped, and the specific lack of data on the flow and migration of talented scientists and their diaspora networks should be properly addressed.[75]

Meanwhile, NREN connectivity, while much advanced over a just a few years ago, remains problematical for most LDCs, especially those that are also landlocked and thus lack direct access to undersea communications cables enjoyed by their coastal neighbours.[76] Moreover, LDCs of the Pacific Ocean are particularly disadvantaged as none have a sufficiently large market to attract commercial providers. And even those littoral countries which have direct access to submarine cables typically are challenged in getting this broadband connectivity into their research campuses, especially those situated inland.

*Strategy*

The SPCB will partner with LDCs and their partner countries in the North and the South, UN-system organizations and international non-governmental and non-profit organizations already working in the STI arena, while helping to bolster their counterpart institutions in LDCs.

Top-down government intervention, while still important (especially if well-funded), does not align with the fact that "International science is largely conducted through bottom-up, informal connections, as scientists become more mobile....seeking to work with the best people, institutions and equipment which complement their research, wherever they may be....Yet little is understood about the dynamics of networking and the mobility of scientists, how these affect global science and how best to harness these networks to catalyse international collaboration."[77]

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[74] The Gates Foundation funded a $20 million, decade-long African Science Academy Development Initiative (ASADI) undertaken primarily by the U.S. National Academies (NAS). From around ten academies at ASADI's launch in 2004, it had raised that total to over 20 when the initiative concluded in early 2015. But only two of the new African academies are in LDCs – Benin and Burkina Faso.

[75] "Knowledge, networks and nations," Royal Society, p. 107.

[76] Nevertheless, two of the most robust LDC NRENS are found in Nepal and Zambia, illustrating that with imagination and corresponding leadership this geographic hurdle can be overcome.

[77] "Knowledge, networks and nations," Royal Society, p. 6.

Thus, the SPCB should be operating at the leading edge of international STI capacity building. While necessary to coordinate SPCB activities with those of other bilateral and multilateral initiatives, there is also merit for the SPCB to collaborate with those international NGOs and non-profit organizations whose proven capacity-building skills could help the SPCB bridge its own capacity gap.

Enabled with expanding NREN connectivity, one of the most valuable functions of the SPCB should be to help LDCs assemble collaborative innovation networks, attracting problem-solvers from government, academia, the private sector, and civil society to work as a team. This should be a core competency of the SPCB. It could reach across multilateral organizations, bilateral donors, and LDC governments and institutions to help forge dynamic global knowledge networks. Locating needed resources and being able to recruit and mobilize them will be paramount.

Partnering with existing institutional actors, this also presupposes that the SPCB should be an active and sustaining participant, and not just a one-time "match-maker." Given that any SPCB-supported knowledge partnership will span borders and continents, it should also operate as a knowledge-network manager. Adroit handling of widely dispersed knowledge collaborations is essential to keeping them on track, and can make the difference between an expensive, inefficient group of disconnected actors and one that innovates strategically, efficiently, and as a coherent unit.[78]

In addition to the "Triangular" North-South-South cooperation, the SPCB should also actively leverage South-South cooperation. To this end, SPCB will cooperate with the South-South Global Assets and Technology Exchange (SS-GATE) in the context of the South-South Technology Transfer Facility for LDCs, which was launched at the ministerial meeting of LDCs held in Cotonou, Benin in July 2014. It should also liaise with entities such as the UNESCO-sponsored International Science, Technology and Innovation Centre for South-South Cooperation (ISTIC) in Kuala Lumpur. Created in 2008, the ISTIC is co-located with the Malaysian Academy of Science. The aim will be to mainstream South-South sensitivity into the work programme of the SPCB.

Impactful technical assistance is often effectively and economically delivered in a regional setting. A "start-up" STIM should make use of regional approach, moreover, in order to link LDC researchers with neighbouring and global peers. Thus, while individual LDCs might be chosen to pilot an STI capacity and policy programme, the actual delivery of assistance could embrace a regional approach whenever possible.

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[78] http://globalknowledgeinitiative.org/pdf/gki_top_10_tools_for_collaborative_innovation.pdf.

The SPCB should collaborate in the advocacy and outreach efforts of the Technology Bank.[79] This would publicize the initiative's launch, informing STI communities in the developed and developing world alike that the Technology Bank is "open for business" and ready to assist.

*Activities in the initial phase*

1. Scaling up STI policy and strategy papers

In order to formulate an appropriate assistance programme, the SPCB would require baseline STI reviews for every LDC. Rapidly scaling up national STI strategy papers should be an immediate priority for the STIM. Realistically, however, this effort will need to start with a group of pilot countries in the initial stage. This will be done in partnership with UNCTAD and UNESCO building on their well-regarded Science, Technology and Innovation Policy (STIP) reviews. As noted before, neither of these is sufficiently funded to assume this extra burden unaided, so the Technology Bank will need to raise funds accordingly. An integral part of the process of preparing the STI strategy papers would be to organize national stakeholder conferences with a view to maximizing the engagement and contribution of the relevant actors and thereby genuine national ownership.

2. Collaborative networking with institutional partners

Establishing collaborative linkages to pertinent institutional actors should be a first-order of business for a SPCB. None of these institutions need reminding that their LDC counterparts require special attention in the realm of STI – many recognize that function in their mandates and mission statements – but by working closely with them the SPCB could help focus assistance accordingly. This would necessitate learning what assistance might be available, how each LDC has set its STI priorities, and how best to facilitate requisite connections. In that sense, the SPCB would play a comprehensive and active liaison role.

3. Supporting Academy of Sciences

Now that more African LDCs academies of science exist, the SPCB can usefully help publicize their ability to inform and advise government development strategies. To that end, it should work with entities such as the InterAcademy Partnership (IAP), the global consortium of science academies based at The World Academy of Sciences (TWAS) in Trieste.

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[79] TWAS and the IAP in Trieste share a four-person Public Information Office, which seems an appropriate template.

Likewise, the SPCB should liaise with the IAP to see what might be done to increase the number and influence of science academies in other LDCs. Haiti lacks an academy, and there are none among the LDCs of Southeast Asia. As noted above, the LDCs in the Pacific Ocean present a special challenge, and could forge a regional academy, as has been done in the Caribbean. Again, the STIM could collaborate with the IAP to this end. It would be useful to promote and strengthen regional networks of the academies of science. The number of young academies of science is rising and there should be strong linkage between the young academies of science and the senior academies. In addition, the academies of science in LDCs need to have a role in their national development policies.

4. STI capacity building of tertiary-level institutions

STI capacity building of tertiary-level institutions, while beyond the institutional skill-set or likely funding ability of the SPCB, should nonetheless remain an objective it supports and for which it advocates. A number of LDC institutions have already benefitted from the Carnegie Corporation's African Regional Initiative in Science and Education (RISE),[80] and the SPCB should actively scan the donor horizon to ensure that pertinent LDC institutions are considered for inclusion in such initiatives, helping donors and potential recipients alike identify synergistic linkages.

5. Training LDCs' researchers in preparing grant proposals

Most LDC scientists, like their developed-world peers, could benefit from learning how to master the grant-writing and application process. [81] This might become in time a valuable service that the SPCB could provide. In the initial phase it could develop an online training module and deliver it to LDC researchers in close cooperation with relevant organizations.

6. Supporting research collaboration

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[80] LDC beneficiaries include Eduardo Mondlane University (Mozambique); Makerere University (Uganda); Sokoine University of Agriculture (Tanzania); Tea Research Foundation of Central Africa (Malawi); University of Dar es Salaam; University of Malawi; and, the Western Indian Ocean Regional Initiative in Marine Science (Zanzibar, Tanzania).

[81] Most leading research universities in Europe and North America conduct courses in grant writing for their faculties. Overburdened LDC academics, even if they learn how, will still be challenged to find time for the grant-application process. The STIM could help them narrow the search for promising and otherwise overlooked funding streams, and arrange for their applications to be critiqued before submission.

Similarly, in coordination with Research4Life document searches, the SPCB could help LDC researchers find like-minded collaborators and, by extension, co-authors when they seek to publish their own research findings. The SPCB could also arrange instruction and guidance on writing for peer-reviewed science and engineering journals, which could be delivered with other institutions such as *AuthorAID* which was launched in 2013 as a sub-set of the UK-based NGO, INASP to help developing world scientists write for S&T journals. [82]

7. Patenting research findings

Working with the IP Bank, the SPCB will also advise LDC authors on when and how to file for a patent, prior to theır public disclosure of their research findings. As noted earlier, many developing-world principal investigators (PIs) appear not to appreciate that their research, once published, is the public domain and no longer patentable. Traditional IP training would entail provision to train academic innovators to understand why and how they can file for protection. LDCs are very rich in traditional knowledge and also enjoy the benefits of geographical indications in many products, and the Technology Bank can support them in getting benefit out of this situation.

The SPCB should be able to advise and if necessary provide negotiating support to participating LDC institutions, which generally lack sufficient legal resources, before entering into collaborative research with other institutions.[83] The SPCB should provide this service from the outset, given its fundamental objective of creating regional and global partnerships, which lends itself to online delivery. It is also a potential opportunity for DARTT and Research4Life to work with publishers to gain access to their extensive collections of expired and current patents, patent applications, and patent search tools and to have training for stakeholders to facilitate more robust knowledge transfer.

A STIM should also alert would-be authors that there has been an unfortunate rise in bogus on-line S&T journals that solicit contributions from unsuspecting scholars, especially those in the developing world. Obviously, any journal associated with Research4Life is legitimate; but it is difficult to know them all, especially when they must be accessed through each

[82] INASP also created Africa Journals Online (AJOL, based in South Africa) in 1997 to publicise the research of African academics. While not confined to science, engineering or medicine, these disciplines dominate its publishing field. AJOL funding comes primarily from the UK (DFID) and Norway (NORAD), but with additional support from the Ford Foundation and the Danish Ministry of Foreign Affairs. www.ajol.info. AuthorAid is currently funded by the UK and Sweden www.authoraid.info.

[83] Virtually every research agreement in the developed world includes an IP annex governing new findings that might be generated under mutual collaboration. But most researchers do not attempt to understand the complexity of Intellectual Property Rights (IPR), relying instead on their university or corporate legal departments to safeguard their IP.

publisher's individual web site. Acting as a one-stop shop and reference point for country focal points, an STI help desk could also act as a filter to verify the *bona fides* of any publication.

8. Diaspora outreach

Regarding diaspora outreach, a priority action should be to determine ways of capturing relevant information.[84] The SPCB should collaborate with relevant institutions with a view to establishing a diaspora STI information base, which will serve as the initial step in the creation of an LDC Diaspora STI Network.

## B. Intellectual Property Bank

*Background and orientation*

Over the past two decades since the acceptance of the 1994 TRIPS Agreement as part of the global IP system, both developed and least-developed countries have struggled to use the existing framework of TRIPS Articles 66.2 and 67 (technical assistance) without demonstrable success, as noted earlier. The IP Bank will endeavour to fill this gap through its initial activities to help LDCs help themselves. The existing interface between developed and least-developed countries has suffered from inadequate communication and lack of coordinated planning for utilization of available assistance and cooperation and the identification of gaps to be filled with rational policy support.

This can be resolved with the simple structural solution of enabling the IP Bank as a sophisticated intermediary to develop capacity in absorption, adaptation, human capital, formation of innovation and financial ecosystems, promotion of technology transfer, foreign direct investment (FDI), and science, technology and innovation (STI). In support of these goals, policymakers must bear in mind a number of considerations.

First, technology transfer according to North-North norms can be harnessed by LDCs via IP Bank training and support. In this regard, there must first be strong research universities and government laboratories to draw from, and these organizations must be well-funded to conduct their research – either from existing budgets or from additional support. The other

[84] "Knowledge, networks and nations," Royal Society, p. 107.

two main activities of the Technology Bank will support creation of additional scientific research. Technology transfer (e.g., university and public licensing like the Bayh-Dole act in the USA) will enable LDCs to harness scientific research.

Technology-transfer efforts should be supported not only by governments, but also by public research organizations, by individual researchers, and by the private sector. All are key participants in the technology-transfer ecosystem, and the goals surrounding technology transfer must be aligned along the needs of these participants.

Technology transfer is an incremental, long-term concept, and the benefits of effective technology transfer will be realized accordingly. It takes time to train and create the organizational and human capital necessary for effective technology transfer in government and public research organizations. Thus, a longer-term strategy and the steadfast pursuit of it are the cornerstones of success. Moreover, most new technologies take 4-10 years of further development before they can be integrated into a commercial application. As such, a lag between the actual transference of new technologies and their integration into an LDC economy will need to be envisaged.

To facilitate endogenous innovation as well as technology transfer, intellectual property rights (IPR) must be clearly delineated, and no unnecessary barriers to license these rights should be imposed. Inappropriate or excessive delays due to the process by which technologies are licensed or otherwise made available can impede research partnerships, licensing arrangements and innovation.

Technology transfer is more than just licensing technology – it is an on-going exercise that improves the interconnectedness of the innovation system. Thus, a technology-transfer policy should facilitate rapid private-sector adoption of technologies transferred to LDCs from abroad, as well as those developed by public research and educational organizations in LDCs.[85]

In fact, few countries have mastered the task of employing IP as an economic tool. The rest of the world, including resource-rich developing countries, is beginning to grapple with this reality, and adopt measures accordingly. The vast majority of LDCs lag far behind in this effort. As the experience of even the most robust developing countries demonstrates, even financial and policy commitments do not immediately bear fruit.

Help is available from a variety of sources, but accessing the latter has proven difficult for LDCs. No wonder then that otherwise promising initiatives have failed to overcome the

[85] Other Technology Bank activities, including enhanced Research4Life access, improved NREN connectivity, and robust STI support should enable LDC scientists and technologists over time to generate their own IP.

structural impediments faced by LDCs. A key immediate task of the IP Bank will be to act as a single point-of-contact representing LDC interests, and help catalyze a sound and viable technology base.

*Opportunities for LDCs*

By providing a one-stop shop for coordinated national IP capacity building and facilitating technology transfers, the IP Bank will generate immediate value to LDCs. Its overriding objective will be to help these countries substantially scale up their growth and sustainable development and thus their positive integration into the globalized world economy and international trade. There is no institutional multilateral arrangement for comprehensively assisting LDCs in this area. The IP Bank, by helping develop requisite capacities, will respond to a long-felt critical need.

As indicated above, the efforts by the LDCs and the developed countries to use the existing framework of WTO TRIPS Agreement paragraphs 66.2 and 67 has failed to yield demonstrable success. The IP Bank will endeavour to change this as a sophisticated intermediary between the developed and developing world.

*Risks and constraints*

The IP Bank will face two primary types of risk: internal organizational competency and integration into the global IP system. The organizational risk comes from the fact that the Technology Bank and its components will constitute a new organization. This generic concern is heightened due to the number of complex tasks necessary to bring it into being and integrate it in the global IP system: working with participating LDCs to assist in developing internal capacities and strategies, formulating particularized programs of actions, sourcing education and training from existing sources and modifying these for each LDC, developing linkages with the global IP system's many participants, and developing the internal capacity to work on the many complex IP subject areas necessary to accomplish these tasks.

The Technology Bank can address these tasks through focus on administration, governance, transparency, and accountability. The IP Bank should also reach out to existing IP system participants and ask for assistance as a natural part of the initial pilot phase that will be experimental in nature. As part of the experimentation process, the IP Bank should

encourage participation by a broad spectrum of stakeholders to ensure widespread consensus on its eventual success.

*Strategy*

The IP Bank is a development tool that should facilitate building IP-related domestic capacities, including the use of transferred patented-IP to LDCs. It should act as a conduit between IP holders and relevant actors in the LDCs to facilitate access and use of appropriate IPR covering desired technologies. Among its main functions should be facilitating access to key enabling technologies to the latter while respecting the property rights of the former.

The IP Bank should also seek to capitalize on existing pathways for technology transfer as well as create new opportunities for the dissemination of key technologies. These are direct transfers of protected intellectual property – as well as the know-how to implement it – to actors in LDCs, including entrepreneurs and SMEs; maximization of transfer of technical knowledge and technology adoption through Foreign Direct Investment (FDI) including supporting LDCs in complex contract negotiations; support of IP protection in the LDCs; and, training to IP enforcement officials as well as strengthening IP Offices in the LDCs.[86]

Aggregates of IP grants are increasingly used as a measure to gauge the wealth and potential prosperity of individuals, entities and nations. While some nations (public and private sector R&D and other stakeholder entities) currently develop, hold and protect extensive IP portfolios, other nations have not fully realized the benefits associated with well-conceived patent systems. In particular, the LDCs have yet to build the underlying legal and technological structures and facilities necessary to stimulate their intellectual property development and economic growth via the protections and benefits offered through the patenting channel. The IP Bank will provide concrete support in this regard.

The IP Bank, in addition to connecting with LDCs and with the global IP system, must also find a way to foster foundation and private sector engagement to drive continual innovation. To this end, it should establish an effective forum involving key stakeholders from LDCs and the partner countries.

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[86] It is recognized that LDCs' human, institutional and financial capacities in IP management and protection are seriously limited. See, Nurun N. Rahman "Cost of Adapting Intellectual Property Laws and Institutional Arrangements to TRIPS Provisions", in UNCTAD (1994) Trade and Development Report 1994 (Supplement) http://unctad.org/en/PublicationsLibrary/tdr14Supplement_en.pdf.

As noted above, the overarching objective of the IP Bank is to assist LDCs to beneficially integrate into the global IP system. It should seek to do so by engendering a virtuous interaction between IP rights holders from developed countries and LDCs that desire to break free from decades of structural barriers that prevent their development to the point where they can graduate and obtain full inclusion and standing in the global trade system and provide for the needs of their citizens. Investing in helping LDCs begin to serve as a new frontier of innovation, collaboratively working with IP owners to modify existing technology to create new markets for existing products and new products for existing markets -- the two sources of high return-on-investment (ROI) growth – will yield disproportionately positive results.

To this end, the IP Bank should focus on the development and use of IP for socio-economic transformation of the LDCs, including enhancing STI ecosystem knowledge, capacity building in absorption and adaptation, and domestic uses of technology within participating LDCs. In doing so, it should take into account the issues of market imperfections, market failures and missing markets.

The IP Bank should support negotiated agreements with terms by providing forms and expertise (directly or indirectly via volunteers) to LDC participants. It should ensure that participants work together and that their respective interests are reconciled, including those of LDCs and IP rights holders. It will be entirely voluntary and use conventional licensing of existing or expired patents and know-how and other knowledge (such as access to training, manuals, supply chain for purchase or donation of parts, etc.)

It is recognized that technology owners already negotiate transfer based on market conditions related to the user's ability to pay. This is illustrated, for example, by pricing of pharmaceuticals with a tiered structure. Where LDCs do not have the ability to pay market rates, this should be understood to be exactly the area where IP Bank's activities should be directed and a common ground found to voluntarily reach agreement with structured deals to allow technology transfer to take place. Recognizing that LDCs must gain familiarity with IP in general and the use and protection of IP in particular, and that dispute resolution arising from technology transfer can be both complex and costly, the IP Bank should include an informal forum for arbitration to resolve disputes using existing norms and practices.

Since the IP Bank is expected to grow incrementally and LDC capacity is expected to also grow accordingly, there are some sophisticated issues that will not be covered in the initial stage such as engaging in patent pools, standards-essential patents (SEPs), or fair, reasonable and non-discriminatory (FRAND) licensing.

*Activities of IP Bank in the initial phase*

The initial activities of the IP Bank must start with recognition that, while the IP Bank is intended to scale up capacity to LDCs, the IP Bank itself will be a start-up in its initial phase. To prevent overreach, the IP Bank during the initial four years must be geared toward accomplishing goals that are fundamental to LDC capacity and that do not require a level of sophistication outside the capabilities or absorption of a start-up organization. Fortunately, there is a generous amount of IP-related technical assistance capacity in existing mechanisms upon which the IP Bank can build, especially in its role as a dedicated instrument for coordinating these initiatives, programs, and activities. This coordination is the only way to ensure maximization of benefits to LDCs from the existing IP-related programmes, with the added value of eliminating duplication and overlap, while engendering complementarities.

The IP Bank should therefore develop coherent integrated strategies that are particularly tailored to the specific needs of each LDC participant. These are all geared toward developing a sound and viable knowledge and technology base that will enable at least half of the 48 LDC countries to graduate from LDC status by 2020 in a manner that is respectful of existing IP rights and integrative into the existing global IP ecosystem.

Key goals are acting to ensure that relevant IP technical assistance is provided to a number of pilot LDCs to: (i) foster LDC capacity to absorb existing IP rights, (ii) facilitate the negotiation of the transfer of these rights consistent with the background provided above and the principles enumerated below, and (iii) help LDCs develop a robust adaptive capacity to initially secure rights derived from use of existing technologies protected by patents, trade secrets, and other commercial means for protecting existing technology in collaboration with entities capable of helping LDC inventors/creators to protect their adaptations.

While the initial phase activities are intended to help LDC participants develop absorption and adaptation capacity, interim activities should be based on an LDC's capacity to engage in more sophisticated IP activities that are more closely integrated with transactions involving projects with developed country partners. These will reflect a phase of development where those LDCs have begun to display robust IP, finance, and human-capital ecosystems that characterize developing country attempts to modernize. In the longer-term, the IP Bank should strive to help LDCs graduate with full implementation of best-in-class capacity like those countries that currently benefit from the use of IP in all phases of its life cycle.

1. Technology Needs Assessment and TRIPs Priority Needs

*a. Needs Assessment*

The IP Bank should assist in facilitating national technology assessments as a distinct part of the STI Policy (STIP) reviews and requisite economic analyses to be prepared under the STIM as indicated above. Building on the results of and lessons from the needs assessments already conducted by the LDCs in the context of the WTO TRIPS Council, this activity should result in the identification of priority technologies for each LDC. Moreover, it should formulate specific requests/proposals for technology-transfer support which will be voluntarily negotiated and structured, taking into account the need to maximize benefits to the LDCs and to incentivize the IP owner to undertake transfer of the identified technology. Key actions in the initial stage should include support to LDCs in:

- Identification of the core area of focus, including those mentioned by the first meeting of the High-level Panel: public health (life sciences), agriculture, sustainable energy (including solar and bio-fuels), information and communication technology (ICT), and preparation of specific proposals for assistance. ODA programs already focus on some of these areas.
- Identification and phasing out of obsolete or weak R&D infrastructure. Unlike many other areas of activity, this will require private-sector incentives. The IP Bank will provide a much needed platform to coordinate with existing capacity building programmes to improve access of LDCs and initiate new programmes.
- Collaboration with LDCs and the existing providers of capacity-building support to ensure that the selection criteria to identify technologies is directed to maximize the spill over benefits to the LDCs. Identified technologies will be voluntarily negotiated and structured, taking into account the benefits to the LDCs and the need to incentivize the IP owner to transfer the identified technology.

*b. TRIPS priority needs*

The IP Bank should also provide expertise to interface with donor countries and international organizations to articulate LDC priority needs, prepare proposals, and communicate with providers of the IP-related support through four main activities of the IP Bank during the initial phase:

- Supporting the identification of LDC priority needs;

- Providing assistance to LDCs with submissions of these needs to the WTO TRIPS Council;
- Coordinating with a multitude of existing interested IP Technology Assistance Providers;
- Determining what these priority needs are results from the four initial activities above; and,
- Assisting LDCs with related financial and business functions necessary to develop projects.

2. Information Access to Support Research, Development, and Demonstration

The IP Bank should closely coordinate with the STIM and Research4Life to assist LDC researchers and innovators in universities and public entities as well as private-sector technology entrepreneurs to have access to information on technology as well as technical and financial assistance in using such information. Many of the most developed patent offices also provide patent information for free, as do the publishers participating in the Technology Bank. One example of existing capacity is WIPO's Technology and Innovation Support Centres (TISC) that provide access to local, high-quality technology information. WIPO provides assistance in patent search and landscape reports. Having access to these types of complicated documents is necessary but not sufficient.

The IP Bank should:

- Provide added value by helping LDC stakeholder access and use free patent information. This is a critical source for identifying existing technologies and requires best-in-class search skills that must be provided to LDCs. This capacity involves both search and, where necessary, translation.
- Assist LDCs in technology scouting, identification and review of available technical information, and support in identifying patent owners and, more importantly, companies with commercially available technical solutions.
- Establish linkages with national, regional and global IP organizations to enhance communication and provision of services to LDCs in the initial phase for all LDCs.
- Serve as a conduit to connect with existing sources of networks where R&D begins to form new inventions and new companies. Other potential partners include accelerators, incubators, science and technology parks, specialized research institutions and other centres of knowledge and excellence, and programmatic interests of major donor foundations such as the Bill and Melinda Gates Foundation. This will require the IP Bank staff to identify and reach out to these organizations to develop necessary linkages for providing assistance to all LDCs;

- Use existing knowledge-sharing platforms for initial use including, for example, the Technology Facilitation Mechanism established by the Yhird International Conference of Financing for Development, held in July 2015, which is a collaborative multi-stakeholder forum that will establish a comprehensive mapping of, and serve as a gateway for, information on existing STI initiatives, mechanisms and programmes, gaps and sharing of best practices within and beyond the United Nations;
- Make use of existing partnering mechanisms, especially online portals that provide access to public private partnership resources;
- Coordinate with STIM activities to conduct education and training of government, business, university and other stakeholders on various forms of IP and fundamentals of technology transfer.

3. Traditional IP Technical Assistance

The IP Bank should begin with providing LDCs with capacity building in the following areas traditionally recognized in the provision of IP Technical Assistance: policy formulation; legal framework, IP administration and enforcements; and IP as a development tool. The IP Bank should focus substantial activities on the five main areas of IP technical assistance: policy framework, legal framework, administration, enforcement and regulation regime, and promoting of innovation, creativity and technology transfer. It should link-up with other ongoing processes that may provide information on IP-related priority technical assistance needs to improve IP TA provision. It is important for the LDCs to put in place strong competition legislation consistent with international best practices that support the proper use of IP. As previously noted, there is currently no technology transfer programme specifically dedicated to LDCs, which has impeded the provision of IP related technical assistance. The Technology Bank will add considerable value in scaling up such assistance by providing a dedicated and coordinated arrangement in this regard.

In the initial phase, the IP Bank will serve as a coordinated mechanism for information sharing and for developing and coordinating access to technical and financial cooperation between the LDCs and the providers of IP-related capacity building assistance in the following areas:

- Provide technical advice on preparing and upgrading existing laws and drafting of new laws, strengthening human and institutional capacities and enhancing implementation and enforcement;
- Support modernization of IP administration in terms of digital search, examination, publication, and recording of ownership; and,

- Enhance the institutional infrastructure and triple-helix of government-university-industry and overall societal support for the role of STI and IP as a tool for economic growth.

4. Supporting IP Rights Acquisition and Technology Transfer

In the initial period, extending the IP Bank's activities beyond basic technology-transfer support may prove to be too complex and burdensome. That does not mean that LDCs will wait indefinitely until the IP bank develops its own capacity to participate in more complex activities.

With that in mind, the IP Bank should initially undertake the following activities:

- Develop a program for attorneys to provide pro-bono support for LDCs in regard to complex contract negotiation towards obtaining patents and negotiate licenses. This could be modelled along the WIPO-WEF Inventor Assistance Program. The IP Bank should also develop model technology-transfer agreements and build on the WIPO-WEF model for attorneys to provide pro-bono licensing for LDCs.
- Develop the expertise to advise and guide both technology owners and LDCs. Over time, higher levels of sophistication will be warranted, and the IP Bank should develop appropriate strategies and activities under the authorization of its governing mechanism.

5. Private-Sector Engagement

As stressed above, effective engagement of the private sector will be vital to the success of the IP Bank in particular, and the Technology Bank in general. To that end, consideration should be given to establishing a programme to focus private-sector involvement in LDCs along the lines of the Trans-Atlantic Business Council and the Trans-Atlantic Business Dialogue (TABD).[87] The TABD was created in response to the formation of the EU and was intended to provide a CEO-driven official dialogue between U.S. and European business leaders (Chairman and CEO) and U.S. cabinet secretaries and EU commissioners. Working groups organized by theme and sector allowed for dialogue between CEOs from both

[87] http://www.transatlanticbusiness.org/about-us/history-mission/.

regions and between CEOs and relevant government ministers. This dialogue structure has stood the test of time and is recognized for its utility in facilitating business-to-business and business-to-government collaboration.

It is proposed that the IP Bank establish a North-South-LDCs version of the TABD under a "High Growth Potential Countries Dialogue" to signify the opportunities that LDCs present in terms of growth potential as new markets for investment, collaboration, and innovation. STI and opportunities to create win-win projects will be at the centre of the dialogue process. It is increasingly recognized that the LDCs represent the final frontier for untapped growth on the planet ("frontier markets" to "emerging markets"), and this activity will help realize the potentials of the LDCs which will be beneficial not only to these countries but also to the rest of the world. Facilitating private-sector engagement will also positively impact the other functions of the Technology Bank.

# Chapter 6: Institutional matters: Governance, Staffing, Cost Estimates, Funding and Financial Arrangements

## A. Background

UNGA resolution A/RES/68/224 requested the High-level Panel to also consider the governance arrangements of the Technology Bank and its institutional linkages with the United Nations. The High-level Panel, at its first meeting, considered these matters and recognized the need for a multi-stakeholder arrangement. The delivery of activities proposed in this feasibility study will warrant the involvement of a variety of stakeholders, thereby justifying a multi-stakeholder governance mechanism.

It is also recalled that the above UNGA resolution also provided that the Technology Bank would be based on voluntary resources.

During the discussions, the governance arrangements of the following voluntary resource-based UN entities with multi-stakeholder governance arrangements came up: the UN University (UNU), the UN Global Compact (UNGC) and Sustainable Energy for All (SE4ALL). A brief account of the main aspects of the governance and reporting arrangements of these entities is provided below, followed by recommendations to the Panel.

## B. Comparative analysis of governing arrangements of selected UN entities

*United Nations University*

The United Nations General Assembly (UNGA) decided to establish The United Nations University (UNU) under the auspices of the United Nations on December 1972 [Res 2951 (XXVII)], after receiving a feasibility study conducted by a panel of experts. It is an autonomous organ of the UNGA, based in Tokyo, and enjoys the privileges and immunities provided in Articles 104 and 105 of the Charter of the United Nations.

The governance structure of UNU is composed by a Council, that serves as the governing body of the University; a Rector, who reports to the Council for the direction, administration, programming and coordination of the university; and a university Centre that supports the Rector in programming, coordination, support, administration and financing of the overall University programme.

The Council is composed of twelve members serving in their individual capacity, who are appointed jointly by the United Nations Secretary-General and the Director-General of UNESCO, in consultation with the agencies and programmes concerned.

The United Nations Secretary-General, the Director-General of UNESCO and the Executive Director of the UN Institute for Training and Research (UNITAR) are *ex officio* members. The Council members are appointed for a non-renewable term of six years. Besides adopting internal rules of procedures and electing its Chairman, the Council also takes into consideration matters pertaining to oversight of finance and resource mobilization, reviews the effectiveness of operations, sets the criteria for those institutions that wish to be associated with the University and is responsible for granting adequate resources to ensure the highest standards for research and training.

The Rector is appointed by the United Nations Secretary-General upon the recommendation of a Nominating Committee of a maximum of five people, to which the United Nations Secretary-General and the Director-General of UNESCO appoint one member each. The Rector serves for five years and is eligible for reappointment for one more term. Conditions of the service of the Rector are determined by the United Nations Secretary-General.

The Rector is responsible inter-alia for the direction, organization and administration of the University, including preparing the plan of work and the budget estimates to be submitted to the Council; directs the activities related to the University's programme of work and appoints the personnel of the University in accordance with provisions established on its Charter.

*United Nations Global Compact*

The United Nations Global Compact (UNGC) was launched in June 2000 at UN Headquarters by the United Nations Secretary-General[88]. Its governance framework in its current form was established on August 2005. [89]

The UNGC is overseen by a Board appointed and chaired by the United Nations Secretary-General. The Board is composed by High-level members of Government, private sector, international labor and business organizations and civil society. Potential candidates to the board are researched by the Global Compact Office and sent to a Nominations Committee established by the United Nations Secretary-General.

The Board provides strategic advice and guidance to the UNGC, advocates its principles and goals and undertakes other activities as decided by the Board itself. While there is no direct reporting line between the Global Compact Office and the Board (non-UN entities cannot

[88] UN News. Executive Summary and Conclusion of High-Level Meeting on Global Compact http://www.un.org/press/en/2000/20000727.sg2065.doc.html (Retrieved on 12 August 2015).
[89] UN Global Compact. "Our Governance" https://www.unglobalcompact.org/about/governance (Retrieved on 12 August 2015).

supervise UN entities), in practice the Global Compact Office responds efficiently to the Board's requests and acts as a secretariat for consensus decisions.

The Global Compact Office reports to the United Nations Secretary-General through the Executive Office of the Secretary General. Both the Executive-Director of the Global Compact Office and the Chair of the Foundation for the Global Compact have an *ex officio* seat on the Global Compact Board.

The Global Compact Government Group (GCGG) constitutes the vehicle that facilitates the participation of governments in the initiative. It was established in 2008 and revised in 2013.

*Sustainable Energy for All*

Sustainable Energy for All (SE4ALL), launched in 2011, is an initiative of the United Nations Secretary-General that promotes partnerships between governments, business and civil society to promote energy access and to foster sustainable generation of energy. [90]

The Executive Committee nominates the CEO of the SE4ALL and the United Nations Secretary-General appoints him/her as the Special Representative for Sustainable Energy for All . SE4ALL operates with an Advisory Board, co-chaired by the United Nations Secretary-General and the President of the World Bank Group and it includes high-profile members of governments, the business community and civil society. The Advisory Board provides strategic guidance and its members serve as global ambassadors to the initiative.

SE4ALL also includes an Executive Committee, at present headed by the current Chairman of the Board of the Bank of America. The Executive Committee provides operational oversight to the initiative and is supported by a Global Facilitation Team. The Executive Committee is responsible for delivering a strategy and work-plan and is composed of high-Level personalities from government, the private sector and civil society. It reports to the co-chairs of the Advisory-Board.

## C. Suggested governance and related arrangements

The following table provides a comparative picture of the governance arrangements of the three entities. There are similarities among these entities except for the fact that the UNU was established by the UNGA. This is particularly important since the Technology Bank is also an initiative arising from the UNGA. The UNU shares key aspects of the other two

[90] Sustainable Energy for All. "About Us". http://www.se4all.org/about-us/ (Retrieved on 12 August 2015).

entities in that all of them are voluntarily funded, have multi-stakeholder governance mechanisms, and executive heads appointed by the United Nations Secretary-General.

**Table 2 Comparing key aspects of governance arrangements of UNU, UNGC and SE4ALL**

| Entity | Established by | Voluntary Funded | Multi-stakeholder governance structure | Appointing Authority of the Executive Head |
|---|---|---|---|---|
| **UNU** | UNGA | Yes | Yes | UNSG |
| **UNGC** | UNSG | Yes | Yes | UNSG |
| **SE4ALL** | UNSG | Yes | Yes | UNSG |

In light of the above, it is suggested that the governance and reporting aspects of Technology Bank should be modeled on those of the UNU. It is noted that finalization of detailed arrangements would need to be done during the operationalization phase of the Bank in consultations with the relevant departments of the United Nations.

### i. Organization

If modeled on the UNU, the Technology Bank, to be headquartered in Turkey could consist of (See organigram in Chart 6):

(a) A Governing Council with twelve members including a representatıve of the host country, and a representatıve of the Secretary-General of the United Nations as an ex-officio member, with the following functions:

- Formulate principles and policies governing the activities and operations of the Technology Bank;
- Adopt such statutes and recommendations as may be necessary for the smooth and effective functioning of the Bank;
- Consider and approve the work programme and adopt the budget of the Bank on the basis of proposals submitted to it by the Managing Director;
- Consider reports of the Managing Director on the activities of the Bank and on the execution of its plans of work;
- Report regularly to the General Assembly, through the Secretary-General of the United Nations, on the work of the Technology Bank; and,
- Create such subsidiary bodies as it deems necessary.

(b) A Managing Director, appointed by the United Nations Secretary-General and responsible to the Council for the direction, administration, programming and coordination of the Technology Bank with, inter alia, the following functions:

- Submit the plan of work and the budget estimates of the Bank to the Council for its consideration and approval;
- Direct the activities connected with the execution of the work programme and authorize the expenditures provided in the budget approved by the Council;
- Appoint the personnel of the Bank following procedures approved by the Council;
- Direct the staff of the Bank;
- Make arrangements with governments and national and international public, private and non-governmental organizations with a view to offering and receiving services related to the activities of the Bank;
- After consultation with the Chairman of the Council, accept voluntary contributions and gifts to the Bank from governments, international and national organizations, foundations and other non-governmental sources, for all purposes related to the activities of the Technology Bank;
- Coordinate the work programme of the Bank with the activities of the United Nations and its agencies and, in so far as possible, with the global science and the STI and IP communities.

(c) A Science, Technology and Innovation-Supporting Mechanism (STIM), an Intellectual Property Bank (IP Bank), and a Management Support, Partnerships and Coordination Unit, with staff responsible to the Managing Director;

(d) Two regional centres of the Bank that could be established in accordance with the UNGA resolution A/RES/68/224 with the concurrence of the Council of the Technology Bank.

**ii. Personnel of the Technology Bank**

The staff of the Technology Bank would be selected with a view to achieving its stated objectives. The basic criteria for selection would be the highest standards of efficiency, competence and integrity, with due regard to appropriate representation in terms of geography, social systems, cultural traditions, and gender.

The personnel of the Bank could consist of: (a) Managing Director; (b) Professional and general service personnel; (c) Short-term staff and Consultants; and (d) Trainees.

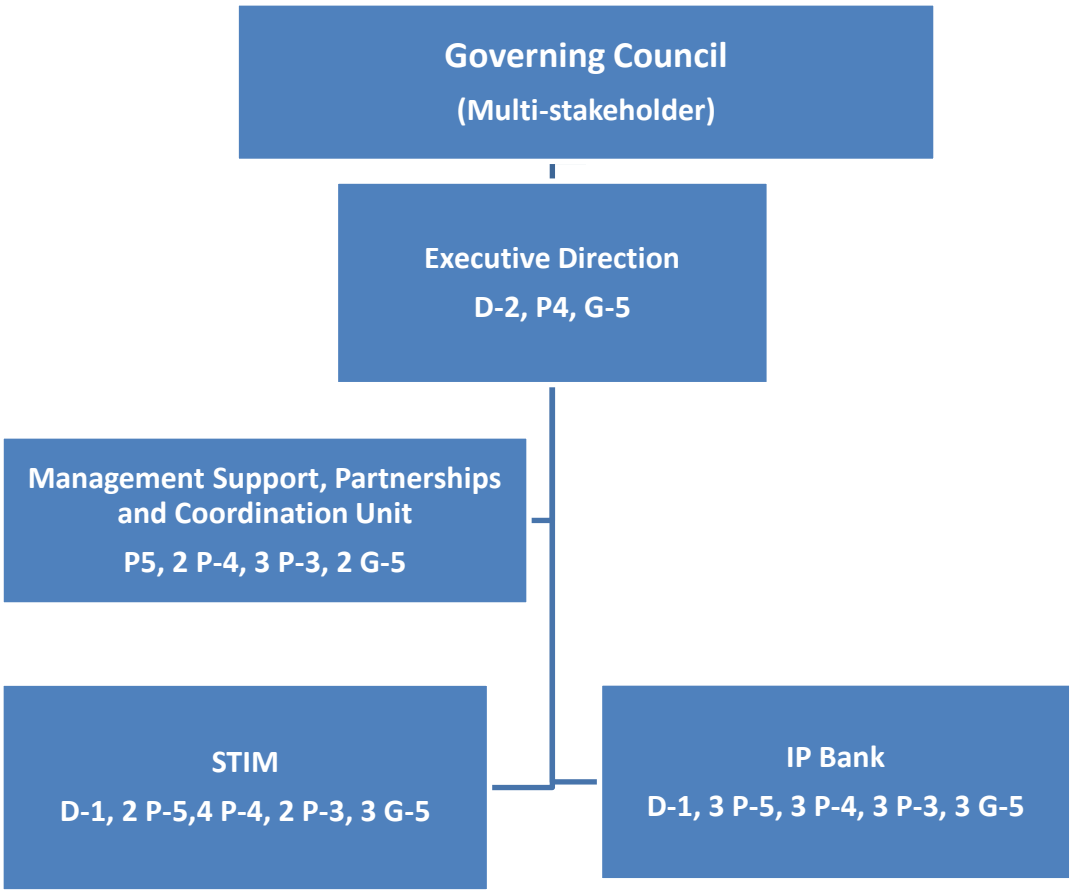
As with UNU's arrangements, the Managing Director, and internationally recruited staff could be covered by the provisions of the Staff Regulations and Staff Rules of the United Nations.

**a. Staffing arrangement**

The main consideration for articulating the staffing structure of the Technology Bank is to maximize programme delivery with greatest efficiency and set a good foundation for the future based on evaluation of its work on a continuing basis. Considering the dynamic nature of technology and the diverse needs of the LDCs, a prudent balance should be struck between core staff and personnel on short-term contracts bringing specific knowledge and expertise. Within core staff, the emphasis should be on programme delivery rather than management overhead. The Bank should also use the best available technologies in programme development and delivery. These were among the main considerations in proposing the staffing arrangement of the Bank and the costs estimates for the first biennium (2016-17).

The proposed cost estimates primarily include staff and non-staff costs but do not include infrastructure support, including the provision of physical facilities (space, computers, technology support, etc.) and servicing thereof, which expected to be reviewed in the context of the host country agreement

**Chart 6 Organigramme of the Technology Bank**




***Executive Direction***

The executive direction of the technology bank is headed by the Managing Director of the Technology Bank, who is appointed by the United Nations Secretary-General at the level of Director (D2).

| Number and Levels of Staff | Areas of functioning |
|---|---|
| 1 D-2, 1 P-4, 1 G-5 | • Functions of the Managing Director have been elaborated above<br>• Other functions will include coordination of the provision of substantive support to work of the Managing Director and coordination with stakeholders, including in the UN system |

***Science, Technology and Innovation Mechanism (STIM)***

Under the delegated authority of the Managing Director, the STIM will be supervised by a Director with the following staffing and areas of function:

| Number and Levels of Staff | Areas of functioning |
|---|---|
| 1 D-1, 1 G-5 | • Overall supervision and management of the STIM<br>• Lead the development of the strategic plan for the STIM in line with the overall strategic framework of the Technology Bank<br>• Identify opportunities, approaches and modalities and prepare programme strategies and plans in harmony with national priorities, capacities and interests of the LDCs<br>• Monitor and oversee programmes to ensure delivery of quality results, timely and appropriate reporting<br>• Oversee the implementation of initiatives, programmes and projects of STIM |
| Digital Research Access and Networking (DRAN)<br><br>1 P-5, 2 P-4, 1 P-3, 1 G-5 | • Coordinate of the implementation of technical assistance and advisory support activities provided at the national and regional level for governments, regional energy organizations and other stakeholders<br>• Engage with governments, regional organizations, the private sector, and other relevant stakeholders in matters pertaining the activities of the Mechanism<br>• Facilitate consultations with stakeholders from the STI Community in the LDCs as well as other Member States<br>• Work with Research4Life to boost its infrastructure<br>• Assist in the mobilization of a small cadre of librarians centrally based within the STIM and identify correspondent librarians in LDCs to help publicize Research4Life availability<br>• Train users in appropriate search techniques, and coordinating general training courses and seminars<br>• Identify local champions in LDCs to act as mentors for building their capacities to help LDC researchers learn to utilize the individual publishing house libraries |

| | |
|---|---|
| | • Liaise with in-country focal points to offer instruction and guidance on writing for peer-reviewed science and engineering journals<br>• Carry out gap analyses of existing national infrastructure, and support the NREN build-out through interaction and advocacy with national governments and regulators<br>• Work with existing RRENs (UbuntuNet Alliance, WACREN, RedCLARA, TEIN*CC, ASREN and CKLN) to ensure that information on the Technology Bank reaches LDCs<br>• Ensure long term donor cooperation and commitments to funding for NRENs in the developing world<br>• Ensure that the Technology Bank server sites are fully interconnected to the NREN in which they are located<br>• Engage with the global NREN community, particularly the developed NRENs |
| STIM<br><br>1 P-5, 2 p-4, 1 p-3, 1 G-5 | • Scale up STI policy and strategy papers in partnership with the UNCTAD and UNESCO<br>• Establish collaborative linkages to pertinent institutional actors supporting Academy of Sciences STI capacity building of tertiary-level institutions<br>• Train LDCs' researchers in preparing grant proposals<br>• Support research collaboration to find like-minded collaborators and to arrange instruction and guidance on writing for peer-reviewed science and engineering journals<br>• Patent research findings by supporting LDC authors on when and how to file for a patent before publishing their research findings<br>• Collaborate with relevant institutions with a view to establish a diaspora STI information base with a view to creating an LDC Diaspora STI Network |

***The Intellectual Property Bank***

Under the delegated authority of the Managing Director, the IP Bank will be supervised by a Director with the following staffing and areas of function:

| Number and Levels of Staff | Areas of functioning |
|---|---|
| 1 D-1, 1 G-5 | • Overall supervision and management of the IP Bank<br>• Lead the development of the strategic plan for the IP Bank in line with the overall strategic framework of the Technology Bank<br>• Identify opportunities, approaches and modalities and prepares program strategies and plans in harmony with national priorities, capacities and interests of the LDCs<br>• Monitor and oversee programmes to ensure delivery of quality results, timely and appropriate reporting<br>• Oversees the implementation of initiatives, programmes and projects of the IP Bank |
| 3 P-5, 3 P-4, 3 P-3, 2 G-5 | • Assist the director in providing technical support in the implementation and monitoring of the programme of work of the Intellectual Property Bank. Partner with key institutions across the UN system as well as strategic global and regional institutions and platforms<br>• In regard to Technology Needs Assessment and TRIPs Priority Needs: (a) identify of the core area of focus and prepare specific proposals for assistance (b) coordinate with existing capacity building programmes to improve access of LDCs and initiate new programmes (c) collaborate with the LDCs and coordinate with existing providers of capacity-building support (d) provide assistance to LDCs with submissions of these needs to the WTO TRIPS Council (e) assist LDCs with related financial and business functions necessary to develop projects<br>• In relation to Information Access to Support Research, Development, and Demonstration: (a) Help LDC stakeholders to get access and use free patent information (b) Assist LDCs in technology scouting, identification and review of available technical information (c) support in identifying |

| | |
|---|---|
| | patent owners (d) connect with existing sources of networks where R&D begins to form new inventions and new companies (e) use existing knowledge-sharing platforms for initial use including, for example, the Technology Facilitation Mechanism established by the Third International Conference of Financing for Development (FfD) (f) make use of existing partnering mechanisms, especially online portals that provide access to public private partnership resources<br>• In relation to IP Technical Assistance: Provide technical advice on preparing and upgrading existing laws and drafting of new laws, strengthening human and institutional capacities and enhancing implementation and enforcement; Support modernization of IP administration in terms of digital search, examination, publication, and recording of ownership; Enhance the institutional infrastructure and triple-helix of government-university-industry and overall societal support for the role of STI and IP as a tool for economic growth<br>• In relation to Supporting IP Rights Acquisition and Technology Transfer : (a) formulate programmes for attorneys to provide pro-bono support for LDCs in regard to complex contract negotiation towards obtaining patents and negotiate licenses (b) develop model technology-transfer agreements and building on the WIPO-WEF model for attorneys to provide pro-bono licensing for LDCs (c) build the expertise to advise and guide both technology owner and LDC party (d) assist LDCs in developing related financial and business functions necessary to develop IP-related projects<br>• In relation to Private-Sector Engagement: (a) establish a programme to focus private-sector involvement in LDCs along the lines of the Trans-Atlantic Business Council and the Trans-Atlantic Business Dialogue (b) establish a North-South-LDCs version of the TABD under a “High Growth Potential Country Dialogue” to signify the opportunities that LDCs present in terms of growth potential as new markets for investment, collaboration, and innovation |

***Management Support, Partnerships and Coordination (MSPC) Unit***

Under the delegated authority of the Managing Director, the MSPC Unit will be supervised by a Chief with the following staffing and areas of function:

| Number and Levels of Staff | Areas of functioning |
|---|---|
| 1 P-5<br><br>1 G-5 | • Implement resource mobilization, outreach and partnership strategies of the Technology Bank<br>• Backstop administrative and executive operations, including setting partnership priorities and developing sector-specific approach plans, which could include philanthropic foundations and donors<br>• Develop strategies to raise the profile of the Technology Bank in LDCs, partner countries and global level<br>• Ensure that financial, human resources, travel and other administrative functions are performed in accordance with relevant laws and regulations |
| Resource Mobilization and Partnerships<br><br>1 P-4, 1 P-3 | • Develop the resource mobilization strategic plan<br>• Prepare project documents and other materials for resource mobilization<br>• Undertake outreach activities for resource mobilization |
| Human Resource and Finance<br><br>1 P-4, 1 P-3, 1 G-5 | • Ensure effective delivery of HR services and travel related activities<br>• Provide day-to-day financial management advice, supporting financial operations related to the functions of the Technology Bank<br>• Apply HR and finance policies, rules and regulations<br>• Implement internal procedures and provide solutions to a wide spectrum of complex HR issues<br>• Support the Governing Council's work on evaluation plans |
| Communications and Outreach<br><br>1 P-3 | • Plan and implement communication and outreach initiatives, including supporting knowledge management within the Bank<br>• Plan and coordinate electronic outreach, including the website of the Technology Bank,<br>• Promote media outreach |

### iii. Staff and non-staff provisional cost estimates

The following table provides estimates for staff and non-staff costs, exclusive of the provision of physical infrastructure and servicing thereof, which are expected to be taken up in the context of the Host-Country Agreement as noted above. These estimates are provided to convey to the members of the High-Level Panel an order of magnitude as regards the size of financial resources needed to carry out the activities presented in this feasibility study during the initial biennium. The actual budgetary exercise will need to be carried out in the context of the operationalization of the Technology Bank, in consultation with the relevant departments of the United Nations.

In preparing these estimates, the following assumptions were made:

I. 2017 NY Standard Salary Costs - Version 2 used for all Professional posts

II. Post Adjustment at the rate of the Istanbul multiplier of 38.4%, derived from the ICSC website

III. G-5 salaries calculated based on General Service Category - Annual Salaries (Ankara) and common staff costs rate based on New York (0.4311). No separate salary scale for Istanbul exists as per the ICSC website. Turkish Lira converted to USD$ at the current UN exchange rate of 2.781

IV. All posts costed for 2016 and 2017 are based on delayed recruitment factor of 0.75 for P level posts and G-5 level posts for 2016, and 0.91 for professional posts and 0.95 for G-5 level posts for 2017

## Table 3 Staff and non-staff cost estimates

| Proposed Staffing and provisional cost estimates for the biennium 2016-2017 | |
|---|---|
| | |
| **Staff Costs:** | $8,566,530 |
| Budgetary provision is made for a total of 36 posts (27 -Professional level, 9 - General Service/local levels). Distribution of posts within the Technology Bank reflected in the organigramme in Chart 5 | |
| Non-staff costs: | |
| ***Executive Direction and Management*** | |
| Staff Travel | $180,000 |
| ***Science, Technology and Innovation-Supporting Mechanism:*** | |
| Contractual Services | |
| *(i) Digital Research Access and Networking* | |
| Launched in 10 countries: | |
| Country-based activities | 395,000 |
| Collection development (activities performed through select universities) | 170,000 |
| Translations of training materials | 40,000 |
| Information technology - initial systems upgrade and yearly special project | 2,050,000 |
| Consultants | 400,000 |
| Training (contractual costs) | 50,000 |
| Other contractual services on secondment to and from DARTT | 400,000 |
| Travel | 215,000 |
| *(ii) STI Policy and Capacity Building* | |
| Contractual Services | |
| Conducting STI strategy papers | |
| 6 countries @ 200,000 | 1,200,000 |
| Training on preparation of grant proposal; preparation of online interactive training module | 50,000 |
| Travel | |
| Staff Travel 6 countries @ 10,000 | 60,000 |
| Other Travel | 50,000 |
| ***Intellectual Property Bank*** | |
| Contractual Services | |
| Technology Needs assessment including TRIPS priority needs | |
| 6 countries @ 150,000 | 900,000 |
| Traditional IP Capacity Building Assistance | |
| 6 countries @ 150,000 | 900,000 |
| Private Sector Forum (High Growth Countries Dialogue) | 100,000 |
| Travel | |
| Staff Travel 6 countries @ 10,000 | 60,000 |
| Other Travel | 50,000 |
| Estimated non-staff costs | 7,090,000 |
| Estimated staff and non-staff costs | 15,656,530 |
| Programme support costs (13%) | 2,035,349 |
| **Total estimated costs for 2016-2017** | **17,691,879** |

**iv. Finance and Budget**

Capital costs and recurrent costs of the Technology Bank could be met from voluntary contributions to the Bank, or from the income derived therefrom, made by:

- Member States, United Nations system organizations and other international organizations
- Non-governmental sources, including foundations, private sector, universities, non-governmental organizations, venture capital and individuals[91]

In addition, in-kind contributions and partnerships will be sought to complement voluntary financial resources.

Financial arrangements could be in line with those of the UNU. Thus:

- The funds of the Technology Bank could be kept in a special account to be established by the Secretary-General of the United Nations in accordance with the Financial Regulations of the United Nations. The Secretary-General of the United Nations could perform all necessary financial and accounting functions for the Bank, including the custody of its funds, and could prepare and certify the annual accounts showing the status of the Bank's special account.
- The Financial Regulations and the Financial Rules of the United Nations could apply to the financial operations of the Technology Bank. Funds administered by and for the Technology Bank could, as provided in the Financial Regulations of the United Nations, be subject to audit by the United Nations Board of Auditors.
- The Managing Director should prepare the budget estimates for the Bank in a manner consistent with the United Nations regulations, rules, policies and procedures. The estimates, together with the comments and recommendations thereon of the Advisory Committee on Administrative and Budgetary Questions, could be submitted to the Council for approval.
- The general administrative, personnel and financial services of the United Nations could be utilized by the Bank on conditions determined in consultation between the Secretary-General and the Executive Director, it being understood that no extra cost to the regular budget of the United Nations is incurred.

[91] A member of the High-level Panel informed that he received an offer from an individual source to commit to the Technology Bank $2 million over a period of three years towards awarding a prize.

## D. Status and Authority

The status and authority of the Technology Bank should be finalized in consultation with relevant parts of the UN Secretariat. It is suggested that, like the UNU, the Technology Bank could be designated as an autonomous organ of the General Assembly of the United Nations and could enjoy the status, privileges and immunities provided in articles 104 and 105 of the Charter of the United Nations and other international agreements and United Nations resolutions relating to the status, privileges and immunities of the Organization. It could acquire and dispose of real and personal property, take other legal actions necessary to the performance of its functions and enter into agreements, contracts or arrangements with governments, organizations, institutions, firms or individuals for the purpose of carrying out its activities. Persons travelling on the official business of the Technology Bank could, on request, be provided with appropriate United Nations travel documents.

# Chapter 7: Recommendations of the High-level Panel

This feasibility study argues that the Technology Bank is feasible. The thinking behind it has been sound and the analysis of this study suggests that it could be launched on a firm foundation. With the offer of the Government of Turkey to host the Technology Bank, this initiative has made a very auspicious start.

The previous chapters indicate that the Technology Bank can result in some quick and outsized gains during its initial phase of operation which would not be possible in the absence of such a dedicated, coordinated and interlinked facility. Improved prospects of ODA to LDCs as reflected in the outcome of the Financing for Development Conference in July 2015, coupled with the opportunity provided by the Technology Bank to channel increased ODA to LDCs in the area of STI, also augur well for the funding prospects of the Bank. As noted above, the Bank should be based on voluntary resources and should use both in-kind and financial support by member States of the UN and other stakeholders.

This feasibility study envisages that the Technology Bank should leverage existing initiatives and grow incrementally, building on the experience gained and lessons learned from its work. In designing and delivering its programmes, it is envisaged that the Bank will accord primary importance to country-ownership. Support provided to each LDC should therefore be primarily country-driven, reflecting its priorities and aspirations.

Moreover, the Bank in collaboration with OHRLLS should strive to ensure full coordination with the UN system by making use of the existing coordination mechanisms at different levels. This should engender synergy, help avoid duplication, improve impact and facilitate the leveraging of ongoing and planned initiatives by UN system organizations in areas that are relevant to the work of the Bank. The Bank should also partner with Member States, the private sector, philanthropic foundations and the civil society in implementing its activities.

In light of the above, the High-level Panel considers the United Nations Technology Bank feasible and recommends its operationalization during the 70$^{th}$ session of the UNGA. Considering the fact that the Comprehensive Mid-term review of the IPoA will be held in Antalya, Turkey in June 2016, it will be desirable to formally operationalize the bank during this important event, signaling the realization of a key initiative coming out of the Fourth UN Conference on LDCs in Istanbul in 2011. To this end, the Panel requests the United Nations Secretary-General to:

(a) Take the necessary steps to launch and operationalize the Technology Bank and inform the UN General Assembly, including preparing a host country agreement;

(b) Establish a Trust Fund with necessary flexibility to attract voluntary funding from Member States as well as other stakeholders including the private sector and foundations;
(c) Mobilize the UN system organizations and other international and regional organizations to support the launching and operationalization of the Bank, and its effective functioning;
(d) Encourage the principal stakeholders to extend generous support to the Bank during its initial phase and beyond.

# Annexes

# Annex - I. The Istanbul Programme of Action and STI policies and Issues in LDCs

The Istanbul Programme of Action (IPoA) underscores the essential role of STI for the development of the LDCs. It highlights the importance of fostering Science, Technology and Innovation across priority areas and invites the international community to support technology transfer and innovation to LDCs as vital instruments to address their development challenges. References to promote research across key developmental areas in the LDCs are made across the document. This Annex highlights explicit mentions related to the support of STI in the LDCs.

*I. STI under priority area A of the IPoA*

The IPoA recognizes the crucial role of science and technology in Priority Area A – "Productive capacity" - where it requests development partners to "Support the development of science and technology to increase agricultural production and productivity". It also identifies the lack of adequate physical infrastructure, including information and communication technology, as a critical constraint for development and encourages LDCs to "Develop modern ICT infrastructure and Internet access, including expansion into rural and remote areas, including through mobile broadband and satellite connections" and to "Build and expand broadband connectivity, e-networking and e-connectivity in relevant areas, including education, banking, health and governance" and "Promote public-private partnerships for the development and maintenance of transport and ICT infrastructure and their sustainability".

The Programme of Action also requests to "Support least developed countries' efforts to facilitate the transfer of relevant skills, knowledge and technology for the development of infrastructure under mutually agreed terms" under the section dedicated to infrastructure. It also refers to the importance of technology transfer under the section on Energy, in which a call to "Facilitate the transfer of appropriate and affordable technology under mutually agreed terms and conditions for the development of clean and renewable energy technologies in accordance with relevant international agreements" is stated as one of the actions by development partners.

The IPoA also includes an entire section dedicated to Science, Technology and Innovation under Priority area A on Productive capacities. It reads as follows:

Science, technology and innovation

51. Science, technology and innovation play an important role in development. All least developed countries are lagging behind in these critical areas which are key drivers for transformation and have great potential to change the development landscape of least developed countries if developed and harnessed properly. Least developed countries have often not been able to move beyond outdated technologies that characterize their production processes and outputs. Acquiring new technologies and building domestic capacity and a knowledge base to be able to fully utilize acquired technologies and promoting indigenous capacity on a sustainable basis for research and development are needed to enhance productive capacities in least developed countries. Furthermore, development of this sector should help to bridge the digital divide and technology gap in support of rapid poverty eradication and sustainable development.

52. Actions by the least developed countries and their development partners on science, technology and innovation will be along the following lines:

1. Joint actions

Undertake on a priority basis by 2013 a joint gap and capacity analysis with the aim of establishing a Technology Bank and Science, Technology and Information supporting mechanism, dedicated to least developed countries which would help improve least developed countries' scientific research and innovation base, promote networking among researchers and research institutions, help least developed countries access and utilize critical technologies, and draw together bilateral initiatives and support by multilateral institutions and the private sector, building on the existing international initiatives.

2. Action by least developed countries

(a) Build or expand strategic partnerships with a broad range of actors, including the private sector, universities and other research institutions and foundations, in order to support innovation;

(b) Ensure that science and technology are mainstreamed into least developed country national development and sectoral policies; A/CONF.219/3/Rev.1 (c) Ensure that the development of science, technology and innovation receives priority in budget allocation;

(d) Promote investments and engagement in innovative solutions for the development of modern and cost-effective technologies that could be locally adapted, particularly in the fields of agriculture, information and communication, finance, energy, health, water and sanitation and education;

(e) Set up and strengthen, as applicable, institutions and expand the knowledge base to support local, national and regional research and development, science and technology;

(f) Facilitate cooperation and collaboration between research institutions and the private sector, with a view to promoting research and development and innovation in the field of science and technology.

3. Action by development partners

(a) Provide enhanced financial and technical support to least developed country research and development, science and technology, including strengthening national and regional institutions, as appropriate and in line with least developed countries' national development priorities;

(b) Urge World Trade Organization members to continue to implement article 7 of the 2001 Doha Ministerial Declaration on the Agreement on Trade- Related Aspects of Intellectual Property Rights (TRIPS) and Public Health;

(c) Consider the provision of concessional start-up finance for least developed country firms which invest in new technologies.

*II. STI under priority area B of the IPoA*

Priority area B on Agriculture, food and nutritional security and rural development requests development partners to "Provide and support, as appropriate, least developed countries with high-yielding and climate-resilient crop varieties, including saline-, drought-, and submersion-compatible species, through transfer of appropriate technology and technical know-how, under mutually agreed terms and conditions". It also calls to "Support least developed countries' national, regional and international agricultural and fishery research institutions, as appropriate, build capacities in tropical agricultural technologies and strengthen agricultural knowledge and information systems supported by agricultural extension services targeting sustained, inclusive and equitable economic growth and poverty eradication in least developed countries."

In the area of trade, the IPoA includes technology transfer as one of the key actions by development partners in regard to supporting the LDCs in strengthening their human, institutional and regulatory capacities. Moreover, it requests to "Provide, in accordance with article 66.2 of the TRIPS Agreement, incentives to enterprises and institutions in developed country member territories for the purpose of promoting and encouraging technology transfer to least developed countries in order to enable them to create a sound and viable technological base".

*III. STI under priority area D of the IPoA*

In Priority area D on Commodities, there is a call to "Support least developed countries in strengthening their capacity to manage their natural resources, including minerals, energy and agriculture, and to diversify their commodity base, including through the transfer of technology under mutually agreed terms and conditions."

*IV. STI under priority area E of the IPoA*

Priority area E on Human and social development includes technology as one of the fields to support in relation to scholarships and trainees from least developed countries to be supported by higher education institutes. In the same area, under the section on Population and primary health, the IPoA requests development partners to "Work with least developed countries to improve access to medicines, encourage the development of technology and the transfer of technology under mutually agreed terms and conditions, the production of affordable, safe, effective and good quality medicines, fostering the production of innovative medicines, generics, vaccines and other health commodities."

The same section states the following joint actions:

"Reaffirm the right to use, to the full, provisions contained in the World Trade Organization Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS Agreement), the Doha Declaration on the TRIPS Agreement and Public Health, the decision of the World Trade Organization General Council of 30 August 2003 on the implementation of paragraph 6 of the Doha Declaration on the TRIPS Agreement and Public Health, and, when formal acceptance procedures are completed, the amendments to article 31 of the Agreement, which provide flexibilities for the protection of public health and, in particular, to promote access to medicines for all and to encourage the provision of assistance to developing countries in this regard. We also call for broad and timely acceptance of the amendment to article 31 of the Agreement on Trade-Related Aspects of Intellectual Property Rights, as proposed by the World Trade Organization General Council in its decision of 6 December 2005."

The section on shelter in Priority area E explicitly mentions technology transfer as one of the actions by development partners, where it asks to "Support least developed countries, including through technology transfer under mutually agreed terms and conditions, as well as financial and technical assistance, for low-cost building, utilizing local contents and materials." The section on water and sanitation also contains a provision regarding support by development partners asking for the "Support transfer of technology under mutually agreed terms for water treatment and water management".

*V. STI under priority area F of the IPoA*

Under Priority area F on Multiple crises and other emerging challenges, the IPoA asks to "Provide financial and technical assistance and facilitate technology transfer under mutually agreed terms to least developed countries' efforts to develop and implement national strategies for sustainable use, preservation and protection of the national environmental resources and the sustainable management of marine biodiversity and ecosystems in line with their broader sustainable development strategies" in relation to Climate change and environmental sustainability. The same priority area includes a request to development partners to "Provide financial and technical assistance to least developed countries to support their disaster risk reduction, emergency preparedness, and post-disaster reconstruction efforts, and, in this regard, strengthen sharing of knowledge and expertise as well as transfer of technology under mutually agreed terms to least developed countries" under the section on Disaster risk reduction.

*VI. STI under priority area G of the IPoA*

Priority area G of the IPoA on mobilizing financial resources for development and capacity-building also includes various mentions to technology transfer. Technology and skill transfer is considered one of the areas that can benefit from foreign direct investment. It is recommended to "Promote strategic and regulatory frameworks for foreign direct investment and other resource flows in this sector that include vital policy areas such as infrastructure development, trade and trade facilitation, research and development and transfer of technology" as a joint action by LDCs and their development partners. It also requests development partners to "Strengthen partnership programmes for technology transfer under mutually agreed terms by fostering linkages between foreign and domestic firms".

*VII. STI under South-South cooperation in the IPoA*

The IPoA recognizes the important role that South-South cooperation can play in least developed countries' development. Science and technology is one of the areas highlighted as a potential beneficiary of enhanced cooperation between countries from the south. Further, Paragraph 139 states the following:

Promotion of least developed countries' access to and transfer of technology through South-South cooperation should be emphasized. Further efforts should be made by developing countries in improving technology cooperation arrangements with least developed countries, such as the Consortium on Science, Technology and Innovation for the South. It is also important to promote, through South-South cooperation, broader technological developments such as technological management capabilities and information

networks that are demand-oriented and involve participation by users of technology or by those involved in the process of technological development, infrastructure and human resources development.

# Annex II - Excerpts from intergovernmental documents on the Technology Bank

*I. Paragraph 52 of the IPoA*

Undertake on a priority basis by 2013 a joint gap and capacity analysis with the aim of establishing a Technology Bank and Science, Technology and Information supporting mechanism, dedicated to least developed countries which would help improve least developed countries' scientific research and innovation base, promote networking among researchers and research institutions, help least developed countries access and utilize critical technologies, and draw together bilateral initiatives and support by multilateral institutions and the private sector, building on existing international initiatives.

*II. Para 8.d of the Istanbul Declaration*

We undertake to promote access of least developed countries to knowledge, information, technology and know-how and to support the least developed countries in improving their scientific and innovative capacity needed for their structural transformation; agree to undertake a joint gap and capacity analysis with the aim of establishing a Technology Bank and a science, technology and innovation-supporting mechanism dedicated to the least developed countries' building on existing international initiatives; and welcome the generous offer of the Government of Turkey to host an International Science, Technology and Innovation Centre and encourage commitments in this regard.

*III. UNGA Resolution A/RES/66/213, Operative Paragraph 14*

Requests the Secretary-General to take the steps necessary to undertake a joint gap and capacity analysis on a priority basis by 2013 with the aim of establishing a technology bank and science, technology and innovation supporting mechanism dedicated to least developed countries, building on the existing international initiatives.

*IV. UNGA Resolution A/RES/67/220, Operative Paragraph 21*

Also reiterates its request to the Secretary-General to take the steps necessary to undertake a joint gap and capacity analysis on a priority basis by 2013, with the aim of establishing a technology bank and science, technology and innovation supporting mechanism dedicated to the least developed countries, building on existing international initiatives.

*V. UNGA Resolution A/RES/68/224, Operative Paragraph 1*

Takes note of the reports of the Secretary-General on the implementation of the Programme of Action for the Least Developed Countries for the Decade 2011–2020 and on a technology bank and science, technology and innovation supporting mechanism dedicated to the least developed countries.

*VI. ECOSOC Resolution E/RES/2012/16, Operative Paragraph 20*

Recalls the request made by the General Assembly to the Secretary-General to take the steps necessary to undertake a joint gap and capacity analysis on a priority basis by 2013, with the aim of establishing a technology bank and science, technology and innovation supporting mechanism dedicated to the least developed countries, building on existing international initiatives.

*VII. UNGA Resolution. A/RES/68/224, Operative Paragraph 25*

Notes with appreciation the offer of Turkey to host a technology bank and science, technology and innovation supporting mechanism dedicated to the least developed countries under the auspices of the United Nations and in this regard:

(a) Requests the Secretary-General, on the basis of voluntary contributions, to constitute a high-level panel of experts drawn from the least developed countries and their development partners, the United Nations system and other relevant stakeholders to carry out a feasibility study, with secretariat support provided, within existing resources, by the Office of the High Representative for the Least Developed Countries, Landlocked Developing Countries and Small Island Developing States, in order to examine its scope, functions, institutional linkage with the United Nations and organizational aspects, including by:

> (i) Assessing the ability of a technology bank to promote scientific research and innovation and facilitate the diffusion and transfer of technologies to the least developed countries, on voluntary and mutually agreed terms and conditions, and with necessary protections for intellectual property;
>
> (ii) Considering the current international institutional landscape, synergies and options for cooperation with relevant international technology initiatives, stakeholders and organizations, both within and outside the United Nations system, and the need to avoid duplication of efforts;

(iii) Examining and outlining potential functions, activities, working methods, governance mechanisms, staffing arrangements and costs for a technology bank and science, technology and innovation supporting mechanism, including possible regional centres in the least developed countries;

(iv) Examining options for facilitating the necessary voluntary financial support to a technology bank for its establishment and effective and sustained functioning.

(b) Also requests the Secretary-General to transmit the report and the recommendations of the high-level panel of experts to the General Assembly at its sixty-ninth session for its consideration, with a view to operationalizing a technology bank during its seventieth session, if so recommended by the panel.

*VIII. ECOSOC Resolution E/RES/2013/46, Operative Paragraph 20*

Recalls the request made by the General Assembly to the Secretary-General to take the steps necessary to undertake a joint gap and capacity analysis on a priority basis by 2013, with the aim of establishing a technology bank and science, technology and innovation supporting mechanism dedicated to the least developed countries, building on existing international initiatives.

*IX. UNGA Resolution A/RES/69/231, Operative Paragraph 14*

Takes note with appreciation of the work undertaken thus far by the Secretary-General to constitute a high-level panel of experts to carry out a feasibility study for a technology bank and science, technology and innovation supporting mechanism dedicated to the least developed countries, welcomes the announcement by the Secretary-General regarding the composition of the panel, and looks forward to the conclusion of the panel's work in line with its resolution 68/224.

*X. ECOSOC Resolution E/RES/2014/29, Operative Paragraph 18*

Recalls the request made by the General Assembly in its resolution 68/224 to the Secretary-General to constitute a high-level panel of experts to carry out a feasibility study on a technology bank and science, technology and innovation supporting mechanism dedicated to the least developed countries, with secretariat support provided by the Office of the High Representative, in order to examine its scope, functions, institutional linkage with the United Nations and organizational aspects, and requests the Secretary-General to constitute

the panel at the earliest possible date, to facilitate the conclusion of its work within the time frame and to transmit its report and recommendations to the Assembly for its consideration, with a view to operationalizing the technology bank during the seventieth session of the Assembly, if so recommended by the panel.

*XI. ECOSOC Resolution 2015 (Symbol awaited)*

Takes note with appreciation of the work undertaken thus far by the Secretary-General to constitute a high-level panel of experts to carry out a feasibility study for a technology bank and science, technology and innovation supporting mechanism dedicated to the least developed countries, and looks forward to the conclusion of the panel's work in line with General Assembly resolution 68/224 of 20 December 2013.;

*XII. Addis Ababa Action Agenda 2015, Paragraph 124*

We look forward to the recommendations of the Secretary-General's High-level Panel on the Technology Bank for Least Developed Countries on the feasibility and organizational and operational functions of a proposed technology bank and science, technology and innovation capacity-building mechanism for least developed countries. We will take into account the High-level Panel's recommendations on the scope, functions, institutional linkages and organizational aspects of the proposed bank, with a view to operationalizing it by 2017, and will seek to promote synergies with the Technology Facilitation Mechanism.

*XIII. Transforming our world: The 2030 Agenda for Sustainable Development, Target 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.

*XIV. Declaration of the Least Developed Countries High-level Meeting on Global Partnerships for a Transformative Agenda for the Least Developed Countries Addis Ababa, 14 July 2015, Paragraph 6*

We recognize that bringing about structural transformation in the economies of LDCs would require transfer, acquisition and upgradation of technologies, including new technologies, domestic capacity and a knowledge base. The Technology Bank for the LDCs is a timely and

critically important initiative to speedily bridge the technology gap faced by LDCs. We look forward to the full operationalization of the Technology Bank during the 70th session of the UNGA. We commend the Government of Turkey for its generous offer to host the Technology Bank and to support the work of the Secretary-General's High-level Panel. We call upon Turkey to continue its support to the Technology Bank and call upon other donor countries to make strong contributions to the Technology Bank by providing at least 0.1 per cent of their ODA to the Technology Bank for its effective functioning. We also request the Secretary General of the United Nations to make expeditious arrangements for effective and timely realization of the recommendations of the High-level Panel.

# Annex-III - About the High-Level Panel

The UN Secretary-General appointed the High-Level Panel on Technology Bank for the LDCs in November 2014 with 9 Members, 2 *ex-officio* members and an Executive Secretary.

**Terms of Reference of the High-Level Panel**

The terms of Reference of the High-level Panel were indicated in the General Assembly resolution A/RES/68/224 to examine its scope, functions, institutional linkage with the United Nations and organizational aspects, including by:

(i) Assessing the ability of a technology bank to promote scientific research and innovation and facilitate the diffusion and transfer of technologies to the least developed countries, on voluntary and mutually agreed terms and conditions, and with necessary protections for intellectual property;

(ii) Considering the current international institutional landscape, synergies and options for cooperation with relevant international technology initiatives, stakeholders and organizations, both within and outside the United Nations system, and the need to avoid duplication of efforts;

(iii) Examining and outlining potential functions, activities, working methods, governance mechanisms, staffing arrangements and costs for a technology bank and science, technology and innovation supporting mechanism, including possible regional centres in the least developed countries;

(iv) Examining options for facilitating the necessary voluntary financial support to a technology bank for its establishment and effective and sustained functioning.

**Composition of the High-Level Panel**

*Prof. Roman Murenzi, Chair*

Prof. Romain Murenzi serves as the executive director of TWAS, The World Academy of Sciences for the advancement of science in developing countries, based in Trieste, Italy. He directs a secretariat that administers some 500 PhD and postdoctoral fellowships per year for scientists from developing countries, plus USD$1.7 million in research grants for individuals and research groups in developing countries. Prof. Murenzi also plays a key role in global science diplomacy and science policy initiatives. He joined TWAS in April 2011. Before that, he served for eight years as Rwanda's Minister of Education, Science, Technology and Scientific Research, and from March 2006 to July 2009 as Minister in the President's Office in Charge of Science, Technology, and Scientific Research, with

responsibilities including Information and Communications Technology. In 2009 he was a senior scholar at the Centre for Science, Technology and Sustainable Development at the American Association for the Advancement of Science (AAAS); he served as director from 2010-2011. He also was visiting professor at the University of Maryland.

Prof. Murenzi was born in Rwanda in 1959 and raised in Burundi. He graduated from the National University of Burundi in 1982. He received his master's degree (1986) in physics and his PhD (1990) from Catholic University of Louvain in Belgium. He was a physics professor at Clark Atlanta University (USA) from 1993 to 2001, serving as physics department chair from 1999 to 2001. In 2013 he earned a Master of Law degree in Information Technology and Telecommunication from the University of Strathclyde (UK). His major areas of research include multidimensional continuous wavelet transforms to quantum mechanics, image and video processing, and science and technology policy.

Prof. Murenzi was elected a fellow of TWAS in 2005 and a fellow of the African Academy of Sciences in 2012. He serves on the board of directors for the Global Research Council (GRC), on the board of the Dian Fossey Gorilla Fund International and on the Leadership Council of the Sustainable Development Solution Network (SDSN). In November 2014 he has been appointed by the UN Secretary-General as the Chair of the High-level Panel of Technology Bank and Science, Technology and Innovation Supporting Mechanism for the Least Developed Countries.

*Prof. Mohamed H.A. Hassan, Member*

Prof. Mohamed H A Hassan is Co-Chair of IAP, the global network of science academies, and Chairman of the Council of the United Nations University (UNU). He also serves on a number of Boards of international organizations worldwide, including the Board of Directors of global change System for Analysis, Research and Training (START), Washington, USA; the Board of Trustees of Bibliotheca Alexandrina, Egypt; the Council of Science and Technology in Society (STS ) Forum, Japan; the Board of the International Science Programme, Sweden; the Board of the Science Initiative Group (SIG), USA; and the International Advisory Board of the Centre for International Development (ZEF), Germany. After obtaining his DPhil in Mathematics from the University of Oxford he returned to Sudan as Lecturer in the University of Khartoum, and later became Professor and Dean of the School of Mathematical Sciences.

Prof. Hassan has a long list of publications in Theoretical Plasma Physics and Fusion Energy; Wind Erosion, Dust and Sand Transport in Dry Lands. He also published several articles on Science and Technology in the Developing World.

Prof. Hassan was founding Executive Director of TWAS, President of the African Academy of Sciences and chairman, Honorary Presidential Advisory Council for Science and Technology, Nigeria.

Among his honours: Comendator, Grand Cross, and National Order of Scientific Merit, Brazil; and Officer, Order of Merit of the Italian Republic. He is a member of several merit-based academies of science, including TWAS; the African Academy of Sciences; Islamic World Academy of Sciences; Academia Colombiana de Ciencias Exactas, Físicas y Naturales; Académie Royale des Sciences d'Outre-Mer, Belgium; Pakistan Academy of Sciences; Academy of Sciences of Lebanon; Cuban Academy of Sciences; and academy of Sciences of South Africa.

*Hon. Bruce Lehman, Member*

For the past 44 years Bruce Lehman has practiced law, advised lawmakers and made policy at the local, state, national and international levels in various capacities as a public servant, diplomat, attorney and non-profit executive. While he is best known for his role in shaping the development of intellectual property law both nationally and globally, his long career also included significant contributions in the areas of civil liberties, national security, health policy and public administration.

Currently, he devotes much of his time to the International Intellectual Property Institute (IIPI) where he serves as board chairman. IIPI is a nonpartisan, non-profit organization, based in Washington, D.C. which he founded in December 1998. The Institute is a think tank and development organization that promotes the creation of modern intellectual property systems and the use of intellectual property rights as a mechanism for investment, technology transfer and the creation of wealth in all countries of the world. In addition to his work with IIPI, Mr. Lehman serves as Senior Advisor to 1624 Capital, LLC, an investment fund specializing in patents and is a member of the Legal Advisory Council of LegalZoom, an Internet-based provider of legal tools for individuals and small businesses. Also, he is counsel to several artists' rights groups that seek meaningful copyright protection for visual artists. In that capacity he has drafted legislation, advised Congress and filed Supreme Court amicus briefs on behalf of fair copyright protection for visual artists.

Soon after taking office in 1993 President Bill Clinton nominated Bruce Lehman to the post of Assistant Secretary of Commerce and U.S. commissioner of patents and trademarks. Subsequently, as a result of legislation developed by Mr. Lehman and his colleagues working under Vice President Al Gore's re-inventing government initiative, the USPTO's management structure was simplified and the title of its leader was changed to Undersecretary of Commerce and Director of the USPTO. However, the responsibilities and position of the Undersecretary in the government hierarchy remain unchanged from Mr. Lehman's tenure as Assistant Secretary and Commissioner.

As the Clinton administration's primary representative for intellectual property rights protection, he was a key player on these issues, both domestically and internationally. At the request of the president, he served concurrently in the fall of 1997 as acting chairman of the National Endowment for the Humanities, which fosters and recognizes the work of America's artistic and creative community.

Mr. Lehman's work in the Clinton Administration was recognized in 1994 by The National Law Journal which named him its "Lawyer of the Year." In 1997 the public-policy magazine National Journal named him as one of the 100 most influential men and women in Washington, noting, "In today's Information Age, the issue of intellectual property rights is no longer an arcane concern, but a vital part of U.S. trade policy. Since taking over his current posts in 1993, Lehman has been the Clinton Administration's outspoken voice on such matters here and abroad."

Serving as the leader of the U.S. delegation to WIPO's December 1996 Diplomatic Conference on Certain Copyright and Neighbouring Rights Questions, Mr. Lehman concluded negotiations that resulted in the adoption of two treaties: the WIPO Copyright Treaty and the WIPO Performances and Phonograms Treaty. By updating international copyright law for the digital age, the treaties have greatly facilitated the growth of online digital commerce over the Internet. Mr. Lehman's guidance on the development of the intellectual property provisions of the Uruguay Round Agreement, now known as TRIPS (Trade Related Aspects of Intellectual Property), has enabled American creators and inventors to more easily protect their creations from piracy throughout the world.

Mr. Lehman also chaired the Working Group on Intellectual Property Rights of the National Information Infrastructure Task Force. In September 1995 the Working Group released Intellectual Property and the National Information Infrastructure, which recommended changes in copyright protection of intellectual property in the networked environment. These recommendations served as the basis for the WIPO treaties and the Digital Millennium Copyright Act.

From 1999 to 2008, Mr. Lehman served on the Policy Advisory Commission of the World Intellectual Property Organization, headquartered in Geneva. From 2000 to 2004 Mr. Lehman returned to law practice as Senior Counsel to the law firm of Akin Gump Strauss Hauer & Feld in Washington, DC.

On February 7, 2006, Mr. Lehman was honoured as one of 23 initial inductees to the newly created International IP Hall of fame, a project sponsored by the London-based Intellectual Property Asset Management Magazine. He was one of ten living original members of the Hall of Fame which also included historic figures such as Thomas Jefferson and Victor Hugo. Mr. Lehman is holds both a B.S. and a J.D. degree from the University of Wisconsin, Madison and served as a First Lieutenant in the United States Army.

*Prof. Tebello Nyokong, Member*

Prof. Tebello Nyokong holds a DST/NRF professorship in Medicinal chemistry and Nanotechnology at Rhodes University in South Africa. She is also Director of the DST/Mintek Nanotechnology Innovation Centre (NIC)-Sensors also at Rhode University. She joined Rhodes University in 1992 after lecturing at the University of Lesotho for five years. She has been undertaking research on applications of phthalocyanines in healthcare: as photodynamic therapy (PDT) of cancer agents in combination with nanosized metal nanoparticles and quantum dots. She has successfully supervised 70 PhD/MSc students. She has published ~ 500 manuscripts (including patents, a book and book chapters). Her H index is 49 (ISI) and she has been cited over 8000 times.

Prof. Nyokong has received many awards for her research including the following: (a) 2013: she received South African Chemical Institute (SACI) Gold Medal; she was awarded "A" rating and "Lifetime achievement" by the National Research Foundation (NRF) of South Africa and a medal by The World Academy of the Science (TWAS) presented in Argentina; (b) 2012: Named by IT News Africa as one of the top 10 most influential women in science and technology in Africa and was included in the National Centre for Research on Human Evolution (CENIEH), located in Burgos, Spain to be one of their "12 Names to Change the World"; (c) the same year she received recognition by IT News Africa as one of the top ten most influential women in science and technology in Africa.

*H.E. Mme. Michèle Duvivier Pierre-Louis, Member*

H.E. Mme. Michèle Pierre-Louis became Prime Minister of Haiti on September 5th 2008, after a series of internal and external shocks that hit the country in the summer of that same year: food and oil crisis, government crisis and a succession of four hurricanes which destroyed the country's fragile infrastructure and environment. Only the second woman to hold this position, H.E. Mme. Pierre-Louis also served as Minister of Justice and Public Security.

Since her return to Haiti in 1976 after her studies abroad, H.E. Mme. Pierre-Louis has devoted special attention to improving literacy and adult education, held training sessions for traditional midwives, opened libraries, and made education one of her core projects. She has also served in the private sector as Director of Credit at the Bank of Nova Scotia, Officer of Administration and Human Resources to the Haitian Development Finance Corporation, and Deputy Director at the Airport Authority.

In 1986 she became a national trainer in the literacy campaign Mission Alpha. In 1991, President Jean-Bertrand Aristide entrusted H.E. Mme. Pierre-Louis with the task of redefining the mission of the state and coordination between the Presidency and the Ministers, taking into account the demands of rural organizations for agrarian reform. Since

1995 H.E. Mme. Pierre-Louis has directed the Knowledge and Freedom Foundation (FOKAL: www.fokal.org) which defends the fundamental position and democratic values that real change can only take place if those concerned become the main actors. The Foundation focuses on the areas of education, culture, community development, environment, gender equity, civil society, and training of young entrepreneurs. In the last years she spent as Executive Director of FOKAL, she was engaged in an urban development project in an impoverished neighbourhood of Port-au-Prince also financed by the European Union. The project also aims at recuperating the last wooded area in the city and transforming it into a Natural Park. Connections have been made with the US National Park Services to that effect.

H.E. Mme. Pierre-Louis was also a University teacher prior to becoming Prime Minister. Her courses focused on "Culture and society in the Caribbean" and "The History of the Great Civilizations." She was a member of a review "Chemins Critiques" which published several issues on politics, economics, arts and culture, from 1989 through 2006.

*Prof. Dorte Olesen, Member*

Prof. Dorte Olesen received her MSc in mathematics and physics from the University of Copenhagen in 1973. She holds a Ph.D. in mathematics as well as a Doctorate of Science, and has received the Gold Medal of the University of Copenhagen. In 1992, she was awarded the Cross of Knight of Dannebrog by HM Queen Margrethe II, and in 2000 awarded the Cross of the First Degree.

Prof. Olesen joined the Department of Mathematics and Computer Science at the Technical University of Denmark in 2011, after having been Director General of the Danish IT-Centre for Research and Education, UNI-C, from 1989-2011. Prior to this, she had a university career as a professor of mathematics. She also held leadership positions such as Dean of the Faculty of Natural Sciences at the University of Copenhagen.

Since 1988 she is President of the Danish Association for the Advancement of Science, in Danish "Selskabet for Naturlærens Udbredelse", under the patronage of H.M. Queen Margrethe II.

In 1987-93, she was a member of the Danish Council for Research Policy, an advisory council to the Danish Government and Parliament, and among other tasks headed a national evaluation of the health sciences which led to a national strategy for the health sciences. In 1991-93 she chaired a Committee on technology-supported learning formed by the Danish Minister of Education. She was appointed member of the steering Committee for the Norwegian Scientific Computing Initiative NOTUR from 2000-2004 by the Norwegian Research Council.

Since 1991, she has been a member of numerous Expert Groups for the EC, starting with the High Performance Computing and Networking Advisory Committee of the European

Commission, where she chaired its Networking Subgroup (The LINKS group). Other groups include the Task Force Human Resources Group of National Experts 1992-96, the DELTA Review Board 1993, the working group planning the "Telematics for research" programme and the "Strategic Requirements Board for the Fifth Framework Programme". For the years 2001-2005, she was a member of the EC "Expert Group on ICT in Education" under DG Education & Culture, in 2010-11 a member of the "High level expert group on the future of GEANT" under DG INFSO and in 2013 a member of the "Expert Group on the Implementation of the ERA Communications" for DG Research.

In 2003 she was elected President of TERENA, the Trans-European Research and Education Networks Association, a post she held for the maximum term of 6 years. In 2012, she was elected Chair of the NREN Policy Committee and the GN3Plus (GEANT) Partners Assembly, and in 2014 she has been elected member of the Board of Directors of the newly formed GEANT Association.

In 2011 she chaired the Data Transport Expert Panel for the Square Kilometre Array project.

From 2004-08 she Chaired the Board of Roskilde University, and was Member of the board for the Royal Danish School for Educational Studies 1992-2000 and for the Danish Pharmaceutical University 2003-2004 as well as Member of the Danish Defence Research Council from1998-2008.

She is since 1990 Member of the board of the Politiken Foundation and since 2003 also Member of the board of the Politiken Holding Company. Politiken is a major Danish newspaper/media house.

*Dr. Posh Raj Pandey, Member*

Dr. Pandey has been working on issues of international trade and economic development for more than 20 years and is Executive Chairman of South Asia Watch on Trade Economics and Environment (SAWTEE), a consortium of South Asian NGOs, working to build capacity of concerned stakeholders in the context of liberalization and globalization.

He holds Ph. D. degree in Economics and Master's Degrees in Business Management and Economics. He was a Member of the National Planning Commission of Nepal, an apex policy making body of the Government of Nepal. He was one of the negotiators for Nepal's accession negotiation for WTO membership.

He is in the indicative panellist of WTO Dispute Settlement Body. Dr. Pandey worked with the United Nations Development Programme (UNDP) in Nepal on the issues of multilateral trade integration and trade related capacity building. He was also a faculty member of the Central Department of Economics, Tribhuvan University, Kathmandu. He has published research papers on international trade in various national and international journals/books.

*Dr. Firdausi Qadri, Director, Member*

Dr. Firdausi Qadri is the Director, Centre for Vaccine Sciences at the International Centre for Diarrhoeal Disease Research, Bangladesh (ICDDR,B). She obtained her PhD in Biochemistry from the University of Liverpool in 1980. Dr. Qadri began her academic career in 1981 as faculty in the Department of Biochemistry, University of Dhaka and then joined ICDDR,B in 1986 as a postdoctoral research fellow and since then has worked her way up to her current title of Senior Scientist and to lead researcher in the Centre for Vaccine Sciences.

She and her team have made significant contributions to international scientific research, particularly in the field of infectious diseases with emphasis on infections which are very common in children in developing countries. Her work includes basic and applied immunology of infectious diseases but also clinical and large field based studies on enteric vaccines. In the last 3 years she has been leading the largest field studies in over 400,000 participants of an oral cholera vaccine in an urban slum in Bangladesh-to pave the way forward for introducing cholera vaccine in high risk people in the country and in the near future in the region and globally.

Her work also involves her devotion to an initiative that she has set up known as the "Institute for developing science and health initiatives" (ideSHi). The primary focus at ideSHi is on the development of science and technology in Bangladesh and encouraging scientists to work in the field of biomedical sciences and also by using the facilities in the ideSHi and ICDDR,B laboratories and through networking with other institutions in the government and private sector.

A large part of her career has been focused in developing leaders in the field infectious disease research from different disciplines and institutions. She also has inspired many young scientists through her teaching and research activities. Her penchant for mentoring can be seen in her lab and field sites, where aspiring fellows from both local and international universities join her team as interns and later move on to faculty positions globally.

*Prof. Fang Xin, Member*

Prof. Fang Xin, currently a research professor, is a member of the Presidium of the Chinese Academy of Sciences (CAS), a member of the Standing Committee of the National People's Congress (NPC) and of the Education, Science, Culture & Health Committee for NPC, a member of the Seventh National Committee of the China Association for Science and Technology (CAST), President of The Organization for Women in Science for the Developing World (OWSD) and TWAS Member.

Prof. Fang Xin was born in 1955 in Beijing, and graduated from the Beijing University of Technology in 1980, majoring in machinery engineering. In 1982, she obtained her master's

degree in optical engineering from the Beijing Institute of Technology and her Ph.D in 1997 from the School of Economics and Management, Tsinghua University. She was a visiting scholar from 1987 to 1988 at the Department of Management Science, George Washington University, Washington DC.

As a scientific administrator, she has served as section chief of policy research, vice director and director of the CAS Institute of Policy & Management. She was elected into the NPC Standing Committee in March 2003 and sit on the committee as a full-time member till November 2004.

Prof. Fang Xin is a long-time researcher in the field of S&T developmental strategy and policy. She is noted for her profound attainment in technological innovation, national innovation system and the institutional reform of the national S&T system. Since the 1990s, she has to her credit a dozen monographs, some 80 research papers and a dozen translated works and articles.

Prof. Fang Xin received the title of An Outstanding Woman Leader from the CPC Committee at the Government Department in 2002, a Prize for CAS Young Scientists in 2001, a first prize for S&T Progress from the Ministry of Education in 2000, four third prizes for S&T Progress from CAS in 1991, 1992, 1995 and 1999 respectively, a second prize for S&T Progress from the former State S&T Commission (SSTC) in 1992, and special citation issued by the SSTC in 1986. She worked concurrently as a member of the International S&T Policy Research Council, President of the China Association for the Science of Science and S&T Policy Research, Vice Secretary-general of the China Society of Soft Sciences, professor at the Management School of the Graduate School of CAS and chief-editor of the journal Studies in the Science of Science.

*Mr. Gyan Chandra Acharya, Ex-Officio Member*

Ambassador Gyan Chandra Acharya, a national of Nepal, was appointed to the position of UN Under- Secretary-General and High Representative for the Least Developed Countries, Landlocked Developing Countries and Small Island Developing States (UN-OHRLLS) on 5 September 2012.

Mr. Acharya has the responsibilities of monitoring and following the implementation of the dedicated programs of action, IPOA for the Least Developed Countries (LDCs), VPOA for the Landlocked Developing Countries (LLDCs) and SAMOA Pathway for the Small Island Developing States (SIDS). He is also called on to analyse and advocate for the issues and concerns of these vulnerable countries and ensure their integration into and coherence with global processes, including those related to the Sustainable Development Goals and the Post- 2015 Development Agenda at the United Nations. He also coordinates the advocacy

work related to the LDCs, LLDCs and SIDS in forums and platforms outside the United Nations.

Mr. Acharya is a member of the United Nations Senior Management Group and the High-Level Task Force for Global Food Security as well as a Commissioner of the high-level Broadband Commission for Sustainable Digital Development. He is also currently serving in the Advisory Board of the Sustainable Energy for All (SE4All) initiative, which is co-chaired by the UN Secretary General and the President of the World Bank.

Mr. Acharya served as the Secretary General of the Third UN Conference on Landlocked Developing Countries held in Vienna, Austria, in November 2014.

Mr. Acharya has three decades of experience in the diplomatic service of Nepal, during which he was involved in the articulation and promotion of bilateral, regional and global issues. Prior to joining the UN, Mr. Acharya was Permanent Representative of Nepal to the United Nations in New York (2009-12), during which he chaired the LDC Global Coordination Bureau for over two years and was a member of the LLDC Global Bureau.

He was Foreign Secretary with the Government of Nepal (2007-2009), Ambassador and Permanent Representative to the United Nations and the World Trade Organization in Geneva (2003-2007), Spokesman of the Foreign Ministry (1999-2002) and Joint Secretary (Director-General) responsible for South Asia, Europe and the Americas and Regional Organizations, Economic Relations and Coordination Divisions (1998-2003).

A strong advocate of the issues affecting LDCs, LLDCs and SIDS, Mr. Acharya has stressed that “LDC, LLDC and SIDS issues are livelihood issues of interest and concern to all, and as such they need urgent global attention and support to complement their national efforts”. He calls for a pro-active role of all the stakeholders in galvanising international support in a spirit of global partnership and solidarity to make best use of the immense potentials that exist in these countries.

*Mr. Hakan Karatas, Ex-Officio Member*

Mr. Hakan Karatas, who has an Industrial Engineering degree, is the Director for International Cooperation at the Scientific and Technological Research Council of Turkey (TUBITAK) since May 2014.

Before this position he worked as the Head of Information and Communication Technologies Department at the Presidency for Turks Abroad and Related Communities of the Prime Ministry between October 2012 and May 2014.

Mr. Karatas has also served as an expert of European Union Affairs at the Ministry for EU Affairs. He also coordinated and led several EU FP 7 projects and took part as the head of

various events such as the National Launch Event for Horizon 2020 and International ERC Conference in Turkey.

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