

Standing Committee on the Law of Patents

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STUDY ON BEST PRACTICES AND CHALLENGES IN TECHNOLOGY TRANSFER IN THE HEALTH AND GREEN TECHNOLOGY SECTORS FOCUSING ON INDUSTRY-ACADEMIA COLLABORATION, CONSIDERING NATIONAL AND INTERNATIONAL REGULATORY FRAMEWORKS

Document prepared by the Secretariat

1. At its thirty-sixth session, held in Geneva from October 14 to 18, 2024, the Standing Committee on the Law of Patents (SCP) decided that the Secretariat would prepare a study on best practices and challenges in technology transfer in the health and green technology sectors focusing on industry-academia collaboration, considering national and international regulatory frameworks, to be submitted to SCP/38. The Committee decided that the study should identify licensing models and contract structures, including effective clauses for remuneration schemes and IP management. The Committee also decided that the study should incorporate Case Studies and practical examples to illustrate successful strategies. In preparation for this study, the Committee agreed that an expert exchange will be organized at the thirty-seventh session of the SCP.
2. Pursuant to the above decision an expert exchange on best practices and challenges in technology transfer in the health and green technology sectors, focusing on industry-academia collaboration was organized during the thirty-seventh session of the SCP, held in Geneva from November 3 to 7, 2025. The expert exchange brought together five experts comprising academics, technology transfer professionals and one industry representative. The presentations offered insights into industry-academia collaboration in the Health Sector, particularly focusing on national and international regulatory frameworks, licensing models and contract structures, including effective clauses for remuneration schemes and IP management.

3. Pursuant to the above decision at SCP/36, Member States and regional patent offices were invited through Note C. 9304, dated January 30, 2026, to submit information to the International Bureau on the above elements in their jurisdiction.¹ In total, 8 Member States provided information. Due to the paucity of inputs received and the complexity of the subject-matter, the Secretariat engaged three external consultants with expertise in technology transfer in the context of industry-academia collaboration for the preparation of this study.² The contributions from the consultants were edited for document coherence and supplemented with Secretariat desk research based on publicly available materials.

[Annex follows]

¹ Member States and Regional Patent Offices were invited, through Note C. 9304 dated January 30, 2026, to submit to the International Bureau any input for the preparation of this study. The input received is published on the website of the SCP electronic forum at: https://www.wipo.int/en/web/scp/electronic-forum/meetings/session-38/comments_received. It should be noted, however, that only a limited number of responses were received from Member States in connection with this document.

² The Secretariat expresses its sincere appreciation to the contributors of this study: Mr. Joy Goswami, Director Intellectual Property & Licensing, Office of Innovation & Partnerships Intellectual Property & Licensing Group, State University of New York Research Foundation, United States of America; Prof. Dr. Fazilet Vardar, Coordinator for Research Partnerships and Innovation, Izmir University of Economics, Izmir, Türkiye; and Ms. Varinka Farren, RTTP, Directora Ejecutiva, HUB APTA, Chile.

Study on best practices and challenges in
technology transfer in the health and green
technology sectors focusing on
industry-academia collaboration, considering
national and international regulatory
frameworks

Contents

Part I: Introduction, background and scope of the study	3
A. Industry-academia collaboration and technology transfer: the ecosystem.....	3
B. Health technology sector and green technology sector: their unique features.....	4
C. The role of industry-academia knowledge/technology transfer (K/TT) in the health and green technology sectors.....	5
D. Scope of the study and conceptual elements: macro, meso, micro levels.....	6
E. Methodology and limitations of the study	9
Part II: International and national/regional regulatory frameworks	10
A. International regulatory framework.....	10
1. Health technology sector	10
2. Green Technology Sector.....	12
B. National and regional regulatory frameworks.....	13
1. Health technology sector.....	13
2. Green technology sector	18
C. Synthesis of national/regional and international regulatory frameworks on K/TT	24
Part III: IP management in the context of industry-academia collaboration in health and green technology sectors.....	25
A. Overview of IP management practices in the health and green technology sectors: key considerations	25
B. Overview of licensing models and contract structures	27
1. Health technology sector	32
2. Green technology sector	34
C. Overview of effective clauses for remuneration schemes.....	35
1. Health technology sector.....	38
2. Green technology sector	38
3. Other considerations	39
Part IV: Synthesis of Case Studies.....	41
Part V: Synthesis of best practices and challenges.....	44
A. Best practices, challenges and their policy implications in industry-academia collaboration in the health technology sector.....	44
B. Best practices, challenges and policy implications in industry-academia collaboration in the green technology sector.....	46
Bibliography	49

Part I: Introduction, background and scope of the study

A. Industry-academia collaboration and technology transfer: the ecosystem

1. Industry-academia collaboration constitutes a foundational mechanism within contemporary innovation systems, particularly in knowledge-intensive sectors such as health and green technologies. This relationship is symbiotic: academia (i.e. universities and public research organizations) generate knowledge but often lack capital, infrastructure and distribution networks to bring discoveries to market, while industry supplies these downstream resources in exchange for access to academic expertise.
2. This ecosystem perspective is consistent with the “Triple Helix” model of university-industry-government relations, which holds that innovation is strengthened where academic research, private-sector development and public policy interact in a mutually reinforcing manner. Universities generate discoveries, industry advances development and commercialization, and governments shape the funding, regulatory and public-interest environment within which such collaboration occurs (Etzkowitz & Leydesdorff, 2000).
3. The increasing complexity of scientific discovery, together with the rising costs of product development and regulatory compliance, has necessitated closer integration between academic institutions and industry actors (Etzkowitz & Leydesdorff, 2000; Perkmann et al., 2013). While universities are principal generators of research and industry typically provides capabilities for development, scale-up, regulatory navigation, manufacturing and commercialization, these roles are neither strictly sequential nor mutually exclusive. Academia may become engaged in validation, clinical studies, prototyping, venture formation and implementation, while industry partners may contribute to problem definition, research design and early-stage development.
4. Industry-academia collaboration is generally shaped by the interaction of “push” and “pull” factors. Push factors are designed to encourage and facilitate the generation of new knowledge and research capacities by universities and public research institutions, with instruments such as research grants. Pull factors operate by creating conditions and markets that ensure the commercial viability of research results, stimulating demand through mechanisms such as regulatory priorities, procurement requirements and financing (Di Stefano, Gambardella & Verona, 2012). As a special pull factor, intellectual property rights and other exclusivities provide the commercial certainty necessary to justify downstream investment in the commercialization of technology. Push and pull factors influence the direction of innovative effort but do not, in themselves, determine whether a resulting technology is ultimately adopted. Diffusion research treats adoption as governed by the innovation’s relative advantage, compatibility, complexity, trialability and observability, as mediated by communication channels and social structures (Rogers, 2003). This distinction is material for the purposes of the present study, as licensing and market entry do not, by themselves, constitute adoption.
5. These forces (push and pull) are now understood as interdependent, with their interaction and sequencing shaping outcomes more than either factor’s intensity alone (Nuñez-Jimenez et al., 2022). Systematic review of evidence confirms that demand-side measures increase patenting and drive cost reduction, while sustained public research funding remains indispensable for radical innovations not yet rewarded by markets (Grubb et al., 2021). Effective technology transfer requires alignment of these forces so that promising research follows viable pathways toward development and adoption.
6. Intellectual property rights and appropriately structured licenses provide commercial certainty needed to justify high-risk downstream investment. In the context of publicly funded

research, the design of licensing arrangements varies across jurisdictions and institutions and may reflect a range of legal, policy, commercial and research considerations. The objective is generally to create a framework that enables further development and commercialization of research outputs by parties capable of undertaking the investments and activities necessary to bring those outputs to market or other forms of practical application.

7. Knowledge and technology transfer (K/TT) operates within this ecosystem. K/TT is accordingly understood as a process of co-development involving a broader network of actors, public agencies and regulators, funders, end-users, manufacturers, investors and intermediaries such as technology transfer offices and incubators, rather than a unidirectional transfer from academia to industry (Perkmann et al., 2013). K/TT operates at the center of this interface, facilitating the movement, exchange and application of knowledge, technologies, capabilities, data, materials and research outputs across institutional and sectoral boundaries (Bozeman, 2000). It encompasses multiple pathways, including collaborative and contract research, consulting and technical services, personnel mobility, data and material transfer, licensing, start-up and spin-out formation, open dissemination, manufacturing transfer, and adoption by industry, government or other public-sector users. Commercialization through intellectual property protection and licensing constitutes one significant pathway within K/TT, but not its exclusive form.

8. Consequently, K/TT is not merely an institutional or transactional function but is interacting with a broader environment shaped by legal frameworks, regulatory institutions and economic incentives. The effectiveness of K/TT systems depends not solely on the existence of formal intellectual property rights, but on the alignment of such rights with regulatory pathways, institutional practice and market dynamics (Sampat, 2006; Thursby & Thursby, 2002). The unique and distinct characteristics of the health and green technology sectors cause distinct dynamics in their interaction with K/TT, as discussed below.

B. Health technology sector and green technology sector: their unique features

9. The World Health Organization defines health technology as “the application of organized knowledge and skills in the form of devices, medicines, vaccines, procedures and systems developed to solve a health problem and improve quality of life” (WHO, 2007). Consistent with this definition, the health technology sector considered herein includes pharmaceuticals and biologics, vaccines, medical devices and diagnostics, digital-health applications, research tools, assistive technologies, and advanced modalities such as gene and cell therapies. These categories are not homogeneous and differ in development pathways, capital requirements, regulatory oversight, IP-dependence and adoption routes.

10. For analytical purposes, it is important to distinguish the technology archetypes in the health technology sector: (i) small-molecule and biologic therapeutics; (ii) vaccines and advanced therapies; (iii) medical devices and diagnostics; (iv) digital-health and AI-enabled technologies; and (v) research tools, platforms and service-delivery innovations. These provide a more reliable comparative basis than treating the sector as uniform.

11. The sector exhibits distinctive structural features. First, many health technologies, particularly novel therapeutics and advanced therapies, are *highly research-intensive*: one widely cited estimate places pre-approval development cost above USD 2.6 billion when failure rates and capital costs are included, though this figure and methodology remain contested and are not generalizable across product types (DiMasi et al., 2016). Second, *development timelines vary markedly* – advanced therapies may require a decade or more, while certain diagnostics and software tools follow shorter pathways depending on risk classification (Paul et al., 2010). Third, *regulatory oversight differs by product and jurisdiction*, administered variously by bodies such as the US FDA, the European Medicines Agency and national authorities. Fourth, *attrition is substantial*, particularly in pharmaceutical development,

where only a minority of clinical candidates achieve market approval, with rates varying by therapeutic area and methodology (Hay et al., 2014). These features render IP rights and regulatory approval complementary, rather than independent, mechanisms in the context of the health technology sector.

12. According to United Nations (Agenda 21, Chapter 34 (Rio, 1992), green technologies “protect the environment, are less polluting, use all resources in a more sustainable manner, recycle more of their wastes and products, and handle residual waste in a more acceptable manner than the technologies for which they were substitutes”. This definition has been adopted by several entities and agencies, including WIPO GREEN as its operational standard. As per the UNFCCC, green technologies fall into two categories: mitigation technologies (e.g., carbon capture, renewable generation) and adaptation technologies (e.g., drought-resistant crops, early-warning systems).

13. The green technology sector also exhibits distinctive features. First, *deployment timelines vary substantially*: mature technologies coexist with emerging solutions (e.g., green hydrogen, carbon capture, next-generation nuclear) requiring 10 – 20 years horizons (IEA, 2023). Second, *the sector is R&D-driven and capital-intensive*, varying along four dimensions: capital requirements, development stage, dependence on physical infrastructure, and adoption route (market, procurement, utility-scale or public deployment). For example, the global clean-energy investment, which is a primary sub-set of green technologies, itself exceeded USD 1.8 trillion in 2023 (Bloomberg NEF, 2024). Third, *international frameworks* (e.g. the Paris Agreement, net-zero mandates, carbon pricing and emissions trading) shape development priorities and investment flows (UNFCCC, 2015). Fourth, *commercialization carries significant risk*, with many innovations facing a “valley of death” between demonstration and deployment (Gaddy et al., 2017).

14. Unlike health technologies, which are often adopted rapidly once approval and reimbursement are secured, green technologies frequently face delayed adoption even after technical validation, owing to incumbent capacity, long amortization periods (i.e. return on capital), and entrenched supply chains. Policy instruments such as carbon pricing, procurement mandates, phase-out schedules thus function as demand-side technology transfer instruments. These must be kept in mind in the context of specific technology transfer challenges in green technologies in the context of this study.

C. The role of industry-academia knowledge/technology transfer (K/TT) in the health and green technology sectors

15. K/TT within industry-academia collaboration refers to the movement, exchange, application and adoption of knowledge, technologies, capabilities, data, materials and research outputs across organizational or sectoral boundaries. It occurs through collaborative research, consulting, personnel mobility, data transfer, open dissemination, licensing, spin-out formation and implementation partnerships. For the purposes of the present analysis, the term “*technology transfer*” is used specifically to denote the *movement of publicly funded research outputs into private-sector development and commercialization pipelines, principally through intellectual property protection, licensing and spin-out formation*.

16. There is also a vital distinction between academic engagement (collaborative research, consulting, advisory relationships) and commercialization (e.g., patent licensing and spin-outs). Academic engagement is more prevalent and motivated principally by access to expertise, facilities and funding rather than financial return (Perkmann et al., 2013). Arrangements centered on commercialization may thus capture only a limited share of actual knowledge flow. In certain niche technology sectors (e.g. biomedical alliances), embedding industry scientists in academic labs, or postdocs in firms, complements financial remuneration

by transferring tacit knowledge and building trust for future deals (Stewart et al., 2016). The broader range depends on institutional initiatives such as identifying opportunities, matching partners and sustaining relationships. Where this articulation is weak, technology transfer depends on individual initiative and becomes uneven (Siegel, Waldman & Link, 2003). Repeated interaction and accumulated trust reduce associated barriers, indicating that relationship continuity merits institutional preservation (Bruneel, D'Este & Salter, 2010).

17. K/TT is pivotal where the translational pathway is particularly complex, integrating validation, clinical trials, regulatory approval, manufacturing and reimbursement considerations. Extended timelines and high failure rates underscore the importance of early alignment among IP management, regulatory planning, funding and adoption routes (DiMasi et al., 2016).

18. K/TT in the Health Sector is central to converting publicly and privately supported research into societal benefit. It enables academic knowledge, technologies, data, materials and capabilities to be applied through multiple pathways, including collaborative research, licensing, startup formation, clinical partnerships, technical services, training, open dissemination and public-sector adoption. Intellectual property rights, including patents, may create the commercial certainty needed to attract investment in technologies requiring substantial downstream development, but exclusivity is only one mechanism through which research outputs can generate value. From a policy perspective, effective K/TT helps ensure that investment in research produces tangible benefits in the form of new or improved products, services, practices, capabilities and health outcomes.

19. In the Health Sector, academic discoveries and research capabilities must be matched with unmet clinical or public-health needs, industry demand, regulatory priorities, procurement pathways, reimbursement conditions and available financing. This connection rarely occurs automatically. It requires coordination among researchers, technology transfer professionals, healthcare providers, industry partners, funders, regulators, patients and other end-users to identify viable applications and move promising research toward development, adoption and societal use (Cockburn & Henderson, 2000).

20. Unlike general-purpose technologies, the translational pathway for green technologies confronts a structurally adverse commercialization ecosystem characterized by long demonstration timelines, often high capital requirements for scale-up, consumer preferences, multi-jurisdictional regulatory compliance burdens, and a persistent financing gap between public R&D expenditure and private investment readiness (Muhammad, Zhang and Janjua, 2024). Without active, professionally structured technology transfer, most green technologies would remain confined to laboratories, without achieving their goals: contribution to emissions reduction, resource efficiency, or climate adaptation rendering the entire public R&D investment commercially and environmentally inert. Unlike the Health Sector, K/TT pathways face a key constraint in terms of absence of immediate market demand and consumer choice available for cheaper non-green product substitutes.

D. Scope of the study and conceptual elements: macro, meso, micro levels

21. This study examines the principal aspects of how academic institutions and private companies bring innovations to market, focusing on licensing, payment arrangements and applicable regulatory frameworks. Case studies illustrate successful practices and common IP-transfer barriers. The study aims to situate comparative best practices for translating academic research into practical societal solutions in the health and green technology sectors within the context of their own national innovation ecosystems.

22. Given the broad scope of the subject matter addressed, the study provides a high-level overview of the principal aspects of K/TT in the health and green technology sectors. It is not intended to provide exhaustive treatment of all dimensions of every topic addressed, and certain areas are necessarily examined at a higher level of generality than others.

Furthermore, the study is not intended to provide an exhaustive survey of all jurisdictions, quantify technology-transfer performance across countries or sectors, or establish causal relationships between policies and commercialization outcomes. The analysis is exploratory and descriptive, and the cases are intended to illuminate broader principles rather than serve as statistically representative examples. Differences in available data, institutional reporting, terminology, and the confidentiality of many technology-transfer transactions further limit direct comparison. The study's conclusions should therefore be interpreted as practical and policy-oriented guidance that requires adaptation to the relevant technology, jurisdiction, and institutional context.

23. The study adopts a three-tier analytical model examining how the enabling environment, institutional capabilities and transaction-level arrangements interact to shape outcomes.

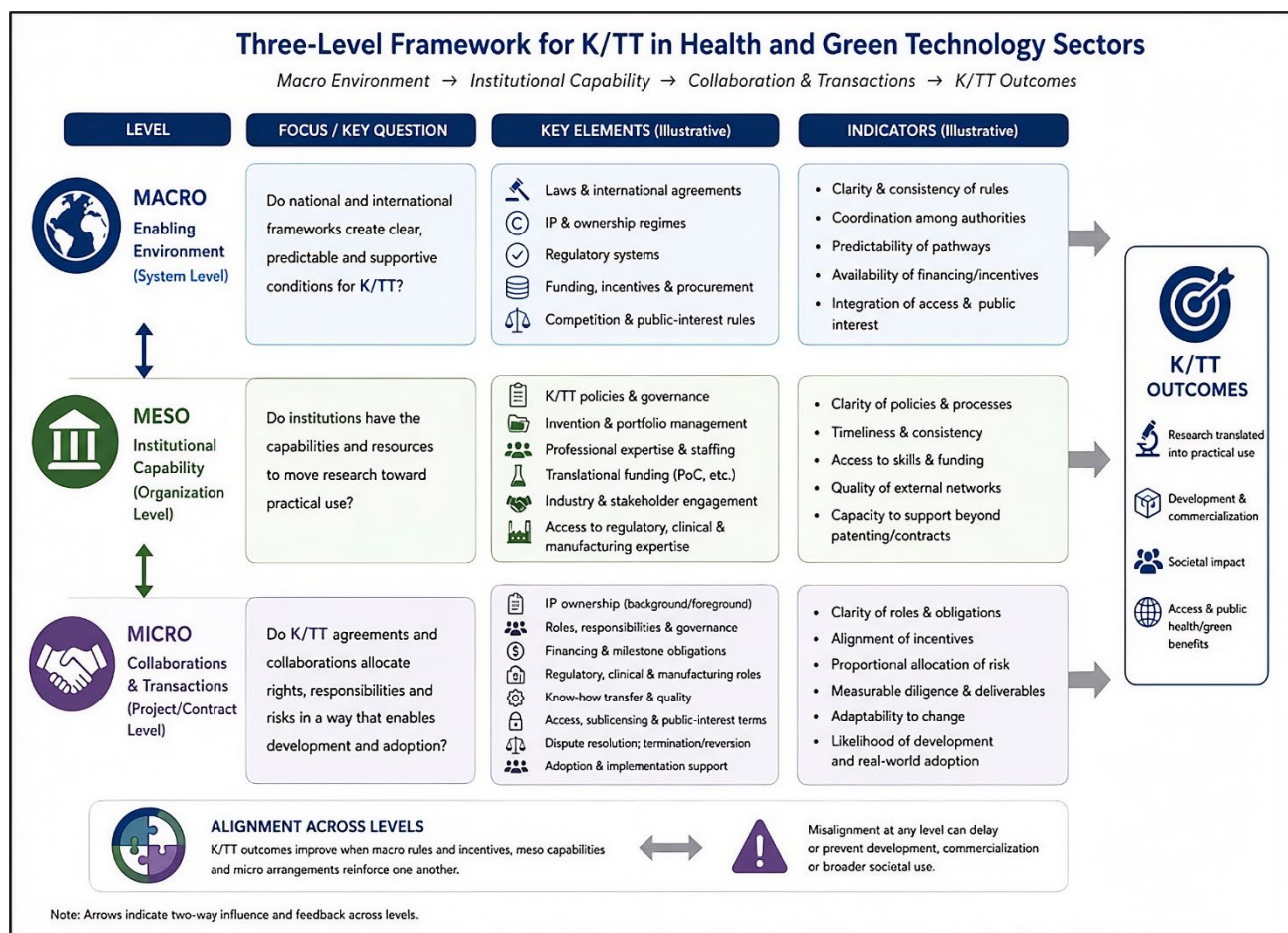
24. At the macro level, the key question is whether national and international frameworks provide clear, predictable and supportive conditions for research collaboration, knowledge protection and use, product development and deployment. The analysis covers laws and international agreements, public-funding rules, IP and ownership regimes, regulatory approval and certification, procurement and reimbursement, competition rules, fiscal incentives and other policy instruments. Indicators include rule clarity and consistency, coordination among authorities, regulatory predictability, availability of public or blended finance, and integration of public-interest and access objectives.

25. At the meso level, the key question is whether universities, public research institutions, technology transfer offices and intermediaries have the governance, expertise, resources and networks to translate research into practical use. The analysis covers IP and commercialization policies, invention and portfolio management, staffing, translational funding, conflict-of-interest rules, startup support, industry engagement and access to regulatory, manufacturing, clinical and scale-up expertise. Indicators include policy clarity, timely and consistent decisions, specialized skills and funding, strong stakeholder networks, and support beyond patent filing or contract execution.

26. At the micro level, the key question is whether collaborations allocate rights, responsibilities, risks, rewards and development obligations appropriately for the technology and its route to use. The analysis covers collaboration design, IP ownership, publication and confidentiality, financing and milestones, regulatory and development roles, know-how and manufacturing transfer, sublicensing, access safeguards, governance, dispute resolution, adoption and termination. Indicators include clear responsibilities, aligned incentives, proportionate risk allocation, measurable diligence, adaptability and prospects for actual development and adoption.

27. This analytical model, illustrated in Figure 1 below, examines how the enabling environment, institutional capabilities and transaction-level arrangements interact to shape technology-transfer outcomes.

Figure 1: Three-tier analytical model for K/TT in Health and Green Technology Sectors



28. K/TT outcomes depend on alignment among macro level rules and incentives, meso level institutional capabilities and micro-level collaboration arrangements. Supportive IP rules may have limited effect without expertise or funding, while sound licenses may not secure deployment if regulatory, manufacturing, financing or adoption pathways are unresolved. This layered framework helps identify good practices and gaps that may impede development, commercialization or societal use (Bercovitz & Feldman, 2006).

29. Table 1 below presents a comparative overview of representative technology archetypes across the health and green technology sectors, illustrating how development timelines, capital intensity, regulatory pathways, intellectual property dependence, and typical financing and adoption routes vary substantially by technology type.

Table 1 — Comparison by technology archetypes in health and green technology sectors

Technology archetype	Development time	Capital intensity	Regulatory pathway	IP dependence	Typical financing & adoption route
Small-molecule / biologic pharmaceuticals	10–15 years	Very high	Full clinical trials + market authorization (FDA/EMA)	High – patents central	VC, pharma partnerships, exclusive licenses
Medical devices & diagnostics	3–7 years	Moderate-high	510(k)/PMA; EU MDR/IVDR certification	Moderate – patents + design + know-how	Strategic/device investors, licensing
Digital health / health software	1–3 years	Low-moderate	Light–moderate (Software-as-a-Medical-Device)	Low–moderate – copyright, trade secret	VC, SaaS revenue, non-exclusive licenses
Industrial cleantech hardware (green H ₂ , CCUS)	8–15+ years	Very high, infrastructure-heavy	Environmental & safety permitting	Moderate – patents + process know-how	Project/blended finance, offtake, JV
Grid / energy software & data tools	1–3 years	Low-moderate	Standards & interoperability	Low – trade secret, standards	VC, service contracts, open/standard licenses
Climate adaptation technologies	Variable	Low-moderate	Sector-specific; often public procurement	Low–moderate	Grants, development finance, procurement

E. Methodology and limitations of the study

30. This study adopts a qualitative, comparative and practice-oriented methodology. It draws on a review of academic literature, legislation, policy documents, regulatory guidance, institutional policies, publicly available knowledge/technology-transfer materials and selected Case Studies from the health and green technology sectors. The analysis is supplemented, where applicable, by the expert contributions of the authors and by information provided through WIPO-supported case-study inputs. Where relevant, input received from WIPO Member States in response to Note C. 9304 was also used in the preparation of this study.

31. Jurisdictions were selected to illustrate different legal, regulatory, institutional, and economic contexts rather than to provide a statistically representative global sample. The study includes examples from established knowledge/technology-transfer ecosystems, emerging innovation systems and jurisdictions facing capacity or implementation challenges. Selection was also influenced by the availability of sufficiently reliable information and the relevance of the jurisdiction or example to the study's principal themes. The examples do not rank jurisdictions or attribute outcomes to any single legal, economic or institutional factor.

32. Case studies were selected purposively to illustrate distinct technology-transfer pathways, collaboration structures, licensing approaches, remuneration models, regulatory

environments or institutional-capacity conditions. The cases are therefore illustrative rather than representative. Where case information was based on confidential or non-public contributions, the analysis relied on information supplied by the relevant contributor or case owner and was presented at a level of detail considered appropriate for this study. Case Studies are summarized in the study, with a more detailed description in the Appendix. The cases should not be understood as independently audited evaluations unless expressly stated.

33. In assessing practices, the study considers whether an approach is supported by documented experience, has been used in more than one relevant context, addresses an identifiable knowledge/technology-transfer challenge and appears capable of adaptation to other institutions or jurisdictions. Because effectiveness depends heavily on sector, technology maturity, institutional capacity, financing conditions and local legal frameworks, practices described as 'best practices' should be understood as context-dependent approaches rather than universally applicable prescriptions.

Part II: International and national/regional regulatory frameworks

A. International regulatory framework

1. Health technology sector

34. The international regulatory and IP framework provides the broader legal and policy environment within which national health technology transfer systems operate. These frameworks influence how countries protect intellectual property, regulate access to medicines, structure public health exceptions, participate in cross-border collaborations, and engage in global health innovation. While national laws determine the domestic frameworks of technology transfer, international frameworks create important baseline expectations and constraints. Technologies developed in one country may be clinically tested in another, manufactured in a third, and distributed across multiple regions. As a result, health technology transfer often depends on the ability to navigate multiple legal and regulatory systems simultaneously. International IP frameworks therefore facilitate cross-border technology flows by creating legal certainty and predictability to engage in technology transfer in different jurisdictions.

a) TRIPS Agreement

35. The WTO Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS) sets minimum standards for IP protection and enforcement without distinguishing among rights held by universities, public research institutions or companies, or directly regulating industry-academia collaboration. It provides a common baseline for territorial IP protection but leaves ownership, contracting, enforcement and commercialization largely to national law and the parties. Predictable cross-border licensing also depends on patent quality, regulation, markets, finance, institutional K/TT capacity and partners' ability to develop and absorb technology. Parties must therefore assess both formal IP rights and practical conditions in each jurisdiction.

36. TRIPS also recognizes technology transfer as an objective. Article 66.2 requires developed-country members to incentivize enterprises and institutions to transfer technology to least-developed-country members to help build viable technological bases. In health technology, this may support research partnerships, licensing, technical assistance, manufacturing capacity and institutional development. Some examples include technologies transferred and other initiatives involving collaboration between developed-country institutions and universities and/or public research organizations in LDCs (Watal, 2018). However,

international IP standards alone are insufficient for industry-academia collaboration. Cross-border research and licensing agreements operate in a much more complex environment: parties should clarify background and foreground IP ownership, observe foreign filing requirements and cater for enforcement, provide access to data and materials, agree on publication rights, and arrange for regulatory roles, manufacturing expectations and development costs. These matters are governed mainly by national law and contract, not the TRIPS Agreement. Because patents remain territorial, institutions should make selective international filing decisions based on costs, partners, manufacturing locations, public-health needs and realistic development pathways.

b) WHO and global health governance

37. WHO influences health-related K/TT principally through normative public-health frameworks and operational mechanisms that support regulatory capacity, technology sharing, local production and access to essential health products. These mechanisms include regulatory guidance and reliance, technical assistance, manufacturing-capacity development, voluntary licensing and pooling initiatives, workforce training and coordinated technology-transfer programs. Their relevance to this study lies not merely in articulating general access principles, but in shaping whether recipient institutions and manufacturers possess the knowledge, quality systems, regulatory capability and production capacity required to absorb and apply transferred technologies. In the context of technology transfer, WHO's role is particularly significant in several areas.

38. First, the WHO supports regulatory strengthening and harmonization, especially in countries where national regulatory authorities may have limited capacity. Without regulatory capacity, even well-licensed technologies from the academia to the industry may fail to reach patients. Second, WHO supports operational technology transfer and manufacturing capacity. For example, since COVID-19, its mRNA Technology Transfer Program connects partner institutions (e.g., universities in South Africa and India) and manufacturers by combining technical knowledge, workforce development, quality systems, regulatory readiness and manufacturing capability, rather than relying on access to patented knowledge alone. Third, the WHO Pandemic Agreement (2025), while not in force yet, addresses the transfer of relevant technology, including the transfer of knowledge/skills, technical expertise, related know-how for the production of pandemic-related health products on mutually agreed terms within networks established by the WHO and beyond. Finally, WHO's work also highlights that technology adoption also depends on clinical utility, health technology assessment, reimbursement or procurement, integration into clinical practice, infrastructure, trained personnel, user acceptance, supply continuity and maintenance. These downstream conditions should inform early K/TT decisions because they shape product design, evidence generation, partner selection, manufacturing, pricing and commercial or public-use viability.

39. For universities, public research institutions, governments and industry partners, the above dimension reinforces the importance of considering technology and know-how transfer, geographically diversified production, training and manufacturing capability as part of pandemic preparedness rather than only after an emergency arises.

40. For industry-academia collaboration, the global health framework is particularly important, because universities often pursue public missions that extend beyond revenue generation, while industry partners must justify the investment required for product development, regulatory approval, manufacturing and market entry. These considerations are especially relevant when research is publicly funded or addresses diseases that disproportionately low- and middle-income countries (LMICs) (World Health Organization, 2020).

41. At the meso level, academic and public research institutions can embed public-health objectives in IP management by assessing public policy considerations and manufacturing needs early; preserving research and educational rights; clarifying background and foreground IP; determining appropriate licensing structures in light of the technology and development pathway and using measured diligence, territorial, field-of-use, sublicensing or access terms, where justified. Integrated internal review should consider legal, scientific, regulatory, commercial and public-interest factors before major collaboration or licensing decisions, while keeping terms commercially workable for a capable partner (Siegel et al., 2003).

42. Other international and mission-driven organizations, including the Coalition for Epidemic Preparedness Innovations (CEPI), the Global Alliance for Vaccines and Immunization (GAVI), the Medicines Patent Pool (MPP), the World Bank, the United Nations Industrial Development Organization (UNIDO) and the United Nations Conference on Trade and Development (UNCTAD) complement WHO's role through financing, market shaping, licensing, industrial-capacity development and technical assistance.

2. Green technology sector

43. Similar to the Health Sector, the TRIPS Agreement creates the sector-agnostic benchmark for IP protection and enforcement, that applies to green technologies as well. As discussed above, its relevance is indirect: by recognizing intellectual property rights, without distinguishing between company and academic holders, it supplies the baseline certainty on which cross-border licensing depends. Provisions that relate to technology dissemination (Articles 7 and 8) do not specifically deal with industry-academia technology transfer but more broadly with balancing IP protection with socio-economic goals and with the ability of the WTO Members to take measures consistent with other obligations to prevent practices that may have an adverse effect on international transfer of technology. Article 66.2 obliges developed-country Members to provide incentives to enterprises and institutions in their territories to promote technology transfer to least-developed country Members; and Article 67 adds technical and financial cooperation.

44. The reporting conducted within the framework of Article 66.2 of the TRIPS Agreement indicates that climate, energy and environmental technologies are among the broad fields in which incentive programs are concentrated, alongside health and agriculture. The measures reported are predominantly public funding, training and cooperation rather than fiscal or regulatory incentives directed at right holders, and successive TRIPS Council reviews have noted the difficulty of assessing their effects. Related work on trade and transfer of technology has produced no agreed outcomes but remains the principal multilateral forum in which patent protection and green technology transfer are discussed together (WTO, 2024). But these are not specifically in the context of industry-academia collaboration and associated K/TT challenges.

45. The international framework of most direct relevance to green technology transfer is the United Nations Framework Convention on Climate Change. Article 4.5 of the Convention commits developed-country Parties to promote, facilitate and finance the transfer of green technologies. This framework, established in 2010, operates through two bodies with distinct functions: the Technology Executive Committee, which addresses policy questions and analytical work, and the Climate Technology Centre and Network, which responds to requests from developing-country Parties with technical assistance, capacity building and support for technology needs assessments. Additionally, Article 10 establishes a long-term vision on technology development and transfer, creates a technology framework to provide overarching guidance to the Technology Mechanism, and links technology support to financial support, principally through the Green Climate Fund (UNFCCC, 2015, Article 10). However, its role in industry-academia technology transfer is limited.

B. National and regional regulatory frameworks

46. National and regional regulatory frameworks operate as the macro-level architecture within which knowledge and technology transfer (K/TT) takes shape, establishing the foundational rules on ownership, funding, protection, validation, approval, manufacturing and commercialization that determine whether research outputs can move from academic institutions into industry and public use. Yet these macro-level conditions do not function in isolation. Their practical effect is mediated by meso level institutional capacity such as technology transfer offices, commercialization expertise, and regulatory readiness, and ultimately realized or constrained at the micro level, through the specific contractual, licensing, and collaborative arrangements negotiated between universities, industry partners, and other stakeholders. This layered interdependence means that even well-designed national policies or regional harmonization mechanisms cannot by themselves guarantee successful technology transfer, adoption, or market translation, since outcomes remain contingent on institutional readiness, partner capability, financing structures, and sector-specific development pathways. The following analysis therefore examines selected jurisdictions not to establish a universal model, but to illustrate how macro, meso, and micro levels interact symbiotically within each specific context, revealing that regulatory frameworks are necessary conditions for effective K/TT but are rarely sufficient in themselves.

1. Health technology sector

47. National and regional regulatory frameworks shape how health technologies move from academic research to industry development and public use. Beyond IP assignment or licensing, K/TT depends on legal, regulatory and policy conditions governing protection, validation, approval, manufacturing and commercialization. Given long timelines, high costs, scientific uncertainty and strict regulatory oversight, university inventions become viable products only when regulatory pathways, ownership, patents, funding and industry partnerships are aligned. These frameworks are therefore active determinants of technology-transfer outcomes.

a) The United States of America

48. The United States of America has a highly developed health-technology ecosystem supported by sustained federal biomedical funding, a large life-sciences market, mature regulatory institutions, substantial private financing, experienced research institutions, entrepreneurial infrastructure and strong industry capacity to develop external research.

49. The Bayh-Dole Act of 1980 clarified ownership and commercialization responsibility for federally funded inventions. Subject to statutory conditions, it allows universities, nonprofit institutions and small businesses to retain title and manage patenting and licensing. It was an important framework, but not the sole cause of growth in US university technology transfer. The Bayh-Dole Act has been especially important in health technology because federal agencies, notably the National Institutes of Health (NIH), fund much early-stage biomedical research. University ownership helped institutionalize technology transfer offices, patenting, licensing and collaboration with biotechnology and pharmaceutical companies.

50. Universities retaining federally funded inventions must disclose them, elect title, file patents and pursue commercialization. The government retains a non-exclusive license and statutory safeguards, including march-in authority where specified conditions are met, such as failure to achieve practical application or certain health, safety or public-use needs. Never exercised to date to compel licensing, march-in rights remain a safeguard rather than a routine pricing or license-review mechanism.

51. Certain exclusive US licenses for federally funded inventions also carry a domestic-manufacturing preference, increasingly relevant to health technology, supply-chain security and domestic production after COVID-19. Licensing must therefore address both commercial terms and federal obligations. During COVID-19, Operation Warp Speed showed that federal support may also combine R&D funding, advance procurement, manufacturing expansion, supply-chain coordination and regulatory engagement. IP treatment varied by agreement, background IP and government contribution; while no uniform ownership regime applied. Its broader significance was demonstrating how procurement and development contracts, alongside patents and licenses, can accelerate development and scale-up during emergencies (US Government Accountability Office, 2021; Patent and Trademark Law Amendments Act of 1980).

52. The NIH further influences health technology transfer through funding and public-access policies, licensing expectations, and guidance on research tools and biomedical resources. It is therefore both a major research funder and a policy actor shaping the management, dissemination and translation of publicly funded biomedical discoveries.

53. The US Food and Drug Administration (FDA) adds a critical layer, with pathways varying by technology. Drugs and biologics generally require preclinical and clinical development before marketing review; devices follow routes based on risk and classification; diagnostics depend on intended use and risk; and digital-health products may face device regulation or other oversight according to their functions and claims. These differences shape evidence requirements, timelines, costs, quality systems and commercial attractiveness.

54. Regulatory authorization alone does not ensure adoption. Commercial value may also depend on reimbursement, procurement, clinical utility, workflow integration, manufacturing quality, supply chains, post-market surveillance and user acceptance. Institutions and partners should therefore assess the full pathway from validation to adoption, not only patentability or approval. In pharmaceuticals and biotechnology, patents interact with regulatory protections such as data, orphan-drug, pediatric and biologics exclusivity. These layered protections may offset effective patent-life losses from lengthy development and approval, supporting investment in high-risk technologies (Grabowski, 2002).

55. Under the macro, meso and micro framework, the United States of America shows strong formal alignment through established ownership rules, substantial public funding, mature regulators and varied institutional and contractual mechanisms. Yet the ecosystem is heterogeneous: leading research universities may have extensive legal, regulatory, entrepreneurial and investment networks, while smaller or less research-intensive institutions often lack comparable staffing, funding, industry links and scale-up support.

56. At the macro level, federal funding, IP law, regulatory pathways and markets form a developed enabling environment. At the meso level, many universities have technology transfer, conflict-of-interest, sponsored-research and commercialization systems. At the micro level, licenses, options, research and material-transfer agreements, startup arrangements and clinical collaborations provide varied transaction pathways.

57. Persistent constraints nevertheless remain. Many university inventions are early-stage and need further validation, funding and regulatory planning, while commercialization capacity varies widely. Policy debates also concern exclusivity, affordability and access, development diligence and public returns from federally funded research, particularly for high-priced or supply-constrained products. Appropriate contractual responses depend on the technology, market and development context.

b) The European Union

58. The European Union combines decentralized national rules on IP ownership, university policy and technology transfer with increasing EU-level harmonization of research, regulation, funding and market integration (Geuna & Rossi, 2011). Some health-technology functions are coordinated at EU level, while ownership, reimbursement, procurement and institutional practices remain largely national. Technologies may therefore benefit from EU-wide regulation yet currently face different national market and commercialization conditions.

59. University technology transfer also varies across member states. Some historically applied “professor’s privilege” that allowed individuals to own their research in publicly funded institutions, while others assigned inventions to institutions; several later moved toward institutional ownership. Yet national laws, employment rules, inventor compensation and institutional policies still differ. Formal ownership changes alone do not ensure stronger commercialization: expertise, incentives, professional capacity and industry relationships remain decisive (Geuna & Rossi, 2011). Companies therefore seek clear ownership, coordinated decisions and predictable licensing.

60. Health K/TT requires alignment of IP with clinical trial, data protection, device, market-authorization and reimbursement requirements. Evolving rules for devices, diagnostics, digital health and advanced therapies protect patients but may burden early-stage innovators. The EU model thus combines EU-level regulation and funding, uneven institutional commercialization capacity, and agreements shaped by national ownership, contracting, state-aid, data-protection and commercialization rules.

61. Regulatory pathways vary by technology. For many innovative medicines, the European Medicines Agency (EMA) conducts centralized scientific assessments and the European Commission grants EU/EEA-wide marketing authorization; other medicines use decentralized, mutual-recognition or national procedures. Medical devices and *in vitro* diagnostics are governed mainly by the EU Medical Device and In Vitro Diagnostic Medical Device Regulations. Market entry generally requires conformity assessment and CE marking, with notified bodies involved according to risk and national authorities responsible for enforcement and surveillance.

62. Authorization or CE marking does not ensure adoption. Pricing, reimbursement, procurement, health technology assessment and healthcare delivery remain substantially national. Although the EU Health Technology Assessment Regulation has coordinated joint clinical assessments since January 2025, national access and reimbursement decisions continue to affect evidence needs, costs, partner selection, market entry and commercial value. EU research institutions, Horizon Europe and cross-border collaboration support translation, but national differences in ownership, university systems and commercialization capacity may impede industry partnerships. Regional harmonization supports technology transfer but does not eliminate local variation. Effective collaboration therefore requires professional K/TT capacity, cross-border coordination and expertise in both EU and national legal, institutional and market conditions.

c) India

63. India is a useful case because of its scale, scientific capacity, major pharmaceutical and vaccine industries, and growing emphasis on innovation, entrepreneurship and technology transfer. It illustrates how weaknesses at one level of the K/TT system can constrain progress at another. Despite a substantial academic and public-research base, conversion of research into licenses, partnerships, startups, products and adoption remains uneven.

64. At the macro level, India lacks a uniform Bayh-Dole-style framework for publicly funded university inventions. A 2008 Bill proposing one was not enacted, so institutions generally follow their own IP policies and funding terms (PUPFIP Bill 2008). Thus, voluntary model guidance supports policy design to some extent (DPIIT Model Guidelines), but decentralized rules can create variation in ownership, incentives, disclosure and commercialization, reducing predictability for researchers, funders and industry.

65. India's patent framework also shapes health-technology development through rules governing patentability, ownership, licensing and enforcement. In pharmaceuticals, product-patent protection operates alongside public-health safeguards (Chaudhuri, 2005). Formal patent rights, however, are only one component of the enabling environment. Their practical value depends on institutional ownership clarity, translational funding, regulatory planning, manufacturing capability and the availability of development partners able to advance the technology.

66. National programs support translational research, proof-of-concept work, incubation, startups and industry partnerships. Biotechnology initiatives backed by the Department of Biotechnology and the Biotechnology Industry Research Assistance Council (BIRAC) provide grants, incubator networks, validation support and early-stage finance. Their effectiveness should be measured by validated technologies, collaborations, licenses, startups, follow-on investment and progress toward approval or adoption, not merely by program numbers.

67. At the meso level, institutional capacity varies widely. Some universities and research organizations have professional IP, incubation and commercialization functions; others rely on limited staff, fragmented decisions or external support. Common gaps include market assessment, proof-of-concept funding, licensing expertise, industry networks, and regulatory, clinical, manufacturing and business-development capability. Patent filing alone has little translational value without validation and a viable development pathway.

68. This uneven capacity sustains a gap between research and translation. A strong research base and major pharmaceutical and vaccine-manufacturing sectors do not themselves demonstrate effective academic K/TT. Many technologies remain early-stage, insufficiently validated, or lack regulatory strategy, development funding and partners. Stronger evidence comes from collaborations combining public-research technology and know-how with industry development, regulatory, manufacturing and distribution capabilities (Stewart et al., 2016).

69. At the micro level, success depends on well-designed collaboration and commercialization arrangements. Partners may be needed not only for finance but also for validation, regulatory submissions, quality systems, manufacturing, supply chains and market entry. IP ownership, development roles, data and materials, publication and confidentiality, milestones, manufacturing, sublicensing, governance and termination are often key components of agreements. Early integration of IP, regulatory and development planning can attract capable partners and reduce delays.

70. In accordance with its public policies, publicly supported technologies addressing major domestic health needs may be subject to implementation of proportionate safeguards, including development milestones, manufacturing or supply commitments, access terms, retained research rights and reversion for non-development (ICMR guidelines, 2021). Their value should be assessed through evidence of improved development or access and implementation challenges. Overly restrictive pricing, manufacturing or territorial conditions may deter capable partners.

71. Viewed across the three levels, India's main challenge is incomplete alignment. Macro level support for innovation, IP, startups and translation coexists with varied ownership and commercialization rules. Meso level institutions differ in staffing, proof-of-concept resources, regulatory expertise, industry links and commercialization support. At the micro level, licensing, co-development, startup and manufacturing arrangements remain uneven, and many technologies do not progress beyond disclosure, patenting or early validation. This explains why strong research and industrial capacity do not consistently yield proportionate academic K/TT outcomes. National programs have limited effects without institutional expertise and translational resources, while capable institutions still struggle when regulatory, finance, manufacturing or adoption pathways are unresolved.

d) Africa: selected contexts

72. Health-technology transfer systems across Africa vary widely in legal, institutional and economic conditions, including research and regulatory capacity, manufacturing, industry demand, finance and institutional K/TT capability. The discussion therefore identifies recurring challenges through selected national and regional illustrations, not a single continental model. The macro, meso and micro framework shows that constraints differ by jurisdiction, from regulation, finance and manufacturing to institutional capacity, partners and development pathways.

73. Comparative dimensions include regulatory maturity, the scale and specialization of public research, local manufacturing and clinical-development capacity, capable industry or public purchasers, professional K/TT functions, and access to proof-of-concept, validation and scale-up funding.

74. South Africa, Egypt, Kenya, Rwanda, Senegal and Ghana illustrate different combinations of these capabilities. Regional mechanisms such as ARIPO, OAPI and regulatory-harmonization initiatives provide coordination but do not replace national research, regulatory, financing or commercialization systems. The examples show, rather than rank, how macro conditions, meso capabilities and micro arrangements shape K/TT outcomes. Regional IP mechanisms may facilitate protection and cross-border licensing, but commercialization still depends on national institutions, finance, industry and markets (World Health Organization, 2024; United Nations Industrial Development Organization, 2025).

75. At the macro level, regulatory capacity also varies. Some jurisdictions have mature authorities or participate in regional harmonization and work-sharing; others rely more on external review or donor-supported capacity building. Unclear expectations, timelines or responsibilities increase development risk and deter investment in local validation, manufacturing and market entry.

76. At the meso level, IP laws do not automatically create effective K/TT. Universities and research institutions may lack experienced staff, legal support, proof-of-concept funding, regulatory expertise and industry networks needed to identify, protect and commercialize inventions and move them toward clinical or public-health use.

77. South Africa illustrates interaction across the three levels. Its publicly financed R&D law governs resulting IP, established the National Intellectual Property Management Office and supports institutional technology transfer offices. Several universities and public research institutions have developed comparatively strong K/TT capabilities. The WHO-supported mRNA Technology Transfer Program combines technology and know-how transfer, training and regional manufacturing objectives. Yet legal and institutional capacity alone is insufficient without sustained finance, regulatory readiness, quality manufacturing, demand and procurement.

78. African institutions also offer substantial opportunities for locally relevant innovation in infectious diseases, diagnostics, vaccines, maternal and child health, digital health and medical devices. The central challenge is linking this research to the finance, validation, regulation, manufacturing, procurement and implementation needed for sustained use in local health systems (World Health Organization, 2024).

79. At the micro level, commercialization and licensing must fit the technology, development stage, investment, market, regulatory pathway, partner capabilities and purchaser. Exclusive licensing may suit technologies requiring substantial private investment; non-exclusive licensing may suit research tools, service models, standardized technologies or multi-supplier needs. The appropriateness of any licensing model depends on the characteristics of the technology, market conditions and the objectives of the parties. Regional manufacturing, public-private partnerships, social enterprises, humanitarian licensing and global-health collaborations may also work where demand, finance, quality systems and implementation capacity are viable. The appropriate model is the one that mobilizes needed capabilities and finance while enabling development, supply and adoption.

80. These are context-dependent options whose effectiveness should be assessed through cases identifying the technology, parties, contractual and financing structures, partner capabilities, regulatory pathway, demand and measurable outcomes. The central issue is not a continent-wide deficiency but differing patterns of misalignment. Policies have limited effect where regulation, finance, manufacturing or demand are weak; institutions lack specialized staff, funding or networks; and collaborations may fail without clear development, financing, regulatory, manufacturing and adoption responsibilities. Effective health K/TT therefore requires aligned policy, institutional capability, transaction design, regulatory planning, capable partners, finance and access objectives.

2. Green technology sector

81. A wide variety of countries have established laws and regulations covering tech transfer, however in most cases, no specific provisions have been incorporated on K/TT of green technologies specifically. As analyzed below, several jurisdictions focused on increasing the technology transfer traction from R&D generated by public funds or oversight of licensing agreements from foreign entities to local industry. However, across the jurisdictions examined, most legislations are technology-neutral, and very few jurisdictions have enacted provisions specific to green technologies. This is not in itself a deficiency. The IP ownership and licensing rules apply to green technologies as they apply to any other subject matter and are the legal basis on which most publicly funded green technology transfer is in fact conducted. The relevant question is therefore not whether green-specific legislation exists, but whether the general framework operates adequately for green technologies.

a) The United States of America

82. At the macro-level, the United States of America has no technology transfer legislation specific to green technologies. Transfer of publicly funded green research operates under a technology-neutral statutory framework assembled since the 1980s. As discussed above, the Bayh-Dole Act (1980) permits universities, non-profit organizations and small businesses to elect title to inventions arising from federally funded research, subject to disclosure obligations, a domestic manufacturing preference, government license rights and march-in provisions. The Federal Technology Transfer Act (1986) authorizes federal laboratories to enter into Cooperative Research and Development Agreements (CRADAs) with private partners and to grant collaborating parties advance rights in resulting inventions. The Stevenson-Wydler Technology Innovation Act (1980) makes technology transfer a statutory mission of federal laboratories and requires them to establish Offices of Research and

Technology Applications. Subsequently, the National Technology Transfer and Advancement Act (1995), required federal agencies to use voluntary consensus standards developed by private standards bodies and clarified royalty entitlements of federal employee inventors.

83. By being technology-neutral, these instruments are the legal basis on which the majority of United States of America's green technology transfer from public research is conducted. Their operation in the environmental field is well documented. The Environmental Protection Agency (EPA) administers a dedicated Federal Technology Transfer Act program through which it licenses EPA-owned inventions and enters into CRADAs with companies, universities and other partners in fields such as air quality measurement, water treatment, remediation and emissions monitoring, and which functions as the principal channel through which environmental technologies developed in federal laboratories reach industry (US EPA, 2025). These instruments do not contain any provision differentiating green technologies from other subject-matter, whether through preferential treatment, dedicated funding or specific licensing conditions.

84. At the meso level, sector-specific interventions in the United States of America have instead taken the form of time-limited administrative measures at the patent office rather than amendments to transfer legislation. The USPTO operated a Green Technology Pilot Program between December 2009 and March 2012, capped at 3,500 applications accorded special status, and subsequently a Climate Change Mitigation Pilot Program launched in June 2022 and expanded in June 2023, which was suspended on 28 January 2025 and formally terminated in April 2025 in order to redirect examination resources to overall pendency (USPTO, 2025).

85. Similar examples are seen at R&D institutions at the micro-level. Long-horizon, industry-co-financed research platforms such as the MIT Energy Initiative and the Precourt Institute for Energy at Stanford University allocate rights in resulting inventions in advance, by contract, within the ownership regime established by the Bayh-Dole Act. Sponsoring companies typically obtain a first option to negotiate a license rather than ownership. At federal level, the Department of Energy National Laboratory system conducts its industrial collaboration principally through the CRADA mechanism created by the Federal Technology Transfer Act.

b) The European Union

86. As in the United States of America, the European legal framework applicable to industry-academia technology transfer is generic rather than green-specific at the macro level. While the general legal architecture of patent protection and enforcement is available to academic outputs, there is no special regime for green technologies. The European Patent Convention (encompassing the EU and further European countries) provides a centralized patent grant procedure whose principal practical effect is to reduce the cost of obtaining a multi-country patent portfolio that international licensing of green technologies typically requires. Although the Convention does not provide green-specific incentives, the Cooperative Patent Classification (CPC) system developed jointly by the EPO and USPTO includes the Y02 category, which enables systematic cross-technological tracking of climate-related patent activity. This is an administrative tool for analysis, not a source of patent-based legal protection or licensing incentives.

87. Since 2022, the EU valorization policy focuses on turning research and data into practical and sustainable solutions for societal benefit and for the benefit of the economy (COM/2022/391 final). Among the key pillars of this non-binding EU level architecture, which mainly addresses national, regional and local policy makers include certain codes of practice introduced as part of the EU valorization policy. For the purposes of this study, two key codes of practice are relevant: a Code of Practice on intellectual assets management adopted in

2023 ((EU) 2023/499) and the code of practice on industry-academia co-creation adopted in 2024 which provides practical guidance and tools for actors and stakeholders involved in research and innovation in order to bridge the gap between scientific research and the market by fostering successful industry-academia co-creation ((EU) 2024/774).

88. The Code of Practice on intellectual assets management recommends strategic management of intellectual assets, including data, know-how and standards, aligned with institutional missions and open science and innovation. It supports relevant IP creation, protection, clear ownership and safeguards against ownership conflicts that can potentially arise in industry-academia collaborations. It aims to further the objectives of the Green Deal and sustainable development goals by requiring knowledge diffusion and (re)-use of results for economic and societal benefit. For jointly owned research results, public research organizations should be able to license third parties, including startups, if the industry partner does not exploit them within an agreed period. In case where the research is predominantly publicly funded, the code establishes guiding principles that would require the organization to grant preferential but commensurate access to the industry partner, based on its contribution to the research or background upstream IP, even with the participating public research organization retaining ownership. The policy further advocates grant of non-exclusive licenses under fair and reasonable conditions to legal entities in the context of public emergencies, including for the purposes of accelerating commercial exploitation during public emergencies ((EU) 2023/499).

89. Competition law regimes for technology transfer affect how universities operate their licensing regimes. In 2026, the revised Technology Transfer Block Exemption Regulation (TTBER 2026) took effect in the EU which applies when technology transfer offices venture into EU markets through licensing (CASRAI, 2026). The determination of whether certain standard licensing terms (e.g. exclusivity, field-of-use restrictions, territorial limits) are lawful would be determined by the application of safe harbors under TTBER 2026. Most importantly, the revised TTBER address data licensing markets protected under copyright or by EU *sui generis* database right, which is relevant for TTOs which are engaged in licensing curated datasets for various purposes (e.g. model training), apart from conventional licensing of patents and know-how (CASRAI, 2026).

90. At the meso level, the EU Green Deal, while establishing ambitious climate and sustainability policy targets, does not include specific provisions regulating the transfer of green technologies or conditioning licensing terms. The OECD's work on university-industry collaboration further documents how institutional IP policies and collaborative research agreements shape technology transfer outcomes across member states. Also, the terms and conditions of competitive calls provide further regulations. One of the main programs, Horizon Europe, comprises open science obligations in its grant agreements, including mandatory immediate open access to peer-reviewed publications and responsible data management on the principle of open by default with justified exceptions. These obligations directly condition the timing of disclosure and therefore the sequencing of patent filing in publicly funded green research.

91. At the meso level, European TTOs operate substantial licensing portfolios and comparatively high rates of spin-out formation. However, their annual reports do not generally disaggregate green technology from other subject matter, and aggregate institutional licensing income is not by itself evidence of effectiveness in green technology transfer, since headline figures are frequently driven by a small number of exceptional licenses in unrelated fields.

c) Latin America

92. The Latin American region as a whole does not have an overall legal or regulatory architecture to foster green technology transfer agreements. The recommended starting point is a structured review of existing applicable laws and regulations which is first at the national level, then scaled to regional integration bodies such as Mercosur, the Andean Community, and the Pacific Alliance. In the context of Mercosur, the recently signed EU-Mercosur interim trade agreement (2026), although containing among its objectives the balance between protection and enforcement of intellectual property rights and effective transfer and dissemination of technology allowing policy space to regulate international transfer and dissemination of technology consistent with the obligations in the agreement, has no specific provisions defining any regime for university-academia K/TT or on green technologies in particular (Chapter 13 on IP (Article 13.2(b)) and Article 13.3(3)). Similarly, within the context of Andean Common Regime on Industrial Property, the overarching provisions on patent rights and patent licensing provide legal stability for engaging in technology licensing, but do not contain rules that have a specific reference to industry-academia technology transfer.

93. During 2026, Chile approved a new law on technology transfer and IP provision (*Ley de Transferencia de Tecnología y Conocimiento Ley N° 21.838*) focusing on the creation of new spin-outs, increasing the relationship between universities and industry, and promoting open access. On the issue of technology transfer, the Chilean legislation specifically promotes the creation and strengthening of Science and Technology-Based Companies (STBs) and advocates of socially responsible licensing for outputs of publicly funded research (Carey and Fuentes, 2026). Thus, the macro-level initiatives shows emerging regulatory frameworks in some jurisdictions in Latin America.

94. In the Latin American context at the macro level, the Pacific Alliance grouping (i.e. Chile, Colombia, Mexico and Peru), has established a regional mechanism called the Pacific Alliance Innovation Ecosystem (EAIP) for promoting innovation, innovative entrepreneurship and competitiveness among the member countries within the framework of Technical Group Innovation under the Alliance. The design, coordination and implementation of strategies, programs and instruments aimed at accelerating innovation and strengthening productive capacities is the objective of this mechanism. While Member States have autonomy in designing and implementing the regulatory architecture in tune with their national innovation policies or institutions, particularly in the context of K/TT, a network of TTOs has been established under this initiative to strengthen and coordinate capacities of startups and companies for use and commercialization of technologies (Pacific Alliance Group, TGI, 2026).

95. At the meso level, the existing capabilities and maturity of TTOs throughout the region remain incipient and are pending effective market fit with the productive sector. The *Oficina de Transferencia y Licenciamiento* (OTL- Transfer and Licensing Office), *Oficina de Transferencia de Resultados de Investigación* (OTRI- Office for the Transfer of Research Results) and *Núcleo de Inovação Tecnológica* (NIT- Core for Technological Innovation) programs in Chile, Colombia and Brazil, respectively, have expanded the university-industry interface and increased patent filings and IP registrations; however, license agreement volumes, licensing income, and the number of market-active science-based startups remain limited. These are distinct and non-interchangeable indicators of TTO maturity: patent counts reflect research output, licensing income reflects commercial traction, and spin-off formation reflects entrepreneurial ecosystem depth. Each requires separate measurement against independently defined benchmarks. In countries such as Peru, Panama and Uruguay, TTO programs are at an emerging level, having been established only in recent years. Several research institutions from Chile, Argentina, Peru and Brazil have employed the WIPO GREEN platform to facilitate licensing of environmentally friendly technologies.

d) Horizontal survey: accelerated patent examination programs for green technologies

96. Several countries have implemented accelerated examination programs for green technology patents. Faster grant assists transactions and licensing in which an enforceable right is the object of the negotiation, but a pending application is not generally the binding constraint on green technology transfer. Also, the implementation of patent classification schemes such as Y02 in the Cooperative Patent Classification and the IPC Green Inventory are search and analysis tools, being relevant as instruments of landscape analysis and partner identification, but not as sources of direct legal advantage.

97. Some examples of accelerated examination programs for green technologies are summarized in *Table 2* below. The data are drawn from different periods and from programs that differ in eligibility criteria, fee structure and current status, and are therefore indicative rather than directly comparable. The [dedicated website on expedited examination programs of IP Offices](#) under the auspices of the SCP provides more information on such programs in general.

Table 2: Accelerated/expedited patent examination for green technologies

Office / Program	Launched	Status (mid-2026)	Eligibility	Reported uptake	Reported effect
UKIPO - Green Channel	May 2009	Operational	Written statement of environmental benefit; broadest criteria	776 requests reported; approx. 20% of eligible applications	Shortest time to grant among the programs Reviewed. This is a historical comparative finding. Not currently confirmed claim.
USPTO - Green Technology Pilot Program	Dec. 2009	Closed March 2012 (cap of 3,500 applications)	Environmental quality, renewable energy, energy conservation and greenhouse-gas reduction. Initial classification restrictions were removed effective May 21, 2010. No additional fee.	3,533 requests reported The figure derives from the USPTO's official programme closure report (7 May 2012)	Advancement out of turn to first action
USPTO - Climate Change Mitigation Pilot Program	June 2022 (expanded June 2023)	Suspended 28 Jan. 2025; terminated 18 Apr. 2025	Technologies reducing, removing, preventing or monitoring greenhouse gas emissions; no petition fee	1,399 petitions filed, 898 granted (as at 7 Jan. 2025)	Advanced out of turn to expedite first Office action on the merits
KIPO - Green Technology Fast-Track	2009	Operational Now incorporated within KIPO's broader	Current criteria: applications directly related to green technology under Korea's carbon-neutrality/green-growth framework and relevant classifications,	604 requests reported	Accelerated examination

		Accelerated Examination system (no longer a standalone program formally titled "Green Technology Fast-Track.")	as well as other specified grounds.		
JPO - Green Technology Fast-Track	2009	Operational	Energy-saving and carbon-saving subject matter; no additional fee for accelerated examination Consideration: Accelerated examination under JPO's green fast-track carries no additional fee. Standard examination fees, which include a per-claim component, apply equally to all applications and are not a green-programme-specific criterion.		Accelerated examination
CNIPA – Priority Examination (green technology categories)	2012	Operational	2012 rules: energy conservation, environmental protection, new energy, new-energy vehicles, low-carbon and resource-saving technologies. Current rules (2026) apply broader strategic/public-interest criteria and do not specifically enumerate green technologies.	Not reported here	Priority processing with specific targets set out in official rules 2012 rules: https://www.cnipa.gov.cn/art/2012/6/19/art_564_147420.html Current 2026 rules: https://www.cnipa.gov.cn/art/2026/7/30/art_74_207457.html
INPI Brazil - Programa Patentes Verdes	2012	Operational	Renewable energy, transport, energy conservation, waste management, agriculture (IPC Green Inventory)	INPI reported 1,352 applications approved for green priority processing from 2012 through April 2026. Official statistics: https://www.	Priority processing and examination under the Programa Patentes Verdes

				gov.br/inpi/pat-br/servicos/patentes/observatorio-de-tecnologias-verdes	
INAPI Chile - PAPV (pilot)	March 2023	Pilot (two-year period).	Alternative energy, transport, energy conservation, waste management, agriculture and forestry, nuclear generation; no additional fee	No official cumulative PAPV uptake figure located.	INAPI's 2023 prospective estimate; empirical programme performance statistics were not yet available at launch.

98. Taken together, the macro-level policy instruments such as the accelerated examination programs, classification schemes and international filing mechanisms shape the environment in which institutional intellectual property decisions are made. What determines whether a green technology is transferred, however, is the quality of institutional practice and IP management at the meso and micro levels: selective protection, deliberate management of disclosure, clean ownership chains, explicit governance of consortium-generated results, and the capacity to structure a transaction that an industrial partner can act on.

C. Synthesis of national/regional and international regulatory frameworks on K/TT

99. International frameworks establish the legal and policy baselines for health K/TT, but their practical effect varies considerably across jurisdictions owing to differences in intellectual property law, regulatory pathways, reimbursement systems, procurement mechanisms and institutional capacity. No single licensing model is universally applicable; cross-border agreements must be adapted to the specific technology, territory and public-health context, addressing not only intellectual property rights but also know-how transfer, regulatory documentation, manufacturing capability and quality systems. Regulatory authorization alone does not ensure adoption, since pricing, procurement, health technology assessment and health-system readiness remain decisive factors. Viewed through the macro, meso and micro analytical framework, international rules are necessary but not sufficient: their translational value depends equally on meso level institutional policies, experienced K/TT personnel and available financing, and on micro-level contractual arrangements that explicitly address development responsibilities, regulatory submissions, manufacturing transfer and post-authorization access. Effective K/TT ultimately requires coherent alignment across all three levels.

100. Applying the macro, meso and micro framework to the green technology sector reveals an uneven landscape, both within and across jurisdictions. At the macro level, the finding is consistent: green-specific provisions are largely absent from technology transfer legislations, and the sector is governed by technology-neutral rules supplemented, in some jurisdictions, by administrative measures at the patent office level. At the meso level, institutional capability varies significantly not only between regions but within them. In the United States of America and Europe, a dense infrastructure of research universities, national laboratories, scale-up facilities and TTOs exists, yet this does not constitute an integrated pipeline: fragmentation between research funding, demonstration finance and deployment finance persists in mature systems, and the gap in outcomes between leading institutions and the much larger number of mid-capability institutions operating within the same legal and funding environment is substantial. In Latin America, several institutions demonstrate growing commitment to

sustainability research, while the full potential of the university-industry interface remains to be fully developed across most of the region. At the micro level, licensing negotiation, patent prosecution, royalty administration and industry co-development capabilities are still consolidating. The WIPO GREEN Acceleration Projects for Latin American Countries connect technology providers and seekers within specific regions or domains, generating landscape knowledge and linking stakeholders to funders, legal counsel, and commercial networks. Such projects match farmers' climate-relevant needs with green technologies (WIPO Green, 2025). While initiatives and platforms such as WIPO GREEN offer complementary responses to the matching problem, evidence on their effect on licensing volumes or deployment outcomes is not currently available.

101. In the context of the international regulatory framework for industry-academia K/TT in the green technology sector, the analysis shows that the relative importance of patents and other frameworks varies considerably according to the technology under examination, and that access to finance, absorptive capacity, engineering and manufacturing capability, infrastructure, skills, supply chains, technical standards and unpatented know-how frequently constitute the binding constraints. This suggests that in the green technology sector, legal and international frameworks are necessary, but not sufficient. Effective technology transfer requires institutions capable of operationalizing those frameworks, financing mechanisms that can bridge the capital gap between demonstration and deployment, and regulatory environments that reward and protect innovation.

Part III: IP management in the context of industry-academia collaboration in health and green technology sectors

A. Overview of IP management practices in the health and green technology sectors: key considerations

106. Effective institutional IP management in the industry-academia collaboration context begins before licensing and extends beyond patent filing, encompassing ownership and disclosure rules, assessing patentability alongside commercial and regulatory relevance, preserved research and publication rights, selective portfolio management, inventor reward and incentive mechanisms, management of background rights, protection of know-how and data, and alignment with realistic development pathways in light of technology type and maturity rather than a uniform patent-first approach. Patenting research outcomes is a necessary but not sufficient condition in the overall context of IP management, particularly in health technologies.

107. Since universities rarely undertake full downstream development, early IP decisions should anticipate industry partners' needs. Premature disclosure, unclear ownership or misaligned patent strategy may deter partners, while overly broad or costly filing strategies waste resources without improving commercial outcomes. The goal is to preserve credible options while creating an evaluable IP position.

108. Health-technology IP management is closely tied to regulatory pathways, given clinical trials, safety, manufacturing and approval requirements. Regulatory delays can reduce effective patent life, and any misalignment risks reduced investment or weakened negotiating positions (Eisenberg, 2012). Patent strategies must align with regulatory timelines by carefully considering the trade-offs involved in early filing risks and reduced patent life or late filing risks and novelty loss, thereby requiring coordination among legal, scientific, business and regulatory stakeholders.

109. IP rights incentivize innovation by enabling firms to recoup R&D through market exclusivity (Scotchmer, 2004), involving considerations of claim scope, filing timing, territorial strategy, freedom to operate, and data exclusivities. Institutional IP-management approaches may vary according to the nature and intended use of the asset. A therapeutic candidate requiring extensive private investment may justify patent protection and a development-focused exclusive license. A broadly enabling research tool, diagnostic platform or software resource may be better disseminated through non-exclusive licensing, standardized access terms or open interfaces. Data, biological materials, manufacturing protocols and tacit know-how may require contractual controls even where patent protection is unavailable or inappropriate. Pre-competitive research initiatives may also combine open sharing of selected research outputs with controlled access to downstream applications. These examples illustrate that effective IP management involves selecting among patent, copyright, trade-secret, contractual, open and hybrid strategies rather than defaulting to a single model.

110. Although this section emphasizes micro-level transactional practice, macro- and meso level conditions continue to shape individual IP decisions. National law and funding conditions determine which rights may be owned, protected or licensed, while institutional policies influence how those rights are managed. For example, a funder's open-access or data-sharing requirement may limit the institution's ability to maintain information as confidential know-how; a university policy favoring non-exclusive licensing of research tools may affect the scope of rights offered to a company; and institutional requirements concerning inventor revenue sharing, retained research rights, conflicts of interest or socially responsible licensing may shape both deal structure and partner selection. The practical task is therefore to translate these higher-level obligations into IP and collaboration arrangements that are legally compliant, commercially realistic, and consistent with institutional and public-interest objectives.

111. The IP management in the green technology sector is not, in its fundamentals, different from other fields and technologies. The comparative evidence on European universities identifies a common set of institutional practices such as a written intellectual property policy, clear rules on ownership and on inventor revenue sharing, a defined invention disclosure procedure, an assessment step before filing, and professional support for negotiation, and finds that the presence and quality of these arrangements, rather than the volume of filings, are central to effective IP management. (European Commission and Holgersson, 2022). The *United Kingdom Intellectual Property Office guidance on intellectual property asset management for public sector research organizations* reaches a comparable conclusion, framing intellectual property as an asset to be managed against institutional objectives rather than as an output to be maximized (UK Intellectual Property Office, 2018).

112. In both cases, there are principles in common:

- Protect selectively and decide early what will not be patented.
- Manage disclosure and publication deliberately.
- Design intellectual property strategies with the future industrial partner in mind.
- Anticipate the effect of institutional and funder policies on licensing.
- Govern jointly owned and consortium-generated intellectual property explicitly.

113. In Latin America, there are some practices established across countries and institutions. For example, considering that most institutions and research centers are budget constrained in the region, to ensure international scope of their tech transfer efforts and intellectual property protection, universities such as Universidad de Chile, Universidade Estadual de Campinas, Pontificia Universidad Católica de Chile y la Universidad Tecnológica de Panamá use the Patent Cooperation Treaty route to preserve international options while deferring national phase costs. In some cases, the patent applications are drafted directly in English in

order to be readable by the international licensee audience they are targeting. This is a selective protection decision where the objective is not to maximize the number of rights held, but to keep open the territories in which a licensee is plausibly to be found, for as long as the institution can fund the process.

B. Overview of licensing models and contract structures

114. The effective management of IP serves as a major foundation for technology transfer activities. However, a substantial share of K/TT activities rely on unpatented know-how, data, materials, software, research services, training, standards and open dissemination, where contractual clarity and partner capability can matter as much as, or more than, formal IP rights. Different parties with different perspectives and priorities are involved in the collaboration. Academia is one party as the knowledge creator represented by their unit in charge of K/TT, while typically the industry (large company, SME, start-up) is the commercializing entity. The participation of these different stakeholders lead to some challenges and dilemmas:

- The universities need to balance incentivizing academics (short term gain) and securing benefits for the academic institution (long-term strategic goals).
- Technologies originating from academia are generally early stage (TRL 3-4) leading to serious difficulties in valuing early-stage IP.³
- Commercializing an academic research result requires long-term partnerships with commercial entities and securing mutual trust is a difficult task.
- All parties are subject to internal, local and national legislative frameworks and maneuvering around these limitations requires meticulous planning.
- The restrictions imposed by specifics of sectors (health and green technology sectors) introduce additional challenges.

115. Collaboration can be done through informal and formal modalities:

- *Informal*: Tacit knowledge exchange, such as hiring recent graduates, informal discussions at conferences, or reading scientific papers. Interestingly, these informal transfers are often more frequent than formal patent licensing and are often the triggering step to formal contracts (Arenas and González, 2018; Dall-Orsoletta et al., 2022).
- *Formal*: Controlled processes including patent licensing, joint ventures, and prototypes.

116. For commercialization of academic research outputs, generally the university grants a company the right to use its IP, through a license agreement. This forms an effective relationship management tool only if the objectives of each party are transparently negotiated and taken into account in structuring the terms and provisions of the agreement. However, where technology is immature, universities frequently use option or option-to-license (evaluation) agreements granting a prospective licensee a defined option period before a full license is negotiated.

117. A license is a contract between two parties, which allows use of rights or materials (in this context, the object of IP rights, such as patents) belonging to one party by the other party, usually in return for some payment or other type of benefits. The structures can vary

³ Technology readiness level (TRL) technologies are classified using the TRL framework containing 9 stages of technology readiness, originally developed by NASA subsequently adapted by the International Energy Agency (IEA) for energy technologies and is adopted by WIPO (WIPO, Glossary 2026).

significantly, depending on the focus and scope of the collaboration. Ordinarily, objectives for obtaining a license fall into three categories (Drozdoff and Fairbairn, 2015):

- to obtain access to technology necessary to develop and make a product or service (*enabling technology*);
- to obtain legal freedom to make and sell the product or service (*freedom to operate*);
- to use technology as competitive advantage, for example, licensing in IP rights to exclude potential competitors from selling the same products or services (*exclusivity in that market*).

118. A license agreement serves three main purposes. First, it defines the scope of rights being transferred between the parties; second, it determines compensation for those rights; and third, it puts in place a structure for managing the risks that each party takes on in carrying out the agreement. License agreements have some typical terms, where a choice between main models has different consequences in remuneration:

- *Exclusivity* prevents granting several licenses to different licensees on the same right. This, naturally, will raise royalty levels. Exclusivity generally also includes the ability to enforce the licensed IP rights against others. Non-exclusive licenses allow the IP owner to grant the same rights to several parties. This arrangement is most common for platform technologies with wide applications in different fields of use.
- *Field-limited or territory-limited licenses* may carry differential rates according to segments, or additional payments for expansion.
- *Allowing for sublicensing* may accrue sublicensing revenue shares (e.g. a percentage of sublicensing income).

119. In addition, there are certain practices that are unique to the Health Sector. *Surrogate licensing* is an emerging model in health technologies. Surrogate licensing involves the creation of an intermediary (“surrogate”) company that holds and manages patent rights and sub-licensing on behalf of the institution. This model has been experimented in the context of precision medicine, particularly for CRISPR technologies (Contreras et al., 2017). The rationale underlying the adoption of surrogate licensing in the context of CRISPR technologies was to manage the complexity arising from multiple sub-licensing activities from the demand side and to share the legal risks arising from overlapping nature of ownership claims over the technology.

120. Rights to grant sublicences can be central to the operation of voluntary *patent-pooling* and other intermediary-administered licensing arrangements. GlaxoSmithKline, and later Alnylam pioneered such an approach in 2009, by contributing key patents to a pool that enabled third-party discovery and development of generics for 16 FDA-listed neglected tropical diseases, demonstrating how exclusive private rights can be re-purposed for humanitarian access without abandoning commercial value in unaffected indications. Another example in the health technology sector is the Medicines Patent Pool (MPP), established by Unitaid. MPP’s model involves negotiating public health-oriented voluntary licenses with patent holders and granting sublicences to generic manufacturers and product developers according to pre-agreed principles and modalities (including, where applicable, know-how transfer) to support affordable access in low- and middle-income countries (LMICs). MPP has substantially expanded its activities beyond its initial focus on HIV medicines, extending them to hepatitis C, tuberculosis, other essential medicines, COVID-19 technologies and to co-leading with WHO a separate program in technology transfer for mRNA vaccine manufacturing. By the end of 2025, MPP had licensed 44 products through agreements with 22 innovators. Its licensees had supplied a cumulative total of 62.14 billion doses of treatment to 148 LMICs, generating reported estimated savings of US\$2.6 billion for the global community (Medicines Patent Pool, 2026). Beyond patent licensing, MPP enabled 13

manufacturers in LMICs to receive mRNA technology transfer training between 2023 and 2025 (Medicines Patent Pool, 2026). These developments illustrate how voluntary licensing, combined with technology transfer and manufacturing partnerships, can support wider access to medicines and health technologies.

121. Effective license contracts require carefully drafted provisions ensuring enforceability, fairness, and sustained trust between parties. In a license contract where the university is in the licensor position and the industry partner is the licensee, the following contractual features, which are critical to ensure enforceability, fairness, alignment and sustaining mutual trust, are typically included in the respective sections.

Definition of Milestones as Payment Triggers

- ✓ Milestones must be objective, verifiable, and measurable (e.g., “regulatory approval granted by the licensee for indication X [by date Y]”).
- ✓ Dispute-resolution pathways should be included if there is disagreement whether a milestone is met (e.g. independent expert review, mutual audit, arbitration).

Royalty Base and Deductions

- ✓ The contract must clearly define how royalties or equity are calculated, linked to a commercial metric.
- ✓ Net sales (gross minus discounts, returns, taxes) or other usage metric, should be clearly defined.
- ✓ Certain deductions can reduce the royalty base to the disadvantage of the licensor and should accordingly be addressed in the definition of net sales. These include, for example, fees paid by the licensee for other intellectual property licenses, sales between the licensee and its affiliates (intercompany sales), and distribution margins retained by affiliated distributors.

Minimum Royalties / Floor

- ✓ Annual minimum royalties can be a useful diligence tool to protect against negligible royalty income. They are typically appropriate after an agreed development or market-entry period, particularly where exclusivity has been granted, and are often unsuitable during long clinical, regulatory or infrastructure development phases.
- ✓ The clause should specify the date or event triggering the commencement of minimum payment obligations (e.g., first commercial sale, or expiry of an agreed development period). This ensures that the licensor obtains a baseline income once the technology can reasonably be expected to generate revenue.

Claw-back / Adjustment / Recoupment

- ✓ Claw-back provisions may entitle the licensee to recover a payment from the licensor following a specifically defined contractual event, such as a finding that a milestone payment was made on the basis of materially inaccurate information. The contract should specify the grounds for recovery, the calculation method and any applicable limits. Lower-than-expected commercial performance alone should not trigger repayment unless expressly agreed.
- ✓ True-up mechanisms reconcile provisional royalty payments with the actual amounts due based on verified sales figures at agreed intervals. Unlike claw-back, this is a routine calculation under the agreed payment terms, rather than recovery triggered by

a specified contractual event. Any shortfall is paid and any overpayment is credited or refunded as agreed.

Exclusivity, Term and Territory

- ✓ The issue of exclusivity (exclusive vs non-exclusive, including field-of-use differentiations for exclusivity) impacts royalty rates.
- ✓ Longer terms or broad territories may require higher payments or rates.
- ✓ The degree of exclusivity that a university is able to grant may be limited by factors such as:
 - government or public funding conditions (e.g., retained government-use or "march-in" rights);
 - pre-existing obligations toward research sponsors or collaborators;
 - the university's own reserved rights for research and teaching; and
 - institutional technology-transfer policies favoring broad dissemination of publicly funded research.
- ✓ Any limitations should be identified at an early stage and clearly reflected in the negotiated scope of exclusivity.

Reserved Rights, Prospective Rights and Grant-back Obligations

- ✓ Retention of some use rights is typical, to keep access to the licensed technology for the licensor's own research, teaching and academic publication purposes, subject to reasonable safeguards for the licensee's confidential information (e.g., a limited pre-publication review period to allow for patent filing). The university should particularly note that the broader the exceptions carved out of an exclusive license, the more difficult it may be to negotiate a commercially acceptable position with the licensee. "Prospective rights" (rights to future technology, improvements, and inventions that have not yet been made) should also be taken into consideration particularly in very early-stage technologies so that the scope of the grant does not inadvertently extend beyond what was intended.
- ✓ Grant-back clauses require the licensee to grant the university rights in improvements developed under the license. Such clauses should be limited by clearly defined subject matter, project, field and duration. Depending on the parties' needs, this may take the form of: (i) an option-to-license (evaluation) agreement, giving the university a defined period to evaluate and negotiate a license to specific improvements; (ii) a first-negotiation right, requiring the licensee to negotiate in good faith with the university before licensing improvements to third parties; or (iii) an automatic license, under which improvements are automatically incorporated into the scope of the existing license.

Audit and Reporting Rights

- ✓ The right to inspect accounting records as well as auditing rights with limitations (e.g., frequency, confidentiality) should be clearly articulated.
- ✓ Regular reporting (quarterly/annual) obligations of sales and usage statistics to verify payments due should be detailed.
- ✓ The right to impose penalties or interest for late payments should be covered.

Transparency and Adjustment Mechanisms

- ✓ The licensor should retain the right to seek adjustment of the concluded contract, but only on defined triggers, to preserve enforceability and investment certainty. Such triggers may include: a manifest calculation or accounting error; a defined change of control; an assignment or sublicensing event; an agreed hardship mechanism; or a significant, clearly defined disproportion between the compensation received by the licensor and the actual commercial success of the licensed technology (sometimes referred to as a "bestseller" adjustment).
- ✓ Except where the licensee is a large, fully integrated pharmaceutical company, it will typically need to partner with third parties to bring a product through clinical trials to market, requiring the ability to grant sublicenses to selected third parties. The agreement should therefore define in detail the licensor's rights in connection with sublicensing (e.g., consent requirements, a share of sublicensing income, and pass-through of relevant obligations to sublicensees). Separately, and distinctly from sublicensing, the agreement should address the consequences of a change of control or acquisition of the licensee (e.g., adjustment of royalty rates, reassessment of performance obligations, or notice and consent rights), as this raises different considerations for the licensor from those arising in a sublicensing scenario.
- ✓ A "most favored licensee" (MFL) clause typically protects an existing licensee by requiring the licensor to extend to them terms granted to a subsequent licensee that are materially more favorable. Where such a clause is included, in particular for the benefit of the licensee, the agreement should clearly define: (i) the comparator terms that would trigger the clause, including standard exceptions (e.g., licenses covering a different field or territory, or involving non-comparable consideration); and (ii) the resulting consequence (e.g., adjustment of the existing terms, or an election by the licensee to adopt the more favorable terms). This ensures the clause operates predictably, rather than being understood as benefiting only the licensor.

Sunset / Termination / Reversion

- ✓ The contract should handle the end-of-term arrangements (e.g., whether royalties continue to accrue on stock remaining in inventory).
- ✓ After a certain period or in case of material breach of a contractual obligation, rights may revert or royalty obligations change.

Performance Obligations / Commercialization Diligence

- ✓ The licensee should be subject to reasonable commercialization obligations to prevent technology shelving or passive holding.
- ✓ The following key obligations can be included in a licensing contract:
 - minimum development activities,
 - regulatory filing timelines,
 - commercialization deadlines,
 - minimum marketing efforts,
 - minimum investment commitments.
- ✓ Failure to meet diligence obligations may trigger:

- conversion from exclusive to non-exclusive status,
 - termination rights,
 - reduction in territorial scope,
 - reversion of rights.
- ✓ Particularly for university technologies, diligence obligations are critical to ensure that publicly funded inventions reach the market. All such considerations must be included in the licensing contract.

122. While the above typical licensing clauses are key to K/TT in the industry-academia environment, there are other complementary considerations that must be considered in the background for successful negotiation of a licensing agreement. Governance issues related to license agreements involving an equity component should be well documented and commercially reasonable, considering that the licensee will typically need to raise financing before its products are approved and commercialized (e.g., through venture capital, equity capital markets offerings, or in connection with a merger or acquisition). Equity and governance provisions should be designed so as not to unduly impede the licensee's ability to secure such financing. Where the university holds equity, it may need to consider governance, board representation, anti-dilution, exit and conflict-of-interest arrangements. The appropriate position will depend on the university's shareholding, governance policy and capacity to manage equity holdings; broad control rights can create conflicts of interest, impose administrative burdens, and deter subsequent investors. Similarly, the design of the compensation structure should balance risk (that the licensed technology fails to reach the market) against potential rewards. For example, in early-stage ventures with a low probability of success, reliance on back-loaded compensation such as milestone payments and equity, rather than substantial upfront cash payments reduce the licensee's financial exposure if the technology is not ultimately commercialized. However, the above general practices vary drastically between the health and green sectors.

1. Health technology sector

123. Universities and other non-profit academic institutions present an important source of new molecular targets and technologies for development and commercialization by companies in the health technology sector. Technology transfer in the health technology sector is characterized by complex multi-sector collaborations between universities, hospitals, firms, governments, and TTOs. Each sector contributes complementary strengths: universities provide scientific expertise, industry contributes commercialization capabilities, and governments support regulation and infrastructure (Tanaka and Lopez, 2024). Therefore, the Health Sector is particularly dependent on licensing agreements because medical technologies often require extensive downstream investment, regulatory approval, and commercialization expertise before reaching the market (Shen, et al., 2022).

124. However, at the time they are drafted and negotiated, health technology license agreements involving academic institutions typically relate to early-stage technologies rather than market-ready products. Most often, license relationships are established around relatively early-stage technology, where the path to an ultimate commercial product is not entirely certain. At these early stages, collaborative research agreements are becoming increasingly important in healthcare innovation.

125. A landmark survey of 62 major US universities found that almost half of all inventions licensed are at only a proof-of-concept stage at the time of licensing, meaning that significant further development is required before commercialization can occur (Jensen and Thursby,

2001). This underscores the inherent risk assumed by licensees of early-stage academic technologies. Consequently, license agreements for academic inventions almost always include running royalties and modest upfront fees — and often incorporate sponsored research arrangements to incentivize ongoing inventor involvement in development. Large upfront payments are less common because the technology remains embryonic at the time of transfer. Thursby and Thursby (2002) demonstrated using a three-stage licensing productivity model, covering (i) invention disclosure, (ii) patenting and licensing, and (iii) commercialization, the latter being driven primarily by an increased willingness of faculty and university administrators to engage, and by growing industry reliance on external R&D. Inventor involvement is critical not only for finding licensees, but for continued technology development once a license is executed.

126. A growing number of multi-year, heavily financed partnerships between large pharmaceutical companies and academic institutions provide pipeline research that pharma firms have shed internally. These sponsored framework partnership (pharma–academia) deals are typically hybrid; a sponsored-research / R&D component (for know-how, materials and tacit transfer) is layered on a more conventional license component governing existing and future IP. The flexibility of these hybrid structures is essential where the technology is early-stage and the ultimate commercial product is not yet defined (Drozdoﬀ and Fairbairn, 2015; Schachter, 2012).

127. Therefore, the distinction between technology and IP, both of which are basic parts of most health technology deals, is important. Not all technology can be or is protected as IP. For example, when non-patentable research methods and other know-how are freely shared between scientists, instead of being kept as trade secrets, they receive no formalized, registered IP protection. Health technology license agreements are therefore often hybrid structures, which combine an R&D agreement component that provides for use and transfer of technology such as know-how and materials with a license agreement component that governs existing and future developed IP (Drozdoﬀ and Fairbairn, 2015).

128. University TTOs play a central role in structuring these agreements. Traditional TTO models focused heavily on patent appropriation and revenue generation, whereas newer approaches emphasize broader utilization and societal impact (Holgersson and Aaboén, 2019).

129. One of the most important licensing distinctions in health technology (specifically pharmaceuticals and complex medical devices) concerns exclusive versus non-exclusive licensing. Exclusive licensing is frequently used when substantial investment is required for product development and regulatory approval. In biotechnology and pharmaceutical sectors, companies often demand exclusive licenses before committing substantial R&D resources (Shen, et al., 2022). This is because clinical validation and safety testing are incredibly expensive and time-consuming: industrial receivers want to ensure they can recoup their high R&D investments (Arenas and González, 2018). Venture Capital (VC) plays a much larger role in health tech than in green technologies.

130. The decision between exclusive and non-exclusive licensing is influenced by several institutional factors beyond technology maturity. Field-of-use restrictions provide an important additional mitigation tool where rather than granting a single blanket exclusive license over the entire technology, an institution may grant exclusivity within one or more specifically defined fields of use while retaining the ability to license other application areas non-exclusively, or to grant separate exclusive licenses to different parties for distinct fields. This approach allows the university to offer the commitment a particular commercial partner needs to justify its development investment, while preserving access to the technology across other potential applications.

131. An analysis of 6,653 licensed patents from 117 Chinese universities found an inverted U-shaped relationship between university prestige and the likelihood of exclusive licensing: moderately prestigious universities are most likely to grant exclusive licenses, while both very high and very low prestige universities tend toward non-exclusive arrangements. Very high prestige universities have sufficient bargaining power to attract multiple licensees and achieve adequate revenue through non-exclusive arrangements; lower prestige universities may be unable to attract exclusive licensees with the capability to develop the technology. Universities generally prefer non-exclusive licensing as a risk mitigation strategy, since dependence on a single licensee creates vulnerability if that partner lacks the capability or commitment to successfully commercialize the technology (Gu, 2023, Liu et al., 2026)

132. Two key moderating factors are: (1) TTO experience, accumulated deal-making knowledge that helps structure appropriate exclusivity provisions; and (2) prior collaboration between the university and the specific firm which builds trust and mutual knowledge, significantly increasing both parties' willingness to accept non-exclusive arrangements. These findings underscore that exclusivity decisions are not purely technology-driven but are shaped by the relational and institutional context of each licensing negotiation (Shen et al., 2022).

2. Green technology sector

133. Technology transfer in green technology sectors differs from healthcare because environmental technologies often involve global public goods, international climate obligations, and large-scale deployment challenges. Intellectual property management in green technologies therefore requires balancing innovation incentives with global sustainability goals. However, green technologies may deliver broad environmental benefits while remaining a proprietary, capital-intensive industrial asset. Public benefit alone does not determine the viability of a specific licensing model owing to market constraints and other trade-offs.

134. International frameworks strongly influence the K/TT structures in green technology sectors. The UNFCCC technology mechanisms, Mission Innovation initiatives, and the WIPO GREEN platform all encourage collaborative technology diffusion while respecting intellectual property rights. The Fuel Cells and Hydrogen Joint Undertaking is an example. It is a quintessential Triple Helix alliance involving the European Commission, the hydrogen industry, and the research community. This partnership allows for the development of green hydrogen technologies that would be too financially risky for any single private firm. By aligning government policy (funding) with academic research (invention) and industrial demonstration (scaling), the alliance has become a leader in decarbonizing the industrial sector (Dall-Orsoletta et al., 2022).

135. Green technology **licensing models** commonly include (Xiang, 2020):

- voluntary licensing,
- cross-licensing,
- patent pooling,
- cooperative R&D agreements,
- technology standards agreements,
- tiered licensing arrangements, and
- pooled procurement systems.

136. Moreover, licensing structures in green technology frequently prioritize deployment and accessibility rather than solely maximizing royalty income. However, faster deployment and accessibility-oriented licensing in green tech is market-driven, not altruistic: it is chosen

because business-model and market factors (bulk/public procurement, market size, competition, standards participation) and regulatory incentives push firms toward open/non-exclusive models that maximize adoption and long-run returns.

137. Consequently, licensing agreements may incorporate additional features such as:

- differential pricing,
- regional licensing limitations,
- collaborative R&D obligations,
- shared patent pools,
- standards participation, and
- capacity-building clauses.

C. Overview of effective clauses for remuneration schemes

138. Remuneration is the contractual arrangement that defines how value is shared between the knowledge creator and the commercializing entity and aims to balance the academic licensor's need to recover R&D costs with the licensee's commercial risk. The remuneration scheme is an essential element of the licensing or collaboration contract, describing how the innovator (typically the university or its IP holding company) is compensated by the industrial partner. A successful deal requires balancing the competing need of the academic licensor to obtain a fair return on its R&D investment with the company licensee's goal to make a fair profit in the face of multiple regulatory, legal, and commercial risks.

139. Contracts must be fair and balanced to reflect the high initial costs of academic research and the long-term profitability goals of the industrial partner. The economic terms of license agreements may be impacted both by the terms of the license agreement as well as other aspects of academic, corporate research or licensing. The licensor's commitment to maintain the patent, the expected profitability of the product, the degree of advantage offered by the patent, the portion of the profit that should be credited to the invention, as well as any ancillary commercial benefits provided to the licensee by the license are all parameters to be considered.

140. The selected licensing model, as well as the IP strategy, and regulatory environment, are intertwined and the remuneration scheme cannot be viewed in isolation, especially in the health and green technology sectors.

IP Strategy & Stage of Patent Life

- ✓ Early in the patent life or before commercialization, the licensor may apply lower upfront payments to facilitate licensing; later, royalties may be a greater preference.
- ✓ In cross-border licensing, costs of patent prosecution/maintenance in multiple jurisdictions should be accounted for when calibrating payments.
- ✓ The remittance structure may differ by region, reflecting different commercialization prospects, regulatory barriers, or market size.

Regulatory Risks / Incentives

- ✓ In pharmaceuticals or medical devices, regulatory approval is a major hurdle. Milestones tied to regulatory milestones are common.
- ✓ Subsidies, grants, or tax credits in green technologies may affect net returns and, consequently, royalty negotiation.

- ✓ Regulatory regimes may impose caps or constraints on royalties or revenue sharing in public health or public-interest technologies.

Country / Institutional Norms & Legal Constraints

- ✓ Some jurisdictions impose constraints on how universities may license (e.g. maximum royalty rates, institutional revenue-sharing ceilings).
- ✓ Public institutions may have policies about equity holding or risk exposure. Limitations on the re-use of the technology (e.g., for further "exploration" vs. immediate market "exploitation") should be defined.
- ✓ In some countries, there may be statutory or mandatory regimes for "appropriate remuneration" or minimum guarantees (especially in regulated sectors).

141. Although there are a number of core remuneration models, in practice many agreements adopt hybrid approaches combining elements of these.

- a) **Upfront (lump sum) fee model:** This model involves a one-time payment made at the time of contract signing. It provides the licensor with immediate, predictable income, transfers some degree of commercial risk to the licensee, and is straightforward to administer. However, because the technology's ultimate commercial value is difficult to predict accurately at the point of contracting, the agreed payment may underestimate what the technology will ultimately be worth. If the licensed technology proves more commercially successful than anticipated, the fixed lump sum will under-compensate the licensor, who cannot subsequently share in that upside. Conversely, if commercialization falls short of expectations, the licensor benefits from having received payment irrespective of commercial outcome. This model is best suited to situations where the technology is relatively mature, its commercial potential is reasonably well understood, or the licensor requires predictable short-term funding.
- b) **Milestone payments model:** The model offers an approach where payments are initiated when defined technical/clinical/market milestones such as regulatory approval, scale-up, and market launch are achieved. Milestone payments based on performance provide a reasonable tool for bridging the valuation expectations gap between a licensor (who assumes that the technology will be successful and will fill the market need) and a licensee (who bears the risk of product failure at multiple junctures). This model helps align incentives, mitigates the risk of paying too early and allows the licensee to "earn" payments. However, a careful definition of milestones is needed as well as a defined method of monitoring them. There is a potential dispute risk over whether a milestone is met and monitoring could present to be a burden and a cost item. This model is best suited in fields where success is uncertain (biotech, medtech) and where value is revealed over stages. Milestone payments are particularly useful when the licensee's effort or success is uncertain and hidden; they act as signals and incentives (Crama, et al., 2008). Upfront fees and milestone payments both provide critical de-risking tools for the transmitter, providing capital during the exploration and validation stages before a market exists.

- c) Royalties / percent of sales or usage model:** The model enables the licensor to receive a fixed or tiered percentage of net sales or usage of products / services related to the licensed technology. When setting a royalty rate, a key consideration is the strength of protection offered by the licensed IP (e.g., patent validity, ease and cost of designing around, scope and restrictions of the license grant, remaining life of the licensed patents, or likelihood of infringing other non-licensed patents owned by third parties) as well as commercial factors including the potential size of the market; whether there is an established market price for the technology; the commercial relationship between the parties (e.g., whether the institution has other deals with the company); whether the technology is a research tool, a compound, or a diagnostic; and the extent of existing competing technologies in the market or the likelihood of market penetration.
- d) Equity / shareholding model:** The model enables the licensor to take equity in the licensee (often a spin-out) as part of the compensation. Since there is no cash involved, it is useful when monetary resources are constrained and it aligns with long-term incentives. There is a potential upside in high growth situations. Liquidity and dilution risks as well as valuation challenges are very real combined with governance issues and possible conflicts of interest in the long run. Startups and SMEs, which are often the most agile, are usually the vehicles for commercializing disruptive innovations. This model is best suitable for start-ups / spin-outs or early-stage ventures with high risk and growth potential. Particularly within the context of Corporate Venture Capital (CVC) involvements where capital is provided to early-stage startups, it “de-risks” projects that have not yet achieved commercial scale, providing a natural exit for the startup and radical innovation access for the CVC.
- e) Hybrid / mixed models:** These include a multiplicity of payment types, including royalties, lump sum and milestone payments and returns on equity. For example, a contract combining fixed and performance-based payments can better extract value from licensees than pure royalty or pure lump-sum contracts. The common implementation steps are:
- A modest upfront license issue fee.
 - Full reimbursement of past and future patent costs.
 - A series of development and regulatory milestone payments.
 - A single-digit running royalty on net sales.
 - Minimum annual royalties beginning a few years after signing.
 - A clause for sharing in sublicensing revenues.

The hybrid/mixed model balances risk and reward for both parties; is more flexible and tailored, while it involves complexity in negotiation and enforcement and if components conflict, there is a potential for misalignment. This model is very common in practice, especially in multi-stage development fields such as the health or green tech sectors.

142. The health or green tech sectors stand out from traditional industries due to their deep integration of science, sustainability, and innovation at the same time presenting certain challenges for commercialization. The most important challenge is the valuation of the IP, due to the fact that the technologies are generally at a very early stage of development (Thursby and Thursby, 2003). The others are high technical and market uncertainty as well as asymmetries of information and approach in the respective parties (university vs industry). Thus, at the contract phase, the negotiation should be regarded not as a battle to be won, but

as a step in co-creating a shared roadmap for successful commercialization. Thus, choosing the right model with a risk-sharing approach is imperative for success.

1. Health technology sector

143. Remuneration structures should reflect uncertainty, technological maturity, market potential, and commercialization risk. Flexible remuneration structures are therefore preferable to rigid fixed-payment systems. Milestone payments are the industry standard. Given the long horizons of clinical trials, the university or inventor receives compensation when the technology passes specific hurdles (e.g., phase I trials, FDA/EMA approval, or first commercial sale). This manages the risk-reward profile: the industry partner pays less upfront but provides significant rewards once the technology is "de-risked".

144. Health technology contract structures often include upfront fees (to recover past costs), milestones (linked to technical or regulatory success, such as clinical trial phases), and royalties (based on a percentage of sales).

- a) **Diligence safeguards on royalty-only deals:** Because biotech / pharma development can take a decade or more, an academic licensor that has traded a low upfront fee for a higher royalty rate bears significant risk that the licensee will pivot, in-license a competing technology, or fail to commercialize. Diligence provisions such as minimum annual royalties, the right to convert an exclusive license to a non-exclusive on failure, and 'commercially reasonable efforts' obligations with associated termination rights are best-practice mitigations (Drozdoff and Fairbairn, 2015).
- b) **Historical / sunk-cost reimbursement:** Health-tech licenses routinely require the spin-out or industry licensee to reimburse all out-of-pocket costs incurred by the research institution in filing, prosecution, maintenance and enforcement of the patent rights up to the date of signing – the so-called 'historical costs' – with all post-signing patent expenses borne directly by the licensee (Universities of the Netherlands, 2025; Drozdoff and Fairbairn, 2015).
- c) **Inventor royalty-sharing design:** Empirical research on US universities indicates that the allocation of royalty income among inventors, laboratories and central university budgets can materially affect technology-transfer outcomes. A larger inventor share may encourage continued participation in development and is associated with stronger licensing performance, whereas directing a greater proportion to general university purposes may weaken these incentives (Friedman and Silberman, 2003). Over time, inventor royalty-sharing formulas have become more standardized, so marginal increases in an inventor's share may now have a smaller effect on disclosure behavior. At the same time, the TTO's gatekeeping role has become more demanding because of complex IP landscapes, data-protection requirements, deep-technology startups and the growing use of spin-out, equity and student-led innovation models (Valdivia (2013) and (AUTM STATT data).

2. Green technology sector

145. Shi et al. (2025), analyze green technology transfer using a multi-layer network perspective integrating knowledge resources, firms, cities and regional innovation systems demonstrating that green technology transfer depends heavily upon geographical proximity,

network structure, knowledge diversity and regional innovation ecosystems. Unlike licensing in health technologies, value often emerges from ecosystem participation, interoperability, network spillovers rather than purely proprietary control. Therefore, contracts frequently include collaborative data-sharing systems, technical-standard compliance, manufacturing partnerships and local-content provisions.

146. Remuneration schemes in green technology differ because sustainability objectives and public policy considerations strongly influence licensing practices. Mutually beneficial green tech cooperation requires “just compensation” combined with accessible deployment mechanisms (Xiang, 2020). As a result, remuneration schemes may include:

- reduced royalty structures for developing countries,
- tiered pricing models,
- cross-licensing arrangements,
- collaborative R&D cost-sharing,
- patent pooling revenue-sharing mechanisms, and
- performance-based environmental impact incentives.

Cross-licensing arrangements are particularly important in green tech because many technologies are interdependent and require access to complementary patents. These arrangements reduce transaction costs and patent thickets while encouraging broader deployment (Xiang, 2020).

Patent pooling agreements similarly allow multiple patent holders to aggregate technologies under unified licensing systems. Such models are useful in renewable energy technologies, battery systems, and smart-grid infrastructures where interoperability is essential.

University-industry collaboration models in sustainability-focused innovation often prioritize long-term societal value over short-term licensing revenue. Effective knowledge management and absorption capacity are essential for sustaining collaborative value creation (Terán-Bustamante et al., 2021).

147. It is pertinent to note that cross-licensing, patent pools, tiered royalties and environmental-performance payments are more commonly associated with inter-firm transactions. They may nevertheless be considered in university–industry green-technology K/TT where complementary patent portfolios, interoperability requirements, broad deployment objectives or measurable environmental outcomes justify their use. These mechanisms should therefore be understood as context-dependent options rather than as common features of green K/TT practice.

3. Other considerations

148. Green and health technology contract structures increasingly employ equity shares in spin-outs. Equity serves as a screening tool that allows a TTO to elicit information from an entrepreneur about the technology's true market potential. Theoretical and empirical modeling shows that a combination of equity and royalties are more successful at creating spin-outs than those relying on fixed fees, as it mitigates asymmetric information between the university and the scientist-entrepreneur. (Savva and Taneri, 2014). Particularly in the energy sector, remuneration is frequently structured as equity in spin-out companies.

149. While the combination of equity and royalties can outperform pure fixed-fee structures in aligning incentives and facilitating spin-out creation, as noted above, this structure should not be treated as a universal default. In some early-stage ventures, particularly where the company has limited administrative capacity, faces immediate cash constraints, or needs to attract external investors, combining equity participation with ongoing royalty obligations may

impose excessive financial and governance burdens and complicate subsequent financing rounds. The appropriate compensation model should therefore be calibrated to the specific circumstances of the deal: equity-only, royalty-only, milestone-based, fixed-fee, or simplified structures may each be preferable depending on the stage of research, capital requirements, investor expectations, and the university's capacity to manage equity holdings. In addition, although exclusive licensing is necessary for health technologies to protect high-cost R&D, they are often avoided in early-stage green tech contracts to foster community growth in the interest of incentivizing wider adoption of the technology. (Arenas and González, 2018).

150. Regulation-driven licensing in green technologies: Environmental regulations (e.g., emission standards, EV mandates, use of specific technical standards) can substantially raise the competitive value for patent holders who license technologies that meet regulatory standards. When compliance with a regulatory standard costs more than acquiring a license, firms that would otherwise prefer to develop alternative solutions independently may find it advantageous to enter licensing arrangements. In fast-moving green technology segments this dynamic has in several cases produced broad-based licensing activity resembling de facto standardization. Because multiple firms must meet the same regulatory requirements, they converge on access to the same or interoperable technologies, and the resulting licensing terms increasingly reflect market-wide norms rather than purely bilateral negotiations (Zhang et al., 2024).

151. Revenue-sharing contracts as an incentive layer on cross-licensing: In sectors where firms compete under carbon-pricing or emissions-trading regimes, cross-licensing arrangements may produce uneven outcomes if the portfolios are of unequal commercial value. A firm that contributes proportionally more valuable patents may receive less in return than it provides. Layering a revenue-sharing obligation on top of such a cross-license can correct this imbalance because the firm that derives a disproportionately large commercial benefit from the arrangement agrees to transfer a defined share of its resulting sales revenue to the other party. This mechanism converts an otherwise asymmetric arrangement into a mutually beneficial one, increasing both parties' willingness to enter and sustain the license and supporting the broader deployment of green technologies in support of carbon-reduction goals (Zhang et al., 2024).

152. Differentiated / tiered pricing for low and middle-income countries (LMICs): Where green technology is intended for deployment across diverse country markets, parties can consider differentiated terms where they are justified by market conditions, development obligations, affordability objectives and applicable law. In practical terms, this means designing agreements with differential terms (for example, reduced or tiered royalty rates applicable in LMIC markets, provisions permitting local production or adaptation of the technology at concessional rates, phased payment schedules calibrated to market revenue, or capacity-building obligations requiring technology support in developing economies).

153. FRAND-style licensing for publicly funded IP: FRAND (Fair, Reasonable, Non-Discriminatory) as a requirement for licensing terms originally developed in the context of licensing of patents essential to technical standards (SEPs) where patent holders voluntarily contribute their patent technologies to standard development organizations and undertake to provide licenses on FRAND terms. Where IP has been developed using public funding, applicable state-aid rules or institutional policies may require that licensing terms reflect the genuine market value of the IP and avoid conferring undue economic advantage on any particular recipient. In this context, principles drawn from FRAND licensing have been experimented with. Applied to publicly funded university IP, a FRAND approach would mean that license fees are set at levels proportionate to the actual value of the technology and the investment required to commercialize it, similarly situated licensees are offered comparable terms without arbitrary differentiation, and fees are not set at levels that foreclose

commercially reasonable access without justification. The Dutch national IP framework and emerging EU spin-out practice have adopted FRAND-style benchmarks in this spirit (KEEN-NL, 2025; NRI, 2025). FRAND-style principles represent a policy option rather than a universal legal requirement and do not automatically apply to all university technology transfer. Whether such an approach is appropriate will depend on the nature of the technology, its commercialization pathway and investment requirements, applicable state-aid or funding conditions, and any relevant public-interest objectives.

Part IV: Synthesis of Case Studies

154. Taken together, the first three Case studies demonstrate that successful health K/TT in the health technology sector depends on the alignment of intellectual property, regulatory strategy, institutional capability, development responsibilities and downstream adoption requirements. They also show that different technology archetypes require different collaboration and commercialization models. A detailed presentation of the Case Studies is to be found in the Appendix.

155. Case Study 1 — University-industry transfer and development of mRNA COVID-19 Vaccines (United States of America/ Germany): The mRNA vaccine Case Study illustrates how foundational academic research, public-sector science, biotechnology platforms, pharmaceutical development capabilities, government funding and procurement can operate through a chain of interconnected agreements. Its central lesson is that rapid translation depends on complementary capabilities and coordinated risk reduction rather than on patent licensing alone.

156. Case study 2 — CRISPR gene editing technology - fragmentation and complexity (United States of America): The CRISPR Case Study demonstrates that overlapping ownership and fragmented licensing can increase transaction costs, freedom-to-operate uncertainty and legal complexity. At the same time, strong science, substantial financing, field-specific licensing and capable development partners may allow commercialization to proceed despite unresolved IP disputes. The case therefore highlights both the costs of fragmentation and the ability of well-resourced ecosystems to manage those costs.

157. Case study 3 — PLUTO hand-rehabilitation Robot – university/hospital-industry collaboration for accessible care (India): The PLUTO Case Study illustrates a locally grounded model of sustained co-development among an engineering institution, a clinical institution and a commercialization partner. Its impact is reflected in affordability, portability, clinical usability and patient reach. The progression from joint research to patent protection, licensing, commercialization and use by more than 1,000 patients shows how alignment among technical design, clinical validation, institutional K/TT support and industry participation can produce measurable societal value.

158. Case Study 4 — Public co-financing of scale-up and validation infrastructure for clean technologies (Chile): The Case Study demonstrates that public co-financing of scale-up and validation infrastructure is a powerful *enabler* of technology transfer even when it is not transfer itself. The key lesson is that pooling university and industry actors as joint beneficiaries of a single competitively awarded instrument rather than positioning them as counterparties in a bilateral license can reduce friction and align incentives at the pre-commercial stage. However, this model is contingent on the existence of a well-capitalized, long-horizon development agency and a domestic industrial base able to absorb results.

159. Case Study 5 — Competitive public tendering for the licensing of publicly developed agri-environmental technologies (Uruguay): The Case Study shows that a transparent, competitive public tender system can be an effective vehicle for transferring publicly

developed green technologies, particularly plant varieties and bio-inputs. The critical lesson is that ex-ante publication of licensing terms lowers transaction costs and enables due diligence, but the model only works where the technology is standardizable, IP protection (e.g., plant variety rights) is enforceable, and a sufficiently large pool of licensees exists to make competition meaningful.

160. Case Study 6 — Licensing agreement chain for next-generation photovoltaics - the Oxford PV perovskite case (United Kingdom) The Case Study illustrates a sequential licensing chain university-to-spinout, then spinout-to-multiple-territorial-sublicensees as a scalable strategy for global diffusion of a foundational green technology. The lesson is that retaining IP ownership at the university while vesting exclusive commercial rights in a specialized spin-out allows that spin-out to become a sophisticated IP licensor in its own right, differentiating exclusivity terms by jurisdiction to match market structure and competitive dynamics. A large, defensible patent portfolio is what makes this cascading model credible to major industrial licensees.

161. Case Study 7 — Industry-led research consortia for bio-based materials - the Continental Taraxagum case (Germany): The Case Study teaches that formal university TTOs are not indispensable when an industrial partner with strong R&D capacity embeds itself directly in a multi-party research consortium from inception. The lesson is twofold: co-financing (here, EU structural funds alongside private investment) can de-risk long-horizon bio-based innovation, and a layered IP strategy that combines genomic/biological protection with process patents – can secure value across the whole innovation chain, from lab to dedicated scale-up facilities to market-ready product.

162. Case Study 8 — Oxford/AstraZeneca vaccine – technological order agreement term (United Kingdom): The Case Study shows that health (and by extension green) technology transfer under urgent, evolving conditions requires adaptive, staged contractual instruments rather than static patent licenses. The Technological Order Agreement Term (TOAT) lesson is that legal mechanisms must be flexible enough to transfer technology still under development, alongside know-how, regulatory alignment, training, and supply-chain coordination – underscoring that successful transfer depends on institutional orchestration as much as IP access.

163. Case Study 9 — CRISPR Technology and Surrogate Licensing in Precision Medicine-surrogate licensing (United States of America): The Case Study demonstrates that highly fragmented, platform-level technologies overwhelm traditional bilateral licensing. The lesson is that surrogate licensing entities, patent aggregation, and field-of-use licensing can simplify commercialization and attract venture capital, but at the cost of concentrating licensing power and risking restricted access to foundational research tools, meaning licensing design must consciously balance efficiency against openness.

164. Case Study 10 — The University of Cape Town (UCT) HPV Vaccine — adaptive licensing (South Africa): The Case Study shows that adaptive licensing, a co-exclusive rather than exclusive structure with conversion rights, allows universities to honor pre-existing consortium commitments while still providing enough certainty to attract major industrial partners. The lesson is that flexibility in exclusivity terms, rather than a binary exclusive/non-exclusive choice, is often what reconciles competing stakeholder interests in global-access-sensitive technologies.

165. Case Study 11 — The MARAVAS - Medical Training and Vascular Care Standardization Program- K/TT of trade-secrets, know-how and regulatory sandbox (Thailand): The Case Study establishes that technology transfer need not be patent-centric: tacit clinical know-how, protocols, and trademarks can be transferred via sole-license arrangements. The lesson is

that when the value lies in reproducible operational knowledge rather than a patented product, a one-time fixed-fee license is an effective remuneration scheme is more appropriate than royalties, since royalty monitoring would add complexity when the primary value lies in clinical expertise, training, and operational know-how rather than future product sales.

166. Case Study 12 — The nutraceutical management of polycystic ovary syndrome-commercialization through spin-off (Malaysia): The Case Study shows that exclusive know-how licensing to a spin-out, combined with milestone obligations and deferred fee structures (nominal early payments, larger fixed payments later), reduces early-stage commercialization risk while incentivizing rapid market entry. The lesson is that remuneration timing can be engineered to match a technology's realistic revenue ramp-up rather than imposing premature royalty burdens.

167. Case Study 13 — Fuel-cell technology – UCT spin-offs (South Africa): The Case Study illustrates an evolutionary IP strategy starting with an exclusive license, then converting to full IP assignment for equity as the spin-out matures. The lesson is that hybrid remuneration by combining royalty deferrals, minimum royalties, royalty holidays tied to milestones, and patent-cost recovery, can align university and company incentives over long green-tech development cycles, though granting first-refusal rights over future IP requires safeguards (defined scope/duration, milestones, reversion rights) to prevent foreclosing competition or public access.

168. Case Study 14 — Thin-film photovoltaics (United States of America/European Union/Germany): The Case Study demonstrates that non-exclusive, ecosystem-based commercialization by combining public R&D funding, shared infrastructure, standardized testing protocols, and iterative manufacturing learning can be more effective than exclusive bilateral licensing for technologies requiring industry-wide diffusion and standards harmonization.

169. Case Study 15 — Integrated Sustainable Farming System (Malaysia): The case study shows that a time-limited, non-exclusive license with low fixed annual fees (deferring royalty negotiation to a renewal stage) allows a spin-out to validate its business model and build market capacity before assuming sales-based obligations, while the university retains ownership, research-use rights, and quality oversight.

170. Across Case Studies 1-3 focusing on the health technology sector, success was not generated by IP protection alone. Impact resulted when legal rights being connected to complementary capabilities, financing, regulatory execution, manufacturing or delivery systems and identifiable users or purchasers. The Case Studies therefore reinforce the study's central proposition that K/TT performance should be evaluated through development, deployment and adoption outcomes, not only through patents, agreements or institutional activity counts.

171. Several cross-cutting lessons emerge. First, the collaboration structure should reflect the technology's maturity, regulatory pathway, capital needs and intended route to adoption. Second, agreements should clearly address background and foreground IP, development responsibilities, data and materials, publication, regulatory roles, manufacturing, milestones and post-termination rights. Third, universities and research institutions should evaluate prospective partners not only on financial terms but also on their technical, regulatory, manufacturing and market-access capabilities. Finally, downstream factors, including reimbursement, procurement, clinical integration, supply chains, training and user acceptance, should be considered early because they may ultimately determine whether a transferred technology produces health impact.

172. Overall, across Case Studies highlighting the role of remuneration schemes, three recurring lessons emerge. First, remuneration structures must be matched to the maturity and nature of the underlying asset. Second, deferred, milestone-linked, or hybrid remuneration mechanisms in several situations reduce early-stage risk and better align incentives than upfront lump sums or immediate royalties, particularly for long-cycle green and health technologies. Third, institutional architecture, whether public co-financing agencies, TTOs, industrial consortia, or surrogate licensors, must be tailored to context. Models proven in one jurisdiction are not automatically transferable absent comparable institutional capacity, funding mechanisms, and market absorption conditions. These cases are illustrative rather than representative. Their lessons should therefore be adapted to the relevant technology, jurisdiction, institutional capability and market context rather than treated as universally applicable models.

Part V: Synthesis of best practices and challenges

A. Best practices, challenges and their policy implications in industry-academia collaboration in the health technology sector

173. The comparative analysis indicates that knowledge and technology transfer (K/TT) outcomes in the health technology sector reflect the coordinated functioning of enabling legal and regulatory frameworks, institutional capacity, and collaboration design. Given the sector's distinctive characteristics, outcomes depend on alignment across macro, meso, and micro levels rather than on any single determinant. Performance assessment accordingly benefits from extending beyond transactional indicators to encompass downstream measures, including technology validation, regulatory progress, manufacturing readiness, adoption, and demonstrable benefit to patients, health systems, and society.

174. The following practices have been identified through comparative analysis as supporting effective industry-academia collaboration in the health technology sector. Their effectiveness is context-dependent and conditioned by the nature of the technology, the development pathway, and the institutional capabilities of the parties involved, and they should therefore not be understood as universally applicable prescriptions.

175. First, clear and predictable intellectual property frameworks are important, but ownership certainty alone does not determine whether industry will engage. Prospective partners also consider the relevance of the research to an unmet need, the technology's maturity, proof-of-concept evidence, regulatory feasibility, market demand, development and financing requirements, freedom to operate, and the organization's capacity to absorb and advance the technology.

176. Second, strong institutional capacity is critical. Universities with well-established technology transfer offices, experienced personnel, and standardized processes are better positioned to identify promising inventions, manage patent portfolios, negotiate licensing agreements, and support commercialization pathways. Institutional capacity also includes access to legal expertise, regulatory understanding, proof-of-concept funding, and entrepreneurial support systems.

177. Third, institutions should use disciplined and evidence-based processes to prioritize technologies for further investment. Not every disclosure or patent application warrants the same level of support. Decisions regarding patenting, proof-of-concept funding, licensing, startup formation or discontinuation should consider scientific differentiation, unmet need, technical maturity, regulatory pathway, development cost, market or public-sector demand, competitive alternatives and the availability of capable partners.

178. Fourth, early integration of intellectual property and regulatory strategies significantly improves outcomes. In the Health Sector, where regulatory approval is often the primary determinant of market entry, IP decisions must be made with full awareness of clinical development timelines, regulatory data requirements, and approval pathways.

179. Fifth, effective collaboration depends not only on selecting an appropriate transaction type, but also on designing workable governance arrangements. Licensing, sponsored research, co-development, clinical collaboration and startup formation may each be appropriate in different circumstances, but the agreement should clearly address background and foreground IP, access to data and materials, publication and confidentiality, decision-making authority, project changes, development and regulatory responsibilities, funding commitments, use of subcontractors, dispute resolution, termination and the parties' rights to use results after the collaboration ends. The structure should be tailored to the technology's maturity, the capabilities and contributions of the partners, and the intended route to development and adoption.

180. Sixth, alignment of incentives across stakeholders enhances collaboration. Academic researchers, universities, industry partners, and public funders may have different objectives, ranging from scientific advancement to financial return to public health impact.

181. Seventh, downstream adoption requirements should be incorporated into K/TT planning from an early stage. A technically successful and regulatorily authorized health technology may still fail to achieve impact if it lacks evidence of clinical utility, reimbursement or procurement pathways, appropriate quality systems, manufacturing and supply-chain capability, implementation support, trained users or acceptance within healthcare settings.

182. Despite the presence of best practices, several persistent challenges continue to affect technology transfer in the health technology sector. One of the most significant challenges is regulatory fragmentation across jurisdictions. For technologies intended for global markets, navigating multiple regulatory systems can create uncertainty and delay commercialization. Additionally, emerging technologies often require interdisciplinary expertise and may involve overlapping regulatory regimes, further complicating technology transfer. A related challenge is the misalignment between intellectual property strategies and regulatory pathways creating mismatch in the timelines and outcomes for patenting and regulatory approvals. Capacity gaps at the institutional level remain another major barrier. Not all universities and research institutions have access to experienced technology transfer professionals, legal expertise, or commercialization support systems. A related challenge is the tendency to continue supporting technologies after evidence of limited technical, regulatory or commercial viability has emerged. Institutions may face internal pressure to maintain patent portfolios, preserve inventor relationships or avoid acknowledging sunk costs.

183. The policy implications below should be interpreted as context-dependent interventions rather than universal prescriptions. Before adopting a measure, policymakers and institutions should identify the specific barrier to be addressed, the actor responsible for implementation, the evidence supporting the intervention, the institutional capabilities and resources required, the likely financial and administrative cost, and any potential unintended consequences. Measures should also be matched to the relevant technology archetype and to the maturity of the national or institutional K/TT system. First, there is a need to enhance coordination between intellectual property and regulatory systems. Second, strengthening institutional capacity should be a priority. Investments in technology transfer offices, training programs, legal support, and commercialization infrastructure can significantly improve outcomes. Third, institutions and funders should adopt outcome-oriented performance measures. Evaluation should extend beyond patent counts, executed agreements and startup formation to include technology validation, partner engagement, follow-on financing, regulatory progress,

manufacturing readiness, adoption, patient or user reach and public-health benefit. Fourth, promoting international convergence and regulatory cooperation can reduce fragmentation and facilitate cross-border collaboration. Finally, policymakers should recognize that K/TT is an ecosystem function rather than a single transaction. Effective policy must address the full pathway from research and disclosure through validation, partner formation, regulatory development, financing, manufacturing, procurement, reimbursement and adoption. Weakness at any one stage may prevent otherwise promising technologies from reaching use. Policy interventions should therefore be designed around identified bottlenecks and should specify the actor responsible, the resources required and the outcomes by which progress will be assessed.

184. Looking ahead, health technology transfer is likely to move further from a linear 'disclose-patent-license' model toward more integrated translational ecosystems. The field has already evolved to include earlier industry engagement, regulatory planning, clinical validation, data governance, manufacturing readiness, startup formation, and public-interest safeguards. The next phase will likely be shaped by artificial intelligence, precision medicine, digital health, gene and cell therapies, platform technologies, and bio-manufacturing.

185. Viewed through the macro, meso and micro framework, the central finding is that health K/TT outcomes depend on alignment across all three levels. At the macro level, laws, public-funding rules, regulatory systems, procurement and reimbursement arrangements, development finance and international frameworks establish the enabling environment. At the meso level, universities, public research institutions, hospitals, technology transfer offices, incubators and related intermediaries determine whether research can be identified, evaluated, protected, validated and connected with capable partners. At the micro level, individual collaborations and agreements allocate ownership, development responsibilities, financing, regulatory roles, manufacturing obligations, access provisions, governance and pathways to adoption.

186. The overall lesson is that successful health K/TT is neither purely legal nor purely transactional. It is a coordinated process in which policy, institutional capability, collaboration design and downstream implementation must reinforce one another. Systems that achieve this alignment are more likely to convert academic research into products, services and capabilities that generate durable economic, clinical and societal impact.

B. Best practices, challenges and policy implications in industry-academia collaboration in the green technology sector

187. The translation of green technology research into commercially deployable and widely adopted solutions depends, in a decisive manner, on the quality of the collaboration between academia and industry. Green technology transfer operates at the intersection of scientific complexity, regulatory heterogeneity, long validation timelines, and urgent climate imperatives. This combination of structural characteristics makes the design of effective industry-academia collaboration models both more demanding and more consequential than in conventional technology domains.

188. The comparative analysis of industry-academia collaboration in the green technology sector reveals a consistent set of practices that have proven effective across jurisdictions at different levels of institutional maturity. These include the co-financing of long-horizon research programs between universities and industrial partners with embedded IP access rights; the use of public competitive tenders as transparent and legally robust mechanisms for licensing publicly developed green technologies; the deployment of sequential sublicensing structures that allow territorially differentiated commercialization strategies; and the integration of dedicated scale-up infrastructure – pilot plants, validation centers, and manufacturing

innovation institutes as essential intermediaries between laboratory discovery and industrial deployment.

189. Across all cases examined, the presence of a skilled articulator: whether a TTO, a public agency, or a specialized intermediary capable of connecting technological, legal, financial, and regulatory dimensions simultaneously, emerges as the single most determinant factor of successful transfer outcomes. Yet the impact of articulation remains largely unmeasured. Conventional K/TT metrics – patents filed, licenses executed, royalties collected, spin-outs – capture transactional outputs but systematically fail to account for the value generated through the connections made, the partnerships enabled, the financing pathways opened, and the institutional barriers navigated by skilled articulators. This measurement gap results in the chronic under-resourcing and under-recognition of the articulation function itself. Just as the field of development economics eventually expanded its evaluation frameworks to capture social impact beyond GDP, green technology transfer practice must develop the indicators and methodologies needed to make articulation impact visible, measurable, and fundable.

190. Industry-academia collaboration in the green technology sector faces a distinctive set of structural challenges that distinguish it from technology transfer in more mature sectors. The long validation timelines and high capital requirements of many green technologies create a persistent financing gap between research outputs and commercial readiness that neither public funding nor private venture capital consistently bridges. The multi-domain regulatory complexity spanning energy, environmental, industrial, safety across jurisdictions imposes disproportionate compliance burdens on innovators, particularly those operating from under-resourced institutional environments. At the institutional level, the asymmetry between academically strong but commercially inexperienced licensors and industrially sophisticated licensees generates persistent imbalances in negotiating capacity and contractual outcomes.

191. Finally, due to the speed and scale at which green technologies are required to be disseminated, literature identifies situations in which environmental benefits are not fully reflected in private returns. In such cases, jurisdictions use differing policy and financing responses.

192. At the macro level, technology transfer legislation in most jurisdictions does not include provisions specifically tailored to green technology licensing and adoption. Regional integration mechanisms may offer a pathway to aligning green technology definitions, classifications, and examination criteria across member jurisdictions, thereby reducing cross-border licensing and patent prosecution costs. Such alignment may be pursued progressively as national frameworks reach sufficient maturity and compatibility to support effective coordination. Accelerated patent examination programs, where implemented, should incorporate data collection mechanisms to permit assessment of their effects on licensing activity, investment, and deployment outcomes. Public financing instruments for green technology transfer — including national development banks, public innovation agencies, and multilateral financial partners — constitute a strategically significant architecture for bridging the gap between demonstration and commercial deployment.

193. At the meso level, support for technology transfer offices should be calibrated to institutional maturity. Emerging K/TT offices may require multi-year public funding for specialist personnel, patent prosecution costs, market assessment, and standardized licensing templates. Shared, regional, or external technology transfer models may be appropriate for institutions that lack the scale or transaction volume needed to sustain in-house expertise. Institutions with intermediate capability may benefit from targeted support in developing green technology specific competencies, including patent landscape analysis, standards-related licensing, and territorially differentiated sublicensing strategies. Digital

licensing platforms may improve access and support the intermediation function, enabling prospective licensees to identify technologies and initiate access processes while allowing technology transfer specialists to focus on negotiation, customization, and market entry activities. International platforms designed to connect green technology providers, seekers, investors, and partners offer complementary reach, though evidence on their effects on licensing volumes and deployment outcomes warrants continued assessment.

194. At the micro level, regional and institutional disparities in legal and negotiating capacity may disadvantage under-resourced public licensors. A standardized, openly available green technology licensing toolkit comprising modular templates for exclusive and non-exclusive licenses, material transfer agreements, option agreements, and collaborative research arrangements, together with guidance on term-sheet design calibrated to technology type, development stage, territory, and exclusivity — may help address these disparities. Such a toolkit should address public interest provisions, access safeguards for climate-critical applications, and commercially viable arrangements for capable development partners. Industry-sponsored research arrangements, under which sponsors obtain a time-limited first option to license research outputs while institutions retain ultimate control over intellectual property, represent a broadly applicable model for sharing development risk and aligning incentives across the pre-commercial stage. For capital-intensive technologies with extended demonstration periods, trial licenses and milestone-based royalties may provide additional mechanisms for aligning payments with progressive risk reduction.

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[End of Annex, Appendix follows]