

D

International cooperation on innovation policies in the digital age

National innovation policies, like other government policies, serve domestic policy objectives. As discussed in Section C, they can generate both positive and negative international spill-over effects, and some of the mechanisms through which they generate spill-overs involve trade. This section focuses on cooperation aimed at addressing the trade-related international spill-overs from innovation policies. Such cooperation could help to ensure that governments have the policy space to pursue innovation policies, and could help to maximize the positive international spill-overs of such policies, while minimizing their negative effects on trading partners.



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Some key facts and findings

- The multilateral trading system contributes to innovation and the diffusion of technologies by promoting trade and stimulating international competition.
- Many provisions in regional trade agreements on industrial and innovation policy in the digital age do not only replicate or build on existing WTO agreements but establish new obligations for participants covering issues including data protection, localization of certain processes, competition and intellectual property.
- The WTO agreements have proved forward-looking in helping to foster the development of economies that can benefit from information and communications technology. The WTO's agreements and other trade agreements can help to prevent the introduction and spread of barriers to cross-border digital trade and to make it an engine for development.
- The rising importance of data as an input in production and the potential use of such data by multiple parties is leading to demand for new international rules on data transfer, data localization and privacy protection.
- The increasing positive "network effects" that innovation policies in digital equipment industries generate for digitally enabled industries across the world strengthen the case for international cooperation to encourage national governments to support innovation.
- The "winner-takes-all" characteristics of many digital industries can lead to calls for international cooperation to limit negative cross-border effects resulting from strategic government policies.

1. Introduction

Over the years, in both regional and multilateral fora, governments have negotiated agreements which, to one degree or another, discipline the use of industrial and innovation policy instruments. With the current revival of industrial policies in the digital age, the relevance of these disciplines tends to increase.

Three trends in the global economy challenge the way in which current multilateral rules regulate innovation policies.

First, the rapid growth of the digital and data-driven economy is leading to changes in national innovation policies. These changes call for more international cooperation to explore the need for and possibly agree upon new international disciplines.

Second, some least-developed and developing countries have not been able to benefit sufficiently from the current wave of globalization and technological progress, and some developing countries seem to be stuck in a so-called middle-income trap, unable to further converge towards the high-income range. The challenge is to ensure that all will benefit from the rapid growth of the digital economy.

Third, big emerging countries have rapidly expanded their economic size and role in the global economy, which has led to bigger cross-border spill-over effects from some of their policies. The growing size of the spill-overs generates more innovation and provides more market opportunities for trading partners, on the one hand, but, on the other hand, tips the balance of rights and obligations in the multilateral trading system, and could lead to growing trade tensions.

Against this background, this section considers the international disciplines and cooperation that may be relevant to digital innovation policies.

Section D.2 provides an overview of multilateral and regional disciplines on digital innovation policies and of innovation-related activities in other international organizations. The overview of multilateral disciplines addresses how the WTO agreements regulate the use of trade or trade-related policy instruments for innovation policy purposes. The discussion covers the relevant provisions in the Subsidies and Countervailing Measures (SCM) Agreement, the Agreement on Trade-Related Investment Measures (TRIMs), the General Agreement on Tariffs and Trade (GATT), the Technical Barriers to Trade (TBT) Agreement, the General Agreement on Trade

in Services (GATS) and the Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS).¹

This is followed by a mapping of the main provisions addressing digital innovation policies in regional trade agreements (RTAs) notified to the WTO. The mapping indicates, amongst other things, where and how disciplines in RTAs go beyond multilateral disciplines.

The first part of Section D.2 ends with a brief sketch of the role played by some international organizations in promoting innovation.

Section D.3 discusses where and why digitalization and digital innovation policies are creating new needs for international cooperation and possibly for new and updated international disciplines on innovation policy instruments.

This discussion starts with a description of how digitalization, in the form of changes in technology and the organization of production, is inducing changes in the structure of the economy which, in turn, are generating changes in national policies which may require a change in international disciplines. A particular focus for the discussion is the new international spill-overs that innovation policies are generating in the digital age and the scope for more international cooperation to either encourage or mitigate these new spill-overs. The arguments for and against more policy space (i.e. the margin of manoeuvre available to governments under international disciplines to adopt the most appropriate mix of economic policies to achieve their development goals) for developing countries are also described.

This discussion serves as a framework for the subsequent discussion of international cooperation in specific areas such as support measures, standards and regulation, intellectual property (IP) protection, competition policy and data policies.

2. The existing framework of international cooperation

(a) Cooperation in the multilateral trading system

Trade is an important engine and vector for innovation. International cooperation in the multilateral trading system favours innovation-related policies in the digital world. By enhancing the flow of goods and services, the multilateral trading system makes a

major contribution to innovation worldwide and to the transfer of technologies.

Since its inception, the basic principles of the GATT (and today the WTO), such as non-discrimination, transparency, reciprocity and the prohibition of unnecessarily trade-restrictive measures, combined with the preservation of policy space for addressing important societal concerns, have promoted trade liberalization and innovation. These principles, although they pre-date the emergence of digitalization, continue to promote innovation in the digital world through the sophisticated, detailed disciplines contained in the WTO agreements examined in this section.

For instance, the SCM Agreement and the TRIMs Agreement require that financial support for innovation be accorded with respect for the principles of the multilateral trading system. The Information Technology Agreement (ITA) promotes innovation in the digital age through the non-discriminatory reduction and progressive elimination of tariffs on information and communications technology (ICT) goods. The TBT Agreement ensures that regulatory measures are transparent, non discriminatory and not unnecessarily trade-restrictive. The Government Procurement Agreement (GPA) requires that domestic public procurement procedures be conducted based on principles of transparency, non-discrimination and procedural fairness. The GATS requires that WTO members design and implement innovation policies with regard to services in a transparent and most-favoured-nation-consistent manner, and in accordance with their specific commitments on market access and national treatment.² The TRIPS Agreement requires a common minimum level of IP protection and enforcement, flanked by non-discrimination provisions, transparency requirements and binding dispute settlement, and ensures that incentives for innovation and the creation of intangible assets are comparable across WTO members' economies.

These agreements transcribe the fundamental principles of the multilateral trading system into detailed rules that affect innovation-related policies and, through those, decisions by public and private economic actors on how and where to invest in innovation. These rules are flexible enough to enable and promote innovation, while ensuring that all WTO members enjoy the benefits of trade liberalization. Moreover, the multilateral trading system provides predictability, while also promoting cooperation and enabling flexible responses to new problems. The WTO agreements thus ensure certainty and flexibility, which are crucial for deploying both innovation-

related policies and quick and adjustable responses to global crises.

(i) *Subsidies*

This subsection provides a brief overview of WTO subsidy disciplines, with a focus on how these relate to innovation-oriented government policy in the multilateral context.

Government financial support, in diverse forms, has long been integral to the development and implementation of innovative technologies, including procurement policies (see Section D.2(vi)). Programmes supporting research and development (R&D) have led to fundamental advances in innovation, creating technological platforms for many of today's dynamic industries. Satellite communications, genomic sequencing³ and the internet are areas of extensive commercial activity today, and came into existence through significant government support. For example, the internet owes its existence to a project funded by the US Defense Advanced Research Projects Agency (DARPA).

WTO subsidy disciplines come into play when government funds are directed more specifically at commercial activities, and these disciplines exist at present only for trade in goods.⁴ Article III:8(b) of the GATT 1994 explicitly affords space to national industrial policy in the form of subsidies. This provision allows subsidy programmes to promote exclusively domestic production, such as of ICT equipment, without falling afoul of the national treatment obligation, but attention to programme design is critical for such programmes to qualify for this carve-out. For example, such subsidies are also subject to the disciplines of the SCM Agreement, including the prohibition against subsidies contingent upon the use of domestic over-imported goods (for example, Article 3.1(b) prohibits subsidies that obliges a recipient of a subsidy to use in-puts or other domestic goods over imported goods). Conditions for eligibility for the payment of subsidies, which define the class of eligible "domestic producers" by reference to their activities in the subsidized product market, are also critical considerations (see, for example, WTO (2018b)).

Under the SCM Agreement, the definition of a subsidy requires a financial contribution by a government or any public body. The different forms of financial transfers are listed explicitly, namely:

- (i) direct transfers of funds such as grants, loans, or equity infusions as well as potential transfers, such as loan guarantees,

- (ii) foregone revenues that are otherwise due, and
- (iii) goods and services provided by the government other than general infrastructure, and purchases of goods by the government.

Article 1.1(a)(1)(iv) of the SCM Agreement specifies that subsidies are also deemed to exist if a government makes payments to a funding mechanism, or entrusts or directs a private body to carry out one or more of the type of functions illustrated under (i), (ii) and (iii) above. In addition to financial contributions by a government within the meaning of Article 1.1(a)(1), SCM Article 1.1(a)(2) also mentions any form of income or price support, as described by Article XVI of the GATT 1994, i.e. support which operates directly or indirectly to increase exports of any product from, or reduce imports into, a member's territory. SCM Article 1.1(b) stipulates that any such financial contribution or income or price support pursuant to SCM Article 1.1(a) must confer a benefit to the recipient if it is to be considered a subsidy in the sense of the SCM Agreement.

A subsidy is not subject to the SCM Agreement unless it is specific. The concept of specificity is also crucial in definitional terms, since particular forms of specificity (i.e. export contingency and contingency on use of domestic goods) attract the strictest discipline (i.e. prohibition), while non-specific subsidies fall outside the scope of the WTO subsidy rules. Specificity in the general sense is deemed to exist where access to the subsidy is explicitly limited to a particular set of beneficiaries. Subsidies in respect of which access is based on objective criteria and neutral conditions, which are strictly respected, are defined as non-specific. Government support for general infrastructure, for example, is excluded from the WTO definition of subsidies.

Concerns with trade effects and impacts on the level field of competition have been a continuing focus of multilateral subsidy disciplines. Certain subsidies (i.e. export subsidies and local content subsidies) are prohibited. Certain other subsidies are treated as actionable, or subject to challenge, either through multilateral dispute settlement or through countervailing action, if they cause adverse effects to the interests of another WTO member. Finally, certain subsidies were provisionally designated as non-actionable (e.g. non-specific subsidies, certain research assistance, certain assistance for adapting to environmental requirements, certain regional assistance), although this designation has since expired.⁵

Non-actionable subsidies included specific subsidies for assistance to promote adaptation of existing

facilities to new environmental requirements, assistance to disadvantaged regions, and research assistance. Research assistance was limited to cover not more than 75 per cent of the cost of industrial research and 50 per cent of the cost of pre-competitive development activity.⁶ Footnote 28 of the SCM Agreement defines the term "industrial research" as:

"[P]lanned search or critical investigation aimed at discovery of new knowledge, with the objective that such knowledge may be useful in developing new products, processes or services, or in bringing about a significant improvement to existing products, processes or services",

and footnote 29 defines the term "pre-competitive development activity" as:

"[T]he translation of industrial research findings into a plan, blueprint or design for new, modified or improved products, processes or services whether intended for sale or use, including the creation of first prototype which would not be capable of commercial use. It may further include the conceptual formulation and design of products, processes or services alternatives and initial demonstration or pilot projects, provided that these same projects cannot be converted or used for industrial application or commercial exploitation. It does not include routine or periodic alterations to existing products, production lines, manufacturing processes, services, and other on-going operations even though those alterations may represent improvements".

Thus, while research directed at upgrading the features of the latest model of a mobile telephone might be understood as competitive innovation, and not as being potentially entitled to non-actionable status, research directed at demonstrating the viability of mobile telephony technology prior to the development of commercial products utilizing such technology might be understood as pre-competitive development activity that could potentially have been eligible for non-actionable status.

Members could not agree to extend the operation of Articles 6.1, 8 and 9 of the SCM Agreement, and these provisions expired on 31 December 1999. At the time, certain developing members opposed provisional extension and wanted these provisions revised to address development concerns as part of a package that would also have revised the transition periods contained in the TRIPS and TRIMs agreements.

The SCM Agreement recognizes three categories of developing-country members: least-developed countries (LDCs),⁷ members with a gross national product (GNP) per capita of less than US\$ 1,000 per year (which are listed in Annex VII to the SCM Agreement),⁸ and other developing members.⁹ The lower a member's level of development, the less stringent is the treatment it receives with respect to subsidies disciplines. Serious prejudice presumptions contained in Article 6.1 are not applicable to developing countries. Actionable subsidies maintained by a developing country are generally not subject to claims of serious prejudice. With respect to countervailing measures, developing-country members' exporters are entitled to more favourable treatment with respect to the termination of investigations where the level of subsidization or volume of imports is small.

Government assistance to R&D for large commercial aircraft became a focus of the most extensive dispute settlement proceedings arising to date under the SCM Agreement. Despite earlier notions that R&D subsidies might be granted without causing trade effects, both complainants (the United States and the European Union) challenged R&D subsidies through the WTO's dispute settlement system. Extensive legal analysis and reference to voluminous factual evidence led dispute panels and the Appellate Body to conclude that much of the government R&D assistance constituted financial contributions that provided a benefit to the recipients, were specific, and caused adverse effects or serious prejudice to the trade interests of the complainants. One factor in the findings was the conditions of competition in the global market for large civil aircraft, as described for example by one panel report:

“[T]echnological innovation is a key feature of the competition that takes place between Airbus and Boeing for new and existing customers. Airbus and Boeing will introduce new LCA products that are technologically advanced precisely to win the competition against each other's existing aircraft” (WTO, 2010c).

Because of this competitive dynamic, R&D assistance was found to cause adverse effects or serious prejudice when the producer would be unable, but for the subsidy, to bring to market a product at a specific time and/or with specific technological attributes.

The findings in the large civil aircraft disputes are grounded in specific circumstances, but one may query the extent to which technological innovation constitutes a field of commercial competition is an important, or increasingly important, feature

in relation to other high-tech and digital economy products and industries. While the SCM Agreement provision of non-actionable status for precompetitive development activity has lapsed, the concept may continue to be relevant to governments in their support policies for innovation in industries where technological innovation is part of the competitive dynamic.

(ii) Trade-related investment measures

This subsection provides a brief overview of the TRIMs Agreement, with a focus on how it may relate to innovation policy in the multilateral context. Foreign investment can present an opportunity for governments to integrate new and innovative commercial sectors, such as the digital economy, into their local economies. Investment measures are, therefore, a potential means of implementing policy goals relating to economic development in these fields.

The TRIMs Agreement recognizes that certain investment measures can restrict and distort trade, and when such measures discriminate against foreign products or lead to quantitative restrictions, these are measures inconsistent with basic WTO obligations.

In the Uruguay Round (1986-94), negotiators were directed to undertake “an examination of the operation of GATT Articles related to the trade-restrictive and trade-distorting effects of investment measures”. The TRIMs Agreement applies to investment measures related to trade in goods only. The disciplines of the TRIMs Agreement focus on investment measures that infringe GATT Articles III and XI, in other words, that discriminate between imported and exported products and/or create import or export restrictions. Article 4 of the TRIMs Agreement clarifies that, to the extent that Article XVIII of the GATT 1994 permits developing-country members to deviate temporarily from Articles III and XI of the GATT 1994, Article 2 of the TRIMs Agreement does not preclude such deviations with respect to trade-related investment measures. An annex to the TRIMs Agreement provides an illustrative list of inconsistent measures.¹⁰

In *Brazil – Taxation* (WTO, 2018b), programmes related to the ICT industry, among others, were challenged by the European Union and Japan as being inconsistent with the TRIMs Agreement, as well as with the GATT and the SCM Agreement. With respect to the ICT programmes, imported ICT products were found to be taxed more than similar domestic finished ICT products in a manner inconsistent with GATT Article III. Accreditation requirements under the ICT programmes were found to result in less favourable

treatment for imported ICT products, in the form of the differential tax burden to which imported ICT products are subjected by virtue of the fact that foreign producers cannot be accredited under the ICT programmes, and because imported intermediate ICT products face an administrative burden that is not faced, or is faced to a lesser extent, by purchasers of domestic intermediate ICT products that receive favourable tax treatment.

Those aspects of the ICT programmes found to be inconsistent with Article III of the GATT 1994 were also found to be inconsistent with Article 2.1 of the TRIMs Agreement. A defence claimed by Brazil on the basis of Article III:8(b) of the GATT 1994 (which permits subsidies to be paid exclusively to domestic producers) was rejected, among other reasons due to the product discrimination elements of the measures. A requirement to use domestic rather than imported goods in the production of ICT products, in order to have access to the assistance programme, was not permitted. Nevertheless, it was clarified that a subsidy programme to promote domestic production of certain products (such as ICT products critical for digital commerce), if properly designed in light of Article III:8(b), could be limited to domestic producers, however the latter were designated by the government programme, without contravening the national treatment obligation of GATT Article III, even though this might result in some competitive effects in the market for ICT products.

(iii) Tariff elimination and reduction in some sectoral agreements

The reduction and progressive elimination of tariffs on ICT goods has a key role in promoting innovation in the digital age. It not only enables and promotes the international flow of ICT goods, thus stimulating innovation, but also has a multiplier effect on the international trade of goods and services that use ICT-based components, infrastructure and hardware, as discussed in Section C.

The 1996 Information Technology Agreement (ITA) eliminated tariffs on computers, peripherals, semiconductors, semiconductor manufacturing equipment, ICT parts and components, productivity software, mobile telephones, and several other "enabling" instruments and equipment for the internet for all participants in the ITA.¹¹

The 14 initial participants in the ITA (counting the European Union as one participant) had grown by 2015 to 53, as most WTO accessions included agreement to the ITA, and several large members' free trade agreements (FTAs) required the parties to

agree to the ITA. Today, the 1996 ITA covers 85 WTO members, which account for approximately 97 per cent of world trade in ITA products.

The elimination of tariffs across the supply chain helped to enable the expansion of multi-country value chains. It also increased trade and related economies of scale, thereby contributing to the reduction of import prices and the increased affordability of ICT goods, freeing the associated potential of technology innovation (WTO, 2017). The lower cost and widespread availability of computers and mobile phones has had a positive impact on access to the internet and the growth of the digital economy, and has created new opportunities for trade. By binding and eliminating duties and other charges on ITA products in their WTO schedules of commitments, ITA participants extend duty-free treatment to all WTO members on a most-favoured-nation (MFN) basis, thereby bringing the benefits of the ITA to the entire WTO membership (WTO, 2017). The ITA has also enabled intensified global competition in mobile phones and smartphones which contributed to the development of mobile internet.

By reducing barriers to trade in ICT products, the ITA can play an enabling role in technology diffusion and innovation. Under the right circumstances, it can ultimately allow broader penetration of developing economies into global production networks and spur innovation in other sectors, thereby benefitting the economy as a whole (WTO, 2017). The ITA has contributed to reducing the costs of acquiring hardware infrastructure for the digital economy, hence expanding access to and usage of the internet in many countries, including LDCs, where access to telecommunications and the internet occurs mainly through mobile devices such as laptop computers and telephones. Removing tariffs on ICT products has made these products, and the potential of the technology innovation associated with them, affordable for a growing number of people around the world (WTO, 2017).

The 2015 ITA expansion added 201 additional tariff lines to the existing ITA, including new-generation semiconductors, semiconductor manufacturing equipment, optical lenses, GPS navigation equipment, and medical equipment, such as magnetic resonance imaging products and ultrasonic scanning apparatus. The ITA expansion allows the benefits of tariff elimination to be connected to innovation by extending these benefits to new ICT products, parts or components that did not exist in 1996. It currently has 26 participants covering 55 WTO members, and represents approximately 90 per cent of the world trade in ITA expansion products. In 2016, world

Box D.1: Tariff elimination in the pharmaceutical sector

At the end of the Uruguay Round, several WTO members agreed to reciprocal tariff elimination for pharmaceutical products and for chemical intermediates used in the production of pharmaceuticals.¹² Currently there are seven signatories of the WTO Pharmaceutical Agreement (Canada; the European Union; Japan; Macao, China; Norway; Switzerland; and the United States). The elimination of tariffs among these WTO members promotes innovation in the pharmaceutical sector, particularly as this plurilateral sectoral agreement eliminates import duties on the entire supply chain.

The Pharmaceutical Agreement has certainly contributed to the emergence of more interconnected and global production chains. Given the dynamism of global trade in this sector (trade of pharmaceutical products has experienced an annual compound growth rate of close to 15 per cent since 1995), the Agreement could also open opportunities for developing countries building production capacity in the pharmaceutical sector.¹³

In the context of the global COVID-19 pandemic in 2020, several WTO members have suggested an approach similar to that pioneered by the ITA. In April 2020, Australia, Brunei Darussalam, Canada, Chile, Lao People's Democratic Republic, Myanmar, New Zealand, Singapore and Uruguay issued a joint ministerial statement affirming their commitment to ensuring supply chain connectivity amidst the COVID-19 situation.¹⁴

Following this joint statement, New Zealand and Singapore launched the “Declaration on Trade in Essential Goods for Combating the COVID-19 Pandemic” on 15 April 2020,¹⁵ whereby signatories commit to eliminating all customs duties (it is unclear whether this commitment is for permanent and binding tariff elimination or for temporary tariff relief) and commit not to apply export prohibitions or restrictions on essential goods, including medical products, hygiene products, pharmaceutical products and agricultural products.¹⁶ Other WTO members have expressed interest in joining the initiative.

In addition, the European Union has recently called for comprehensive negotiation of a plurilateral agreement that would lead to a level playing field, including the possible permanent liberalization of tariffs on medical equipment.¹⁷

exports of both ITA and ITA expansion products reached a share of more than 20 per cent of total manufactures exports (see also Box D.1).

(iv) Technical standards

Technical standards¹⁸ provide an essential framework for the development of innovative and interoperable digital technologies. Technical standards facilitate innovation because they codify and disseminate best practices in technology in a way that can be built upon by others and make it easier to bring inventions to the market (Blind, 2009) (see section C). Technical standards regulating safety, quality and other characteristics of products – including technological goods – often affect international trade (see also Box D.2).

The main WTO agreement disciplining these measures is the TBT Agreement.¹⁹ The TBT Agreement also recognizes the pivotal role of technical standards, in particular of “international standards”, in technology development and dissemination. For instance, it enshrines in its preamble the recognition by WTO members of the “contribution which international standardization can make to the transfer of technology

from developed to developing countries”. The seamless interoperability that consumers expect in digital technologies, enabling and driving forward innovative digital technologies (e.g. autonomous vehicles; additive manufacturing such as 3D printing; the Internet of Things (IoT); Blockchain; artificial intelligence (AI)),²⁰ is built upon a rich patchwork of technical standards (e.g. those for enabling IoT, the 5G mobile network, etc.). Together, these elements allow “the whole to be greater than the sum of its parts” (Lim, 2019).

However, technical standards do not only ensure interoperability; they are also designed to ensure other important societal values such as safety, quality and environmental protection. This is why regulators draw upon technical standards when they intervene in the market to address market failures.

WTO disciplines on international standards and mutual recognition are two important tools by which the multilateral trading system fosters cooperation on digital technologies. The TBT Agreement promotes the harmonization of national technical requirements and standards with international standards, enabling the

Box D.2: International regulatory cooperation and COVID-19

The COVID-19 pandemic illustrates the value of international regulatory cooperation to build trust in the regulatory approvals of other members that can be relied upon in an emergency.²¹

For instance, if a crucial vaccine has already been approved by a regulator in a trusted member, this approval can be relied upon directly by regulatory agencies in other members. This will allow them to fast-track their own domestic approval process, ultimately ensuring that the vaccine is put to use more quickly.²²

There are a range of fora that bring together regulatory authorities of members to align procedures and standards in specific medical sectors, such as the International Medical Devices Regulators Forum and its Medical Device Single Audit Program, by which a single on-site audit of a medical device manufacturer is accepted by five countries.²³ This could minimize burden on industry and help promote more efficient and effective use of regulator resources for faster approval of innovative devices.

Mutual recognition of conformity assessment for medical devices and pharmaceuticals in RTAs, or in other bilateral or regional arrangements, can also help to avoid duplication and reduce unnecessary delays in approvals. To date, members have notified 22 such agreements (mutual recognition agreements, cooperation agreements etc.) to the TBT Committee.²⁴ Nine of these notifications concern both pharmaceutical products and medical devices, while another seven concern solely pharmaceutical products and six solely medical devices.

global diffusion of interoperable digital technologies. The Agreement recognizes that (voluntary) standards development may sometimes be a joint private and public endeavour. Its various disciplines (reinforced by the guidance developed by the TBT Committee over the years)²⁵ apply equally to technical standards prevalent in the digital economy. The ultimate goal of the TBT Agreement is to ensure that regulatory measures adopted by economies around the globe are transparent, non discriminatory, and not unnecessarily trade-restrictive, while preserving the wide policy space that countries have for addressing important societal concerns, such as health and the environment.

As already mentioned, one key element in the TBT Agreement for furthering its ultimate goal is the promotion of the harmonization of technical standards. To this end, the Agreement favours, in particular, regulatory harmonization on the basis of “international standards”. The TBT Agreement strongly encourages governments to use international standards as a basis for their own regulations and standards. For instance, technical regulations that are “in accordance with” international standards are in principle “presumed” to be TBT-consistent (at least in the sense that they do not create “unnecessary obstacles” to international trade).

The TBT Agreement also promotes other forms of global regulatory harmonization or convergence. One such tool is “mutual recognition”. Under the Agreement, members shall ensure, wherever possible, that the results of conformity assessment (e.g. testing

and certification) carried out in other members are accepted, even when such procedures differ from their own. Members are also encouraged to be willing to enter into negotiations for the conclusion of mutual recognition agreements.

Another tool is “equivalence”. The TBT Agreement provides that members must at least give “positive consideration” to accepting as “equivalent” the technical regulations of other members, even if these regulations contain specifications that differ from their own (provided that they are “satisfied” that these regulations “adequately” address the legitimate objective of their own regulations).

Karachalios and McCabe (2013) argue that the success of the internet has benefitted from the bottom-up, globally open, market-driven system of standardization as supported by the TBT Committee’s *Decision on Principles for the Development of International Standards, Guides and Recommendations with Relation to Articles 2, 5 and Annex 3 of the TBT Agreement*²⁶ in 2000. For instance, on “Effectiveness and Relevance”, the Decision states that:

“international standards need to be relevant and to effectively respond to regulatory and market needs, as well as scientific and technological developments in various countries. They should not distort the global market, have adverse effects on fair competition, or stifle innovation and technological development”.²⁷

The TBT Agreement is also relevant with respect to regulations implementing the results of research when applied to products traded internationally. For example, clinical trials, product testing, or marketing approval of medicines, biotechnology or other novel products²⁸ are governed by the disciplines of the TBT Agreement to the extent that the said regulatory measure is, for instance, a “conformity assessment procedure” within the meaning of the TBT Agreement.

Cooperation on technical standards is also especially important when confronting novel regulatory challenges and risks, such as those related to “dual use technologies” (i.e. both for civil and defence purposes) or to the area of AI.²⁹ Technical standards applying to dual-use technologies, for instance with respect to radio, telecommunication and network security, or autonomous vehicles and aircraft, are notified by WTO members under the TBT Agreement.³⁰

AI offers many potential benefits – including addressing health challenges³¹ – but may also lead to potentially significant risks (including for health, safety and privacy), the contours of which are not yet fully understood. Nevertheless, governments are already developing new regulatory frameworks to grapple with such risks. It is possible, therefore, that countries may end up adopting divergent AI regulations addressing similar types of risks. These divergences may deter or substantively delay the deployment of AI, IoT and robotic solutions, including those that could be relevant for addressing urgent and serious situations. Early global regulatory cooperation on AI,³² including through agreement on common international standards for AI safety and performance, is important for avoiding unnecessary barriers to trade in products involving AI. Members can draw upon the practices and disciplines of the TBT Agreement to promote better regulations that will allow AI to deliver while posing as few unintended risks as possible (Lim, 2019).

(v) *Government procurement*

Public procurement on average accounts for 10 to 15 per cent of GDP in most countries, and is thus a key economic activity. In addition to governments’ primary need to purchase goods and services for public purposes to fulfil their functions, governments increasingly use public procurement as a strategic tool to attain broader policy objectives, as discussed in Section C. These objectives notably include supporting and facilitating innovation (OECD, 2019).

“Innovation procurement” consists in using the government’s purchasing power to buy the process

of innovation (R&D) or the outcomes of innovation (innovative goods or services). What this means is that governments, by virtue of their purchasing power, have the ability to create markets for or to shift markets towards innovative products. This is of some interest notably in the context of sustainability-oriented public procurement (United Nations Environment Programme, 2018). Policy instruments used to support procurement for innovation vary from concrete overarching strategies to financial instruments.

The plurilateral WTO GPA, which currently has 20 parties covering 48 WTO members, enables and facilitates innovation procurement in three key respects.

First, innovative solutions may not be available for purchase at home or may be available at home only at a substantially higher cost, offering less value for money, or at lower quality than abroad. On this basis, several parties to the GPA have opened relevant procurement to international competition in the framework of the GPA, i.e. covered such procurements in their Appendix I Annexes to the GPA (or “schedules”) as follows:³³

- Several GPA parties cover specialized research bodies as procuring entities.
- GPA parties cover most goods, including innovative goods.
- GPA parties provide significant services coverage. While R&D services are not typically covered, many other services sectors, including those with particular relevance to digital innovation (e.g. computer and related services) are covered. Furthermore, some parties cover commercial market research services, and market research and public opinion polling services.

Second, the GPA procedural and transparency rules facilitate innovation procurement. Generally, GPA rules reflect and incorporate international best public procurement practices. Adherence to these rules supports successful innovation procurement, at least indirectly. GPA rules notably require that domestic public procurement procedures be conducted based on principles of transparency, non-discrimination and procedural fairness. The GPA also contains more directly innovation-related rules that are useful to highlight.

To begin with, GPA rules bar procuring entities from excluding suppliers from public procurement procedures on the basis that they have not previously

been awarded contracts by those entities and clarify that relevant prior experience may be used as a condition for supplier participation only where such experience is essential (Article VIII:2). These rules clearly support newly entering (start-up) or disruptive suppliers that wish to provide innovative technological or other solutions. Moreover, the GPA explicitly permits qualitative contract award criteria (as opposed to solely price- or cost-based criteria) (Article XV:5 and X:6). This is highly relevant in the context of innovative products. Owing to their important R&D component or still limited market penetration, innovative products may be associated with higher purchase prices. In addition, the GPA allows procuring entities to design technical specifications to promote the conservation of natural resources or protect the environment (Article X:6) and thus potentially use such environmental standards to drive and foster technological innovation.

Similarly, GPA rules stipulate that procuring entities must, where appropriate, set out technical specifications in terms of performance and functional requirements (rather than design or descriptive requirements) and may not normally prescribe technical specifications that require or refer to particular trademark, patent, etc., or else they are to indicate that “equivalent” solutions may also meet their requirements (Article X:2 and 4). These rules promote innovative solutions and keep public procurement markets contestable for innovative new market entrants.

Furthermore, to safeguard policy space for GPA parties, normal GPA rules do not need to be followed in their entirety where a procuring entity in the context of a government contract with a supplier for research or development procures a prototype from that supplier (Article XIII:1(f)).

Finally, the GPA also permits procuring entities to leverage suppliers’ innovation capabilities in times of extreme urgency. The COVID-19 pandemic demonstrated the critical importance of governments’ access to innovative solutions and products in a context of urgency and scarcity of medical supplies and related services. GPA rules provide procuring entities with the necessary procedural flexibility to fast-track innovation in urgent situations (Article XIII:1(d)).

Third, the GPA encourages (but does not require) the use of e-procurement as an alternative to paper-based procurement. The GPA-sanctioned trend towards e-procurement in itself stimulates demand for innovative digital technology solutions and can lower the costs associated with and lead to greater

participation in public procurement procedures of micro, small and medium-sized enterprises (MSMEs) (Anderson and Sporysheva, 2019). MSMEs, owing to their agility, can often be innovation leaders.

To date, most GPA parties have been developed-country WTO members, but most WTO members that are currently negotiating accession to the revised GPA are developing-country members. The revised GPA provides policy space for least-developed and developing members to pursue domestic socio-economic policies. In its preamble, the revised GPA recognizes “the need to take into account the development, financial and trade needs of developing countries, in particular the least developed countries”. The GPA incorporates provisions on special and differential treatment for developing and least-developed countries through tailor-made transitional measures, subject to negotiations during the GPA accession. In particular, developing countries may be allowed to maintain or adopt offsets and/or price preferences and to implement coverage commitments (entities and lower thresholds) gradually over time, subject to these measures being set out in their negotiated coverage schedules. Overall, the GPA transitional measures are designed to respond to the development, financial and trade needs, and circumstances of least-developed and developing countries.

(vi) Trade in services

There are mutually beneficial synergies between innovation and multilateral cooperation on trade in services. The existing multilateral framework for cooperation in services trade has enabled and promoted enhanced innovation around the world. The GATS contains detailed disciplines that contribute to competitive frameworks and good regulatory practices that support innovation. The GATS regular bodies also serve as forums for WTO members to share experiences and compare regulatory regimes governing services regulation that are often intimately linked to innovation policies. As discussed in Section C, innovation and digitalization have also transformed trade in services, bringing about new and different business models and allowing for the cross-border supply of services by the use of digital technologies (Franc, 2019).

The existing multilateral framework – GATS

The GATS does not mention “innovation” specifically; nevertheless, it contains relevant obligations and commitments, including provisions on the domestic regulation of trade in services. It allows WTO

members to design and implement innovation policies provided that they do so in conformity with their specific commitments, GATS general obligations and in the recognition of each member's right to regulate.

The link between the GATS and innovation is premised on two assumptions. The first is that trade in services, through four modes of supply (i.e. the cross-border supply of services from the territory of one member into the territory of another member (mode 1); the consumption of services abroad (mode 2); the establishment by a service supplier of a commercial presence abroad (mode 3); and the movement of individuals to another country in order to supply a service there (mode 4)), may promote innovation (and technology transfer) in host countries. The second is that members are free to design and implement innovation policies provided that they do so in accordance with their obligations under the GATS, in particular their specific commitments on market access and national treatment, as well as the principles of transparency and MFN treatment.

Indeed, trade in services may influence technological innovation in host countries through several mechanisms:

- the development of R&D in host countries, through the establishment of tech labs, design centres, or R&D hubs (mode 3);
- the creation of backward linkages, i.e. domestic services suppliers becoming suppliers of services for multinational corporations (MNCs), through outsourcing contracts (modes 1 and 3);
- the development of forward linkages in the host country through mode 3 subsidiaries of or joint ventures with services MNCs, requiring therefore some form of knowledge transfer from headquarters;
- the effects on local capital formation, e.g. staff of foreign services subsidiaries, via mode 3;
- the dissemination of knowledge through staff mobility as intra-corporate transferees or contractual service suppliers (mode 4).

GATS commitments on mode 3, in particular, provide a predictable environment for foreign service suppliers to establish a commercial presence abroad. To the extent that these suppliers are at the forefront of innovative processes or products (such as the outsourcing of software development or of network

management), they provide a conduit to transfer knowledge to the local workforce they employ and, potentially, to local suppliers, thereby promoting innovation diffusion. It should be noted, however, that any requirements that foreign suppliers establish locally as joint ventures need to be scheduled under the GATS as a market access limitation in committed sectors.

Similarly, any mandatory requirements that foreign suppliers train employees or transfer technology, or any policy that would reserve for domestic services firms only any subsidies related to R&D or to the development of technology by other means would need to be scheduled as national treatment limitations in committed sectors (this can also be done in the horizontal section of a member's schedule of commitments, thus covering sectors that are specifically scheduled, as well as those that are not).

Apart from the MFN and transparency obligations (and to some extent domestic regulation), most GATS disciplines, including most provisions on domestic regulation, apply only to committed services. The most advantageous conditions for the digital supply of information-intensive services are achieved when relevant commitments exist and when those are as open as possible (Tuthill, Carzaniga and Roy, 2020).

So far, WTO members have made uneven use of the possibility of undertaking GATS commitments. The proportion of schedules that contain commitments on cross-border supply and commercial presence for electronically transmitted services such as voice telephony, computer services, and online information and database retrieval, for example, is higher than in a number of other services sectors. However, more than one-third of schedules provide no guarantees of treatment even in these sectors. Retailing services, which include online retailing platforms, are uncommitted in the majority of members' schedules. Commitments on R&D services fall between these two poles, with a moderate but not extremely high number of commitments.

In addition, the number of schedules containing commitments on mode 1 is limited with regard to services, where the ongoing improvement of digital networks provides opportunities for cross-border electronic supply of services such as accounting, engineering, R&D, and advertising, audiovisual and educational services. Currently, 64 per cent of members' schedules that includes additional commitments in relation to the Reference Paper on Basic Telecommunications, drafted during the WTO negotiations on basic telecommunications.³⁴

Indeed, innovation and digitalization in the telecommunication and computer services sectors wherein generous GATS commitments supported open borders and regulatory reforms, have brought about further innovation not only in technology, but also in business models, for a wide array of information and knowledge-intensive services in other sectors.

The GATS and its obligations and commitments are considered to apply to the online services that result from digital innovations. As a result, innovation policies have had to take into account the cross-border contributions to innovation afforded by GATS modes 1 and 3, providing a stable framework for the flow of ideas regardless of origin. Software development and other forms of R&D, for example, are often conducted abroad both through foreign direct investment (FDI) and outsourcing by foreign subsidiaries taking advantage of GATS commitments. Moreover, the GATS serves as an overarching framework that can impact all services sectors; the following sectors are the most relevant examples.

Telecommunications

The GATS Annex on Telecommunications³⁵ and Reference Paper on regulatory principles for basic telecommunications³⁶ promote innovation policy insofar as they support competitive regulatory frameworks for the supply of telecommunications services. The Reference Paper helps to foster innovation, generally, as well as digital trade, by means of the extension of an affordable and efficient infrastructure for the wide array of electronic supply and purchasing activities that constitute e-commerce (WTO, 2018).

The Annex on Telecommunications applies to all WTO members. It requires that WTO members ensure that foreign service suppliers of all scheduled services have access to and use of public telecommunications transport networks and services (i.e. basic telecommunications) on reasonable and non-discriminatory terms and conditions.

The Reference Paper, unlike the Annex, becomes legally binding only on members that incorporated it into their schedules of commitments. Thus far, 103 WTO members have done so. It requires adherent governments to prevent anti-competitive practices by dominant suppliers of telecommunications that serve basic transport functions in regulatory areas ranging from interconnection to universal service provision.

Telecommunications services, including internet, mobile and data transmission services, play a key role in supporting continued innovation in the digital

age. Information telecommunications hardware and services infrastructure enable the electronic supply of innovative services and trade through digital networks. Telecommunications services, for which GATS contributed to opening markets, are today at the forefront of innovation and digitalization. For example, GATS commitments on market access for mobile telecommunications are by and large made on a technology-neutral basis in line with the scheduling guidelines contained in the Chairman's Note on Scheduling Basic Telecommunications).³⁷

Therefore, as innovation in mobile telephony has transformed the networks to adopt increasingly sophisticated technologies (i.e. second-generation mobile networks (2G) to 3G, with 5G and 6G currently on the horizon), the services could be smoothly introduced and continue to benefit from the predictability guarantees offered by the commitments and the Annex and Reference Paper obligations. By extension, development of the 5G mobile network is expected to support R&D and the deployment of enhanced audiovisual and other media services requiring high speeds and bandwidth, and also to serve as a launchpad for new and emerging technology services to become more widely available. These will include services such as AI, the IoT and high-capacity data analytics (Big Data).

Financial services in the digital age

The GATS coverage of financial services can play a key role in supporting their transformation in the digital age. The GATS Annex on Financial Services defines a financial service as "any service of a financial nature offered by a financial service supplier of a member", and defines a financial service supplier as "any natural or juridical person of a member wishing to supply or supplying financial services". The Annex on Financial Services allows WTO members to take measures for prudential reasons and to recognize other countries' prudential measures, through harmonization or otherwise.

The financial services industry has become one of the most ICT-intensive industries. Innovation in financial services has led to the introduction of innovative financial products and services, has altered the production process of financial institutions (e.g. non-core functions now tend to be outsourced/offshored), has allowed for the multiplication of delivery channels (e.g. ATMs, internet banking, mobile banking), and has led to new organizational forms (e.g. virtual banks) (WTO, 2010).

A concrete example of innovation in the area of payments is the accelerated use of electronic

payments (e-payments), which allow the whole transaction to be carried out through electronic means. Due to innovation and digitalization, the area of payments, once dominated by banks, is witnessing both increasing competition from new entrants and the emergence of e-payment methods that involve partnerships among different players, from telecommunications operators to express delivery companies and retail agents (WEF, 2018).

The development of e-payments allows for the expansion of e-commerce and drives the sale and purchases of new digitalized products and services. Nevertheless, together with these new opportunities, e-payments often arise as a challenge facing businesses trying to expand their global e-commerce, particularly small businesses. The main concerns often mentioned by small businesses with regard to making and accepting cross-border payments are transaction fees, the risk of fraud, foreign exchange fees and the speed of processing and settling payments (Saxo Payments Banking Circle, 2017) (see Box D.3).

(vii) Trade-related aspects of IP and innovation

The TRIPS Agreement sets in a trade policy context the traditional objectives of IP policy – namely, to balance incentives for innovators and creators with the interests of business and the public at large in promoting the benefits of disseminating the fruits of innovation and creativity.

Through common minimum levels of IP protection and enforcement, and provisions on non-discrimination and transparency, the TRIPS Agreement provides the necessary legal foundation for investment in innovative activities and the creation of intangible assets. It articulates general principles to be adapted according to domestic circumstances, allowing scope for diverse policy choices, so as to achieve a “balance of national IP systems and essential interoperability between national systems, rather than providing a specific model or prescription for innovation capacity.” (Taubman, 2019). The TRIPS Agreement also forms the basis for trading IP protected products, such as e-books and apps, as well as IP licences, securely and predictably within and across borders, thus facilitating a burgeoning trade in creative content.

Article 7 of the TRIPS Agreement sets out the policy context for the IP system, situating the objective of incentivizing innovative activity alongside the dissemination of, and access to, inventions and creations, so as to ensure a functioning, sustainable

innovation ecosystem, and to contribute to overall public welfare gains. TRIPS negotiators incorporated this provision against a longstanding background of international debate about the role of IP as a tool of public policy, marked particularly by the concerns of developing countries that the IP system should not simply respond to the interests of innovative firms – at the time, largely located in the developed world – but should serve broader social interests through the effective dissemination and diffusion of new technologies. The debate continues today, even as the landscape for innovation diversifies across the globe, with particular emphasis on health innovation, the green economy and overcoming the digital divide, with a continuing emphasis on balancing spurs for the development of new technology with mechanisms to accelerate its diffusion: in short, innovation and access (WTO, WHO, WIPO, 2020).

To achieve these ends, the TRIPS Agreement formulates a balanced set of standards across the entire spectrum of IP, also covering administration and enforcement, and providing scope for competition safeguards and public policy exceptions and limitations. The principles expressed in the TRIPS Agreement have proven sufficiently flexible to accommodate both new digital technologies and ways of creating and using protected materials in the digital environment (World Trade Report, 2018), and it extends traditional copyright principles to computer programmes and data compilations.

The implementation of TRIPS Agreement copyright standards by members forms part of the essential framework for e-commerce and international digital trade, as many digital products are defined in terms of use of specific intellectual property rights (IPRs), often in the form of a licence to use a copyrighted work. For instance, purchasing a video game, an application or a music file from an online retailer, or renting a film from a streaming platform, usually means obtaining a limited licence from the right-holder to use copyright-protected material, which can include the authorization to make a copy, and to obtain and use future updates of the game or software.

Patent laws implementing TRIPS standards mobilize private sector investment in R&D for new technologies, and facilitate technology transactions and the integration of complex technologies from diverse sources, both public and private, in a decentralized fashion. Recent patent filings have grown sharply, with computer technology and digital communication remaining among the top three categories in China, Japan, the Republic of Korea and the United States for several years, illustrating how firms seek to bring new applications of scientific

Box D.3: COVID-19-related measures and notifications in the WTO and in other contexts

WTO members have adopted a number of regulatory and legislative measures in the context of the COVID-19 pandemic, which have direct or indirect connections with WTO agreements. Since the beginning of the pandemic, the WTO has received a number of notifications under the transparency obligations of specific agreements or on a voluntary basis, as many members were willing to share such information.

The availability of online information is especially important in situations of global crisis, where physical access to national legislation is impeded or delayed. Online access to national legislation greatly improved opportunities for foreign operators to become acquainted with the different measures put into place by WTO members in response to the pandemic. The WTO also dedicated a webpage to compiling and reporting on COVID-19-related trade measures.³⁸

Border clearance for COVID-19-critical medical goods has been expedited by cutting back red tape. Since the beginning of the pandemic, the WTO has received a number of notifications regarding trade facilitation measures related to COVID-19. The measures have included, for example, guidelines on facilitating air cargo operations, relief from import duties and VAT exemption, streamlined procedures for applications to import, and export licences, among others. Thanks to digitalization, interested parties have detailed information about notifications, ratifications and implementation statistics and other relevant content at their fingertips.

Efforts to secure supplies of medical supplies and personal protective equipment (such as facemasks) in the early phase of the pandemic led some countries to protect national stocks of such equipment with temporary export restrictions, with measures being relaxed and imports being facilitated to improve sourcing from producing nations. Notifications of measures taken and relaxed were important to provide transparency during this difficult period.

About two-thirds of the 150 formal notifications and communications on the COVID-19 trade-related measures received to date from WTO members and observers, including from G20 economies, were related to sanitary and phytosanitary (SPS) measures and measures relating to technical barriers to trade (TBT). Many of these measures aimed to streamline certification procedures and tended toward increased use of electronic/digital procedures, including electronic certification, to facilitate access to medical and protective equipment.

Under the SPS Agreement, members have the right to adopt emergency and/or provisional measures based on available information. As more scientific evidence emerges and risk assessments begin to be carried out, the measures imposed must be reviewed within a reasonable period of time. A glance at the measures notified to the WTO under the SPS Agreement seems to indicate that, initially, members adopted measures imposing import restrictions on live animals from affected areas. Subsequently, most notifications and communications from members concerned measures aimed at facilitating trade by temporarily easing product certification requirements and moving towards more electronic/digital procedures, for example, regarding the acceptance of scanned copies instead of original documents, while ensuring product safety.

While some members explicitly indicated the temporary character of their measures during the pandemic, others have completed their ongoing transitions to paperless certification in their trade of plants and plant products and, to a lesser extent, animal products. Several members also included temporary flexibilities for foodstuffs, for example with respect to packaging and labelling. While food safety and animal and plant health remain a priority, the procedures set up by countries during the pandemic can contribute to reducing time and costs in the performance of SPS-related control, inspection and certification procedures, and could set the basis for more permanent solutions. TBT notifications concerned both pharmaceutical products and medical devices.

The work undertaken by the Committee on Government Procurement also provided opportunities for exchanges of views on digital innovation related topics. The COVID-19 pandemic has led to reflection on how best to procure innovative goods and services needed to respond to a crisis or on using government procurement to stimulate rapid innovation, as well as on how government procurement can best support post-crisis economic recovery. During the COVID-19 pandemic, several governments worldwide responded to their need for up-to-date information on the spread of COVID-19 by procuring innovative COVID-19-tracing applications. In that regard, considerations such as the need for the rapid development of new technology and concerns regarding how information will be used and stored should be taken into account when government procurement procedures are being designed.

Box D.3: COVID-19-related measures and notifications in the WTO and in other contexts (continued)

Many other actions and measures have been notified during the pandemic, in the contexts of existing agreements, committees, working groups and other informal mechanisms and on matters such as information-sharing on IP (including free access to relevant patents databases, technology transfer incentives, facilitating the exchange of clinical trial data and sharing IP to develop treatments), regulatory cooperation and competition policies. Several competition authorities issued additional guidance on the application of competition policy in times of urgency and of limited supplies, and clarified whether and when coordination between firms in order to respond to crisis needs could be permitted at least temporarily. Experience-sharing between competition authorities was important during the pandemic.

Beyond the crisis-response phase, competition authorities are expected to focus on how competition policy can support economic recovery and facilitate a return to optimal levels of competition. In that regard, the application of competitive neutrality rules and other competition policy principles to government support measures could help to avoid unnecessary market distortions.

and technological advances to the market. Patent applications on blockchain technologies have risen at least 140 per cent annually since 2013, forming over 3,000 patent families (IP Australia, 2018). Innovation in AI techniques grew by at least 28 per cent annually between 2012 and 2017 (WIPO, 2019), in over 55,000 patent families, the predominant applications being in the fields of computer vision and natural language processing. Recent trademark activity has been pronounced in the distinct clusters of research and technology, leisure and education, and business services, illustrating innovation in organizational and business models.

Much technology is disseminated when business right-holders license their IP or sell IP protected products or services, resulting in rapid commercialization of innovative products, notably digital technologies such as applications, smartphones, operating systems and video games, as private sector players respond to market incentives for the dissemination of new technology, which – in turn – allows and enables downstream technological and organizational innovation by users. The TRIPS Agreement framework has enabled a flexible range of innovation structures, defined by a diverse array of business models and technology licensing practices which defend IP assets – and thus investment – against free-riding by competitors and yet ensure avenues for private and public actors to formulate diverse arrangements for cooperation and pooling of technology licences. Public research institutions and other players therefore leverage IP to facilitate the take-up and dissemination of new technologies while advancing a social responsibility agenda (see Box D.4).

Pooling technology can remove obstacles to implementing common technology standards that create benefits and foster downstream markets.

For instance, over 30 companies contributed their patented technologies to a patent pool that enabled numerous commercial actors to implement the MPEG 4 visual standard, a widely used technology for compressing video and audio content. Through this pool, standard-essential patents have been licensed collectively to video, television and gaming applications – such as QuickTime or Xvid – for use on computers and mobile devices. Companies have also licensed and pooled relevant IPRs to cooperate in other complex technological areas.

The main IP mechanisms for the development and dissemination of innovations are commercial initiative and public-private cooperation through licensing. But the TRIPS Agreement also promotes access to and use of innovations by requiring patent applicants to disclose their inventions in a manner sufficiently clear and complete for them to be carried out by a person “skilled in the art” in return for the granting of patent rights, thus enabling early publication and understanding of emerging technologies, which can, in turn, spur technology transfer and further innovation. New digital research tools have significantly facilitated the use of patent information as a rich source of technological know-how, much of it in the public domain in most developing countries. For example, the World Intellectual Property Organization (WIPO) PATENTSCOPE enables detailed searches of over 80 million patent-related documents.³⁹

The TRIPS framework includes exceptions and limitations to IP rights that serve as regulatory tools to reconcile competing interests in IP policymaking, notably in the digital economy and in the public health space. Many innovative online business models (e.g. search engines, news aggregator services and platforms for user-generated content) rely on

Box D.4: Initiatives to accelerate innovations to fight COVID-19

Since creating a new drug is risky, lengthy, and expensive, while producing the drug is very cheap, the pharmaceutical industry offers a compelling case for patent protection (EPFL, 2020). Against this background, there is a lively ongoing discussion about the role of IP protection in the current fight against COVID-19.

There have been free licensing initiatives by private firms. The most well-known cases involve the antiretroviral drug Kaletra, produced by AbbVie (the company announced it will not enforce its patent in the current pandemic), and Remdesivir, an experimental drug for COVID-19 for which Gilead Sciences issued a voluntary licence to generic drug-makers. There are also ongoing initiatives of voluntarily sharing knowledge, IP and data, such as the Tech Access Partnership (TAP), hosted by the United Nations Technology Bank, or the Open COVID Pledge. Initiatives like these can foster innovation by providing information on patents, by offering legal certainty to follow-on innovators, and by reducing contracting costs between the patent-holder and potential users of the technology (EPFL, 2020).

Since 2010, a number of firms have concluded voluntary licences for health technologies with the Medicines Patent Pool (MPP). The MPP facilitates affordable access to medicines for those in most need and promotes transparency concerning patent coverage and licensing structures through its MedsPaL database (<https://www.medspal.org/>). Its mandate was recently extended to cover medicines under investigation for possible treatment of COVID-19.

In April 2020, the World Health Organization (WHO) joined with governments, global health actors and private sector partners to establish the Access to COVID-19 Tools (ACT) Accelerator, with the goal of accelerating the development and production of and equitable global access to new COVID-19-related essential health technologies. In May 2020, the WHO launched the Solidarity Call to Action and the COVID-19 Technology Access Pool (C-TAP) “to promote global public health goods, based on equity, strong science, open collaboration and global solidarity”. C-TAP will centralize commitments to share COVID-19 health technology-related knowledge, IP and data voluntarily.

Other significant initiatives both by the public and private sectors have aimed to accelerate innovations to protect against and treat COVID-19 and to secure equal access to relevant technologies through the voluntary sharing of IP rights. Sanofi and GSK entered into a Material Transfer Agreement to jointly develop a COVID-19 vaccine. Some publishers have made copyright-protected content on COVID-19 freely available to support research efforts. Under the Open COVID Pledge, multinational technology companies such as Microsoft, Amazon, IBM, Intel, Hewlett Packard and Facebook offered free worldwide licences to anyone to exploit essentially all their IP portfolios to end the pandemic and minimize its impact. Medtronic grants permissive time-limited licences to allow open access to design files and software for its ventilator for the purpose of treating COVID-19.⁴⁰ Its Ventilator Training Alliance transfers know-how required for the use of ventilator technology. The European Union and Singapore are making copyright-protected standards freely available to facilitate the manufacturing of medical devices and personal protection equipment (Enterprise Singapore, 2020; European Commission, 2020b). Singapore has made its contact tracing app open-source (Choudhury, 2020).

exceptions to constraints on the use of copyright-protected content (e.g. displayed by search engines or aggregators). Patent exceptions and limitations define where proprietary technologies can be used for research without the right holder’s authorization, thus helping to spur further innovation, and TRIPS dispute settlement practice has clarified the scope for generic producers to seek timely regulatory approval of follow-on medicines. Members may authorize more extensive use of patented technologies without the right-holders’ consent, including government use or public non-commercial use, with TRIPS leaving open the grounds for such authorization while stipulating procedural conditions so that the scope, time span

and territorial extent of such permitted use remains commensurate with its rationale (Box D.5).

(viii) Aid for Trade and innovation

The Aid for Trade initiative seeks to help developing countries, and in particular LDCs, to address supply-side and trade-related infrastructure obstacles that constrain their ability to engage in international trade. The initiative works by seeking to leverage development finance to resolve these obstacles. Total support disbursed through official development assistance since 2006, following the launch of the Aid for Trade initiative, amounts to some US\$ 450 billion.

Box D.5: TRIPS policy options to address COVID-19

The 2001 Doha Declaration on the TRIPS Agreement and Public Health affirmed that the Agreement “can and should be interpreted and implemented in a manner supportive of Members’ right to protect public health and, in particular, to promote access to medicines for all”, and clarified key public health flexibilities. It thus underpins general recognition that the TRIPS Agreement provides significant latitude for members to deploy policy options for public health.

In the absence of voluntary collaboration, patent exceptions and limitations in the TRIPS Agreement, as implemented into regional and national law, determine to what extent proprietary technologies can be used to develop new technologies and to secure access to existing technologies relevant to the pandemic. For example, when treatments and vaccines to treat COVID-19 come to market, the regulatory review exception permitted under Article 30 of the TRIPS, and clarified in dispute settlement, will enable a patented invention to be used to obtain early regulatory approval of a generic follow-on product.

Where appropriate, and subject to the conditions established in Article 31 of the TRIPS, compulsory or government use licences may also be granted to allow the manufacture or import of technologies protected by patents. All WTO members may grant such licences for healthcare technologies, such as medicines, vaccines and diagnostics, as well as any other product or technology needed to address COVID-19. To date, one government-use licence has been granted to import generic versions of lopinavir/ritonavir (deemed effective in treating COVID-19) because the right-holder could not supply the medicine. Some WTO members have also eased procedures to prepare or facilitate the prospective use of compulsory and government use licences to respond to the pandemic.⁴¹

Since 2003, an additional flexibility, now enshrined in Article 31bis of the amended TRIPS Agreement, has allowed members to issue special compulsory licences for the export of pharmaceutical products to members with insufficient manufacturing capacity, an avenue for access to medicines that may become more important as patents on pharmaceuticals become more prevalent in traditional low-cost producer countries. According to paragraph 1 of the Annex to the amended TRIPS Agreement, special compulsory licences may cover pharmaceutical products, including medicines, vaccines and diagnostics, needed to address epidemics.

The mechanism may thus be used by developing countries with insufficient or no manufacturing capacities and by LDCs to import healthcare technologies relevant to COVID-19. How a potential exporting country responds to the demand of an importing country would depend on a range of factors, including their own domestic needs, as special compulsory licences provide for the entire production to be exported. For instance, if a producing country grants a standard compulsory licence for its domestic needs, a non-predominant part may be exported to meet the import needs of such a country.

Limited digital infrastructure and poor internet connectivity constrain the participation of many developing country firms to be able to engage in e-commerce and to use the internet to spur innovation. International Telecommunication Union (ITU) data estimate that 47 per cent of the world’s population is still not connected to the internet. It also reveals a diverse picture: whereas in advanced nations, nearly 90 per cent of inhabitants enjoy access to reliable and affordable internet services, the figure does not exceed 45 per cent in the case of the most connected LDC, and is under 20 per cent for most other LDCs.

In 2017, the WTO-led Aid for Trade Global Review focused on the topic of “Promoting Connectivity”. A monitoring and evaluation exercise invited

stakeholders to outline actions they were taking to improve digital connectivity. The results of the exercise provided further information on the digital divide within countries: between large and small firms and between urban and rural areas, as well as between women and men. It also highlighted the difficulties many developing-country governments have in approaching the issue of digital connectivity and e-commerce from a trade perspective (WTO and OECD, 2017).

Further findings from the OECD and WTO (2017) centred on the critical role that digital connectivity plays for trade facilitation (a top priority for developing countries), given how it intertwines with other modes of physical connectivity (air, maritime, road and rail) and unlocks participation in e-commerce.

Digital networks offer access to e-commerce, but this process is far from automatic, as other skills need to be acquired to participate successfully in e-commerce trade. In short, digital connectivity is not sufficient to engage in e-commerce.

OECD and WTO (2017) points to action by a range of countries at different levels of income to harness digital connectivity for their development – actions that are being actively supported by Aid for Trade financing and the private sector. Aid for Trade support for digital connectivity has reached US\$ 8.6 billion.⁴² Many developing countries suggest that expenditure on digital connectivity should be boosted in future.

OECD and WTO (2017) also underscores the role that trade policy plays in influencing digital trade connectivity costs, in terms of both the availability and the affordability of connections, and so the ability of developing countries to use digital connectivity for their trade integration and economic development.

(b) Cooperation at the bilateral, plurilateral and regional level

Regional trade agreements (RTAs) have often been dubbed laboratories in which new types of provisions are adopted in order to address existing and more recent trade-related issues and challenges. As of October 2020, 306 RTAs that are in force have been notified to the WTO.

A limited number of RTAs incorporates provisions referring explicitly to industrial and innovation policy. The inclusion of such explicit provisions in RTAs is, however, not a recent phenomenon. For instance, the 1959 Central American Multilateral Free Trade and Economic Integration Treaty committed the parties to adopt, by mutual agreement, measures designed to further the establishment or expansion of regional industries. Explicit provisions on industrial and innovation policy take different forms, from industrial policy coordination to cooperation activities in industrial development as well as in science and technology. Besides the main text of RTAs, relevant provisions on industrial and innovation policy can also be found in specific declarations, directives, resolutions or agreements on industrial and innovation policy adopted after the entry into force of some RTAs.

While most trade agreements do not explicitly address industrial and innovation policy, many different provisions can both support and constrain industrial and innovation policy in the digital era. Importantly, in some cases, some issues relevant to industrial and innovation policy are explicitly excluded from the scope of application of RTAs. In

other cases, the parties to the RTA agree to enter into future discussions concerning specific issues related to industrial development or innovation. As with the WTO agreements, and given their cross-cutting nature, there is no one single type of provision in RTAs that addresses industrial and innovation policy.

A broad range of provisions in RTAs can be relevant to industrial and innovation policy in the digital era, such as those on support measures, IP, competition, investment, movement of natural persons, government procurement, telecommunications, data management, standards, and cooperation activities on issues related to industrial development and innovation.⁴³ While some of these provisions replicate or build on existing WTO agreements, other provisions establish new commitments. These new provisions remain particularly heterogeneous, including in agreements negotiated by the same country. Overall, the most comprehensive and detailed provisions and commitments relevant to industrial and innovation policy are found in relatively recent RTAs in which one of the parties is a developed economy.

(i) Support measures

Subsidies are part of the traditional industrial and innovation policy toolbox. Similarly, subsidies and state aid have been included in most RTAs representing one of the standard chapters of trade regulation even though these provisions do not make an explicit reference to industrial or innovation policy. Most provisions on subsidies in RTAs build on the SCM Agreement. Most additional commitments are mainly of an ancillary or procedural nature (Rubini, 2020).

Prohibition of export subsidies and trade-distorting subsidies are some of the most common type of subsidy provisions found in RTAs.⁴⁴ Most RTAs with subsidies provisions regulate local content requirement through references to existing WTO disciplines. In parallel, some RTAs incorporate provisions exempting legitimate subsidies, mostly regional aid, agricultural subsidies, sectoral aid and public service support.

Subsidies and grants applied to trade in services are excluded from the scope of application of most RTAs (Gootiiz *et al.*, 2020). Only a limited number of RTAs have established explicit subsidy disciplines relating to services trade.⁴⁵ For instance, the Revised Treaty of Chaguaramas establishing the Caribbean Community (CARICOM), including the CARICOM Single Market and Economy, commits its members to harmonizing national incentives to investments in the industrial, agricultural and services sectors. The Agreement establishing the European Economic

Area (EEA), concluded between the European Union and Norway, Iceland and Liechtenstein, introduces substantive disciplines on state aid that may distort competition, including in services sectors.⁴⁶

(ii) Intellectual property

IP can play an important role in mitigating the risk faced by the different actors involved in the process of taking innovative technologies to the marketplace, including through the commercialization of new or improved goods and services. Although the inclusion of IP provisions in RTAs is not new, the incorporation of comprehensive and detailed IP is a relatively recent phenomenon (Wu, 2020).

IP provisions in RTAs cover a broad range of issues, including those related to MFN and national treatment, IP enforcement procedures and issues related to specific IP rights, such as copyrights, trademarks, industrial designs, patents and trade secrets. As with other types of provisions in RTAs, the language, scope and depth of IP provisions vary widely across RTAs (Valdés and McCann, 2014).

While some provisions build on the existing TRIPS provisions, other provisions go beyond the TRIPS Agreement (TRIPS-plus) and expand the scope of IP issues covered.⁴⁷ Some of the most contentious TRIPS-plus provisions relate to patents, such as the obligation to apply new use and/or new process patents for a known product, patent term extension in case of unreasonable (regulatory) delays, patent linkage and patent revocation (Wu, 2020).⁴⁸ Other TRIPS-plus provisions, considered controversial by some, include provisions providing for a minimum term of protection for undisclosed tests or other data for a new pharmaceutical product, agricultural chemicals and biologics. These provisions are often complemented by cooperation provisions, some of which promote the exchange of experience and information on technology and market intelligence.

An increasing number of RTAs also explicitly address a broad range of different specific digital regulatory issues related to IP (WTO, 2018). Several IP provisions related to digital technologies establish disciplines on the protection and enforcement of copyrights and related rights, including through the accession and ratification of the WIPO Copyright Treaty and the WIPO Performances and Phonograms Treaty (“WIPO Internet Treaties”),⁴⁹ implementation of technological protection measures, and rights management information protection.⁵⁰

The confidentiality protection of the list of programming commands necessary to understand

and modify how software works, commonly known as source code, has also been explicitly addressed in the e-commerce chapter of a couple of recent RTAs, such as the Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP) and the Economic Partnership Agreement between the European Union and Japan. In particular, these few agreements commit the parties not to require the transfer of, or access to, software source code owned by a person of the other party, as a condition of the import, distribution, sale or use of such software, or of products containing such software, in their respective area. This obligation is, however, limited to mass-market software or products containing such software, and explicitly excludes software used for critical infrastructure.

(iii) Competition

Competition laws can be an important instrument in industrial and innovation policy. The recognition of competition as a fundamental tool for trade is explicitly incorporated in many RTAs (Anderson *et al.*, 2020; Anderson *et al.*, 2019). Although some differences remain in countries' approach to and focus of competition-related provisions in RTAs, an increasing number of more recent RTAs include detailed provisions on competition policy (Laprévôte, 2019; Licetti, Miralles and Teh, 2020).

The obligation to establish or maintain competition laws and to create an institution to enforce them is one of the most significant competition-related commitments found in RTAs. In parallel, an increasing number of RTAs include substantive provisions regulating competition policies either by referring to existing treaties regulating competition, or by specifying provisions on antitrust obligations and merger control.

In addition to such substantive competition-related commitments, some RTAs incorporate provisions on procedural fairness, transparency and cooperation among authorities, with a view to guaranteeing an efficient competition policy framework. A limited number of RTAs, such as CARICOM, include provisions calling for the creation of supranational competition rules. However, competition provisions in a relatively large number of RTAs are not subject to dispute settlement under the RTA.

More recently, some RTAs established disciplines on state-owned enterprises (SOEs) and designated monopolies. For instance, the CPTPP commits its parties to avoiding discrimination and applying commercial considerations to SOEs. The parties are also committed to limiting the scope for designated

monopolies to engage in anticompetitive practices. Furthermore, the parties are required not to provide non-commercial assistance capable of causing adverse effects or injury to the interests of another party. The parties have also the obligation to offer an impartial regulatory and institutional framework for SOEs, and to make them accountable for their actions in the other parties' territory.

(iv) *Investment*

Foreign investment can promote industrial development and technological innovation in host countries through several mechanisms, including the dissemination of knowledge and human capital formation. While, initially, investment was addressed in bilateral investment treaties, the number of RTAs with investment provisions has increased significantly in the last 20 years (Crawford and Kotschwar, 2018).⁵¹

The investment chapter in RTAs often combines disciplines on the protection and promotion of investment with provisions on the liberalization of foreign investment. These provisions complement other provisions related to the establishment of commercial presence in the partner country (mode 3 of the GATS) found in the RTA chapter on cross-border services.⁵²

An increasing number of RTAs commits parties to removing restrictions on foreign investment in their respective economies and/or to providing protection for foreign investors seeking to enter their markets. Performance requirements on investment, defined as conditions or measures that host states impose on investors in order to operate a business or benefit from an incentive offered by the host state, are explicitly prohibited in many RTAs.⁵³ A limited number of RTAs extend this prohibition to the pre-establishment phase with respect to some sectors/industries. Some agreements further incorporate special provisions prohibiting nationality requirements for senior management but allowing nationality requirements for a majority of the investment's board of directors.

(v) *Rules of origin*

Rules of origin set out the criteria that determine the national source of a product to qualify for preferential tariff treatment. Although preferential rules of origin are designed to avoid trade deflection, they are often negotiated with the objective of helping to scale up regional industrialization and promote regional value chains by affecting the sourcing of inputs.⁵⁴

Rules of origin are not only incorporated in an increasing number of RTAs, but the method for determining the origin varies across agreements. While the requirement of substantial transformation is universally recognized, some agreements apply the criterion of change of tariff classification, others use the *ad valorem* percentage classification or the criterion of manufacturing or processing operation. An increasing number of RTAs set out a combination of these methods for determining origin (Donner Abreu, 2013).

In recent years, rules of origin in RTAs have received increased attention in the trade policy debate because strict rule of origins could be used to support the re-localization of certain parts of production processes to avoid facing additional tariffs (Francis, 2019). For instance, the rules of origin for automobiles and auto parts under the United States-Mexico-Canada Agreement (USMCA), formerly known as the North American Free Trade Agreement (NAFTA), have been renegotiated with a view to increasing the North American content in several key aspects of the production. In particular, the USMCA requires 40 per cent or more of parts for each passenger vehicle be manufactured by workers who are paid at least US\$ 16 per hour as a condition to be granted duty-free tariff treatment.

(vi) *Movement of natural persons*

The temporary movement of people to supply R&D services and other (skilled) professional services abroad (mode 4) can be an important means of supporting research networks and innovation. While governments resort primarily to bilateral, non-trade policy instruments, such as labour market arrangements EPS, to manage flows of workers, an increasing number of regional trade arrangements with specific provisions on temporary entry have been negotiated (WTO, 2019a).

Most of the regulatory disciplines on movement of natural persons in RTAs go beyond the obligations contained in the GATS (WTO, 2019a). The most common type of provisions on movement of natural persons relates to the setting of visa fees. These provisions are often complemented by the obligation to process visa and work permit applications in an expeditious manner or within a given time limit. Other relatively less common related provisions include the obligation to inform visa and/or work permit applicants of the outcome of their application and to publish material relevant to visa applications.

Many of the RTAs with provisions on the movement of natural persons limit the recourse to their dispute

settlement mechanisms to situations where there is a practice of rejecting applications and after local administrative remedies have been exhausted. Only a couple of RTAs, such as the European Union and the Southern Common Market (MERCOSUR), have established work visa exemptions or facilities allowing citizens from any of the parties to work in any other parties. Some RTAs also incorporate provisions for cooperation and mutual recognition of qualifications of specific professional services, including the validation or recognition of foreign studies and degrees.

(vii) Government procurement

Public procurement can be used as a strategic tool to stimulate innovation in the private sector by opening up procurement markets for specific goods and services and prescribing rules for the conduct of government procurement requiring innovative solutions. An increasing number of RTAs incorporate provisions on government procurement in a dedicated chapter.

Most government procurement chapters in RTAs are based on the GPA (Anderson, Müller and Pelletier, 2017; Anderson and Sporysheva, 2019), in terms of language, content and structure. While some RTAs provide market access commitments in specific sectors that are deeper than those of the GPA, overall market access opportunities created by RTAs are generally lower than those available under the revised GPA (Anderson, Müller and Pelletier, 2017). Furthermore, some government procurement chapters explicitly exclude research and development services from their respective scope.

An increasing number of RTAs include provisions encouraging e-procurement. While in most instances, these provisions replicate the relevant GPA provisions, increasingly RTAs incorporate other, more specific provisions related to digital technology, such as the dissemination of information on government procurement through a single electronic portal (Ganne, 2018). More recent RTAs, such as the new EU-Mexico agreement, establish provisions on sustainable public procurement, allowing procuring entities to take into account environmental and social considerations throughout the government procurement process, provided that the principle of non-discrimination is respected (European Commission, 2020a, 2020b).

(viii) Telecommunications

Telecommunications services, including internet, mobile telephony, and data transmission services, provide basic information telecommunication hardware and transmission capacity that can play a key role in industrial and innovation policies in the digital age.

Provisions establishing specific telecommunications regulatory principles, including with respect to anti-competitive behaviours of major suppliers in the telecommunications sector, are increasingly incorporated in RTAs.

While some provisions in RTAs replicate or add clarity to certain disciplines established in the WTO Annex on Telecommunication⁵⁵ and the Reference Paper on Regulatory Principles on Basic Telecommunications,⁵⁶ other provisions establish new obligations either by extending the type of telecommunications services covered by the regulatory provisions or by addressing new regulatory issues (WTO, 2018a; 2019a).

An increasing number of RTAs extend the scope of the Reference Paper obligations beyond basic telecommunications services by also covering value-added telecommunications services in certain respects. Unlike the Annex and the Reference Paper, some RTAs explicitly address the question of whether to employ *ex-ante* or *ex-post* regulatory approaches. This includes, for example, provisions on so-called forbearance, whereby governments are encouraged to exercise their enforcement powers after the fact only when it is found to be necessary to prevent unreasonable or discriminatory practices or to protect consumers.⁵⁷

A limited but increasing number of telecommunications chapters in RTAs include provisions calling on governments to extend to telecommunications services suppliers the right to use the technology of their choice in supplying services. Some recent RTAs, such as the CPTPP, specify, however, that the parties retain the right to condition the financing of broadband networks on the use of particular technologies. A few recent RTAs also contain explicit principles on access to and use of the internet, such as suppliers' right to negotiate with the other parties' suppliers international internet connection on a commercial basis and consumers' right to run the applications and services of their choice subject to law enforcement needs. Similarly, the principle of internet neutrality, according to which all internet traffic should be treated equally, has been explicitly addressed in a couple of recent agreements, such as the RTA between Argentina and Chile.

(ix) Data management

Besides connectivity, industrial and innovation policies in the digital age are dependent on access to and use of data. A limited but increasing number of RTAs incorporate specific provisions explicitly addressing data management, including personal data protection and cross-border data flows.⁵⁸

A very limited number of RTAs to which the European Union is a party includes a chapter dedicated to personal data protection. Many of these provisions establish specific principles, such as purpose limitation, data quality and proportionality, transparency, security, right of access, rectification and opposition, as well as restrictions on onward transfers. Other provisions address the protection of sensitive data and enforcement mechanisms.

Commitments to adopt measures to protect personal data have also been established in a limited but increasing number of e-commerce chapters negotiated by some high-income economies, such as Australia, Japan, Singapore and the United States (Monteiro and Teh, 2017). In parallel, a few recent RTAs, including the RTA between Australia and Hong Kong, China and the USCMA, incorporate specific provisions committing the parties to allow cross-border electronic transfer of information, including personal information, in the context of digital trade (see Box D.6).

Cross-border data flows and personal data protection are also explicitly addressed in the financial services chapter of several RTAs. In particular, the commitment not to adopt measures preventing the processing of

financial information, including electronic transfers of data, is complemented by the right to adopt or maintain measures to protect personal data, personal privacy and the confidentiality of individual records and accounts, as long as such measures are not used as a means of avoiding commitments.

Closely related to free flows of information across borders is the controversial issue of disciplining data localization requirements (Azmeah *et al.*, 2019). Only a couple of recent RTAs, including the RTA between Japan and Mongolia and the CPTPP, establish specific disciplines related to the use and location of computer servers and devices for the processing or storage of information for commercial purposes. These RTAs commit parties not to require that another party's service suppliers, investors and investments use or locate computer facilities in the [first] party's territory as a condition for the exercise of their business activity. However, some of these RTAs specify that parties are not prevented from adopting or maintaining measures affecting the use or location of computing facilities in order to achieve a legitimate public policy objective, provided that such measures are not applied in a manner that would constitute a means of arbitrary or unjustifiable discrimination or a disguised restriction on trade.⁵⁹

Box D.6: Digital economy agreements

In addition to chapters on e-commerce negotiated in their respective RTAs, Australia, Chile, New Zealand and Singapore have negotiated standalone digital economy agreements. In June 2020, in an entirely online virtual signing ceremony, Chile, New Zealand and Singapore signed the Digital Economy Partnership Agreement (DEPA). Australia and Singapore also signed the Australia-Singapore Digital Economy Agreement (DEA) in August 2020.

This new type of trade agreement aims to create a framework for the digital economy and facilitate digital trade. These agreements specify that they co-exist with the parties' rights and obligations contained in other international agreements such as the WTO agreements and RTAs. While some of the provisions in these agreements build on existing provisions found in e-commerce chapters of RTAs, in particular the CPTPP, other provisions establish new obligations related to various digital issues.

These new agreements expand on existing obligations on the cross-border transfer of data, data localization and improved protection for source code. They also establish new commitments on compatible e-invoicing and e-payment frameworks, as well as new benchmarks for improving safety and consumer experiences online. Some obligations are specific to a single agreement. For instance, the Australia-Singapore DEA establishes obligations to facilitate submarine cable installation, maintenance and repair, and the prevention of cable disruptions.

These agreements put in place a comprehensive framework for bilateral cooperation covering different digital issues. For instance, these agreements foresee collaboration between financial technology (fintech) and regulatory technology (regtech) enterprises and industry bodies to explore business opportunities and to develop standards for open banking. Other cooperation topics include government procurement, competition policy, MSMEs, digital identity (e.g. national business numbers), digital inclusion and AI, including the promotion of ethical and governance frameworks.

(x) Standards

Standards and technical regulations can play an important role in fostering technological progress. Standard-related issues, and more generally technical barriers to trade (TBT) measures, are increasingly being addressed in RTAs.

While some provisions replicate those found in the TBT Agreement, an increasing number of RTAs establish TBT commitments that go beyond what is provided in the TBT Agreement (TBT-plus) (Espitia *et al.*, 2020). Provisions on equivalence and mutual recognition in RTAs typically cover technical regulations and conformity assessment procedures, while provisions on harmonization tend to apply more to voluntary standards.

In addition to general TBT provisions, some RTAs include TBT-related disciplines that apply to specific industries or products, such as telecommunications equipment and renewable energy generation. More recently, a couple of RTAs, including the USMCA, have established specific disciplines on technical regulations and conformity assessment procedures for ICT products using cryptography, and on the electromagnetic compatibility of IT equipment products. Under these agreements, the parties commit not to impose or maintain technical regulation or conformity assessment procedures that would require manufacturers or suppliers of ICT products using cryptography to transfer or provide access to their proprietary information for cryptographic technology or to use or integrate a particular cryptographic algorithm or cipher, as a condition of the manufacture, sale, distribution, import or use of those ICT products for non-governmental uses.⁶⁰

(xi) Cooperation activities

Beyond the rules and obligations established under RTAs, many agreements establish cooperation provisions to support the implementation of certain commitments. A limited but increasing number of RTAs include explicit cooperation provisions on industrial and innovation policy, whose scope and purpose are often specific to a single agreement.

The RTA between the European Union and Armenia includes a cooperation chapter dedicated to industrial and enterprise policy, in which the parties commit to enhance cooperation based on the SME and industrial policies of the European Union. In particular, the cooperation aims, among other things, to facilitate the modernization and restructuring of industry in certain sectors; to encourage the development of innovation policy, via the exchange of information and

good practices regarding the commercialization of R&D (including support instruments for technology-based business start-ups), cluster development and access to finance; and to promote a more business-friendly environment with a view to enhancing growth potential and investment opportunities.

More explicit provisions on innovation, including R&D and transfer of technologies, are incorporated in the cooperation chapter. For instance, the RTA between the Eurasian Economic Union (EAEU) and Singapore foresees the possibility of holding informational seminars, training courses or sessions, roundtables and other events dedicated to improving cooperation between the parties in the fields of transfer of technologies encompassing digital innovation, entrepreneurship and application of cutting-edge technologies. Similarly, the RTA between the European Union and Central America includes a detailed article on scientific and technological cooperation covering a broad range of issues, such as the development of centres of excellence and high-tech clusters.

Although they do not refer explicitly to industrial development and innovation, many other cooperation provisions found in RTAs can be particularly relevant to industrial and innovation policy.⁶¹ These cooperation provisions cover a wide range of issues, including education and training, environmental protection, digital trade and MSMEs.

(c) Other forms of international cooperation

As discussed in the preceding subsections, unilateral measures undertaken by governments may not be sufficient to fully capitalize on the opportunities offered by digital innovation and digital trade. There is scope for international cooperation in addressing the specific issues arising from digitalization that have cross-border ramifications. In particular, international organizations have an important role in international cooperation, to enhance positive cross-border spill-overs such as technology diffusion or to mitigate potential negative spill-overs.

Most international organizations are involved in some capacity in international cooperation on innovation and industrial policies in the digital economy. Initiatives of international organizations can be categorized by more specific policy objectives, such as harmonizing and mutually recognizing standards and regulatory frameworks, addressing IP-related issues, tackling challenges in ICT infrastructure, tax and competition issues, and supporting digital inclusion and MSME participation. This subsection discusses relevant work

and initiatives in international fora other than the WTO to foster international cooperation in the digital field.

Many of these efforts conducted by international organizations support and provide direction for countries' policies to achieve the United Nations Sustainable Development Goals (SDGs), in particular Goal 9 to build resilient infrastructure, promote sustainable industrialization and foster innovation, and Goal 17 on revitalizing the global partnership for sustainable development.

(i) Harmonizing and mutually recognizing standards and regulatory framework

Technical standards are an established norm and requirement in virtually every product. These standards safeguard the interests of consumers and are crucial in the adoption of new technologies. Technical standards for the safety and interoperability of new and existing digital products and services are important to bridge the gap between research and markets, and to ensure the speedy diffusion of new technologies. To date, governments, industry and user groups have engaged in both intergovernmental and multi-stakeholder fora to develop international norms, guidelines, principles and standards, primarily to build trust and enable openness (World Economic Forum, 2020).

International organizations like the International Organization for Standardization (ISO) and International Electrotechnical Commission (IEC) play an important role in the introduction and implementation of standards. The standards set by the IEC are especially important for innovation in ICT and digital sectors as the focus of the IEC is the standardization of electro-technologies. The IEC has specific committees on various digital technologies, such as IoT and related technologies, AI, cloud computing and distributed platforms, data management and interchange, the interconnection of IT equipment and software and systems engineering. The ISO has a technical committee on innovation management,⁶² which works on the standardization of terminology, tools and methods with a specific focus on innovation. This committee has so far published four standards under its direct responsibility and is currently working on four more.

The United Nations Economic Commission for Europe (UNECE) publishes standards related to public-private partnerships in various sectors.

The transboundary nature of the digital economy and the fragmentation of domestic regulatory frameworks may undermine the potential benefits of digital innovations. The lack of a robust legal and regulatory

framework for the governance of digital trade can hinder technological advances and pose serious challenges for consumers and businesses alike. Thus, international organizations can play an important role of establishing international regulatory frameworks, facilitating coherence between domestic frameworks, increasing dialogue or providing guidance and recommendations. The dynamic characteristics and the strong cross-border effects of digital economy regulations will require periodic adaptations and constant monitoring.

The United Nations Conference on Trade and Development (UNCTAD)'s eCommerce and Law Reform Programme, for example, offers developing countries access to expert reviews of e-commerce legislation and provides expert advice to policymakers regarding effective laws governing e-commerce. Areas covered under this programme include consumer protection, cybercrime, data protection and privacy, IP and electronic signatures.

The Budapest Convention on Cybercrime under the Council of Europe has 67 signatories, including non-members of the Council of Europe from outside the European Union. Signatories have agreed to designate certain acts as criminal within their legal systems, and some participating signatories also provide each other with legal assistance for offences jointly defined as criminal. Regulatory cooperation is also under development within the Association of Southeast Asian Nations (ASEAN), where legal alignment on data governance definitions and privacy is being developed concurrently with internal data flow mechanisms.

The ITU, for its part, supports the development of transparent and forward-looking legal and regulatory frameworks to stimulate ICT investment and promote universal, ubiquitous, affordable and secure access to ICTs through its Infrastructure, Enabling Environment and E-Applications Department. In 2019, the ITU hosted the Global Symposium for Regulators that focused on inclusive digital connectivity and established the Best Practice Guidelines to encourage digital connectivity for inclusive participation in the digital economy to benefit from digital transformation (ITU, 2019).

(ii) IP-related issues

The protection of IPRs is crucial to incentivize innovation and the dissemination of technologies. The effect is particularly pronounced in digital markets, where the global and borderless nature of the internet has challenged the concept of trademark and copyright use. While the existing technology-neutral intellectual

property rules in place in the 1990s provided, for the most part, a robust regulatory environment for the digital exchange of licences and protected subject matter, the disruptive impact of digital technology did raise challenges for the existing rules: for instance, the trademark significance of a domain name, and the ease of copyright piracy on the internet (Meier-Ewert and Gutiérrez, 2020). Discussions in multilateral fora have sought to accelerate the development of international harmonized principles in this regard (Croze, 2000).

As discussed in Section D.2(a), WIPO administers the WIPO Copyright Treaty and the WIPO Performances and Phonogram Treaty (known together as the "Internet Treaties"), which set down international norms aimed at preventing unauthorized access to and use of creative works on the internet or on other digital networks. The WIPO General Assembly also adopted the "Joint Recommendation Concerning Provisions on the Protection of Marks, and Other Industrial Property Rights in Signs, on the Internet" in 2001. It was the first implementation of WIPO's policy to adapt to the pace of change in the field of industrial property by considering new options for accelerating the development of international harmonized common principles.

One example of international cooperation is in the registration of domain names. Domain names are not considered to be distinctive marks but are internet addresses that define a realm of administrative autonomy or control within the internet. The global nature of the domain registration system means that cross-border disputes may arise over the ownership of common domain names. The WIPO Domain Name Process and Article 6 of the WIPO "Joint Recommendation" addressed the issue by providing a standard legal framework for the redressal of grievances related to "cybersquatting", or the practice of registering domain names based on others' trademarks, with a view to leveraging financial gain (Croze, 2000; WIPO, 2020).

One of WIPO's responsibilities is to facilitate and support the transfer of technology and knowledge. In 2007, WIPO members agreed to adopt a multilateral agreement with 45 proposals under the WIPO Development Agenda. The objective of this instrument is to facilitate the transfer of technology to developing countries while maintaining incentives for innovative firms in developed countries. The proposals include a recommendation for conducting analytical studies and evaluations related to the impact and efficiency of IPR systems in countries, enabling better policymaking. The WIPO Development Agenda also aims to bridge the digital divide, promote best practices and works in

accordance with the outcomes of the World Summit on the Information Society (WSIS). A committee was also established to monitor the implementation of these proposals, and has since overseen various projects related to the development of IP infrastructure, training of personnel and sharing of knowledge.

(iii) Addressing challenges in ICT infrastructure

As a secure and reliable ICT infrastructure is crucial for capturing the benefits of digital innovation and can be a catalyst for economic growth, it has become central in domestic policy agendas (OECD, 2018). Yet a digital divide between countries can be a major obstacle to inclusive growth. Several international organizations are actively involved in initiatives that aim to support governments in developing ICT infrastructure and using digital technologies, through supportive measures such as financing, policy guidance and technical capacity assistance.

A recent report by the ITU and the United Nations Educational, Scientific and Cultural Organization (UNESCO) estimates the cost of bridging the connectivity gap in Africa by 2030 at around US\$ 100 billion, or close to US\$ 9 billion a year (Broadband Commission, 2019). The World Bank Group's regional initiative, the Digital Economy for Africa Initiative,⁶³ aims to ensure that every African individual, business and government will be digitally enabled in Africa by 2030. One of the foundational pillars in the framework set to accomplish this objective is digital infrastructure, with the increase in broadband and cashless payments as a priority. To attain this objective, the World Bank intends to invest US\$ 25 billion between now and 2030 to assist in enabling policy frameworks in digital economy policy measures (e.g. in development policy operations) and in financing measures (e.g. investment in broadband infrastructure).

Another example of international support for ICT infrastructure is the ITU's Telecommunication Development Sector programme. The ITU, through the ICT Development Fund, co-finances projects with partners from member governments and from the public and private sectors to enhance countries' capacity, cybersecurity, digital inclusion and digital innovation systems. In partnership with the United Nations Children's Fund (UNICEF), in 2019 the ITU launched a global school connectivity initiative to connect every school in the world to the internet and empower young people with digital skills.

A number of regional organizations, as well as various regional development banks, also have programmes

in place to facilitate the development of ICT infrastructure. The African Development Bank plays a key role in coordinating a Connect Africa Initiative to mobilize the human, financial and technical resources needed to bridge major gaps in ICT infrastructure across Africa. It has funded a number of connectivity projects including an eastern African submarine cable system deployed along the east and south coasts of Africa, and a central African “backbone” project to provide several central African countries with digital broadband access through terrestrial fibre connections. In the Asia Pacific region, the Asia-Pacific Economic Cooperation (APEC) Internet and Digital Economy Roadmap identifies the development of digital infrastructure, the promotion of interoperability and the achievement of universal broadband access as key focus areas (APEC, 2017).

(iv) Tax and competition issues

As also discussed in Sections B and D.3, technology can enable taxpayers to use sophisticated methods to avoid tax, and can also impact taxpayers' business models more generally, thereby raising systematic policy challenges for the international tax framework. Multinational firms have an incentive to shift their profits to jurisdictions with lower tax rates, and such jurisdictions have an incentive to keep their tax rates low to attract foreign investment, thus eroding the tax base of the higher-tax jurisdictions.

To combat this, countries have agreed to review key concepts of the international income tax system, responding to a mandate from the G20 Finance Ministers to work on the implications of digitalization for taxation. Under the Organisation for Economic Co-operation and Development (OECD)/G20 Inclusive Framework on tax base erosion and profit-shifting (BEPS), over 135 countries are collaborating to put an end to tax avoidance strategies that exploit gaps and mismatches in tax rules to avoid paying tax. In November 2016, over 100 jurisdictions concluded negotiations on the “Multilateral Convention to Implement Tax Treaty Related Measures to Prevent Base Erosion and Profit Shifting”,⁶⁴ which offers concrete solutions for governments to close loopholes in international tax treaties. This framework facilitates international collaboration to end tax avoidance and aims to mitigate the negative spill-overs that may arise by equipping policymakers with tools to combat tax avoidance and by creating a harmonized international taxation framework that ensures profits are taxed where economic activity and value creation occurred.

As discussed in Section C, the cross-border activities of digital firms can result in spill-overs, for example

in the case of varying stances across different jurisdictions towards abuses of dominant positions and their impacts on national markets. Hollman and Kovacic (2011) argue that negative international spill-overs may arise if an economically significant jurisdiction persists in using manifestly inferior analytical approaches, procedures or techniques for the administration of a competition agency. Concerns regarding such potential spill-overs form the rationale for the work of the International Competition Network (ICN), the OECD, UNCTAD and other international organizations active in the field of competition policy (Anderson *et al.*, 2018b). The ICN has been working to increase understanding of individual competition systems, identify and build consensus about best practices, and encourage individual jurisdictions to opt in to these practices. These organizations have already promoted a significant degree of convergence in national competition policies generally, through their extensive and informative analytical, policy development and advocacy work (Hollman and Kovacic, 2011).

(v) Supporting digital innovation inclusion and MSME participation

Although digital innovation can create many opportunities for businesses, MSMEs are on average less innovative than their larger counterparts, mainly due to a lack of resources, finance, skilled labour, legal and regulatory counsel, etc. (OECD, 2018a). To harness the full potential of digital innovation, tailored innovation initiatives directed at MSMEs can assist not only in increasing innovation among these businesses, but also in helping to close productivity and wage gaps between MSMEs and larger firms. Initiatives can further focus on bridging the digital divide within countries, targeting marginalized groups and enabling such groups to use digitalization and innovative technologies as a catalyst for inclusion instead of experiencing them as a barrier, which furthers the divide.

Various international organizations are active in this area. The International Trade Centre (ITC) has actively focused on supporting the participation of MSMEs in digital trade. ITC's ecomConnect initiative,⁶⁵ for example, supports MSMEs in developing countries and LDCs through their digitalization transformation. It utilizes training programmes, research and the facilitation of innovative solutions, collaborative structures, partnerships and digital tools and technologies to support trade internationally via online channels. A recent ITC report presents recommendations to boost the participation of women in trade through FTAs, as a tool-kit for policymakers and trade negotiators to gauge how gender-

responsive their agreements and trade policies are (ITC, 2020).

The United Nations Industrial Development Organization (UNIDO) has a science, technology and innovation group that seeks to enhance MSMEs' productivity and international competitiveness by providing technical assistance while simultaneously acting as a global forum. UNIDO uses its Business Information Centres programme⁶⁶ as an access point for MSMEs, usually in conjunction with private and public institutions, to provide advisory services, access to information and reliable internet, ICT training and assistance in establishing connections to local, regional and international markets. In addition, UNIDO's e-learning platform offers high-quality courses in areas such as e-commerce and value chain development.

The World Bank has undertaken an "eTrade for Development" programme⁶⁷ to assist developing countries in expanding their digital entrepreneurship, to diagnose a country's performance on e-trade and assess its main limitations, to improve developing countries' regulatory environments for digital markets based on international best practices, and to facilitate

the adoption of customs procedures and logistics conditions to reduce costs related to the movement of goods through e-commerce. The World Bank further provides finance as well as advisory services for MSMEs, and especially for underserved groups such as MSMEs owned by women. The programme has specifically introduced digital innovation finance to its MSME projects through e-lending platforms, the use of alternative data for credit decisions, e-invoicing and supply chain financing.

Other global and regional organizations also focus on digital inclusion and supporting MSMEs. For example, the G20 Financial Inclusion Action Plan encourages dialogue in financial inclusion through policy advocacy, knowledge-sharing, and international cooperation. Within the action plan, a main pillar is MSME finance with an overarching theme of digital innovation. APEC sponsors a "Startups Incubator Capacity Building Symposium towards Digital Society", focusing on how incubators can help MSMEs in digital transformation and how to improve capacity-building for female entrepreneurs and female executives in high-tech companies (see Box D.7).

Box D.7: University cooperation

International and regional organizations are not the only players key to international cooperation for digital innovation. Universities and academic institutions also have an important and unique role in knowledge curation and transfer, both necessary components for innovation. While the benefits of knowledge transfer and the associated spill-overs are most often seen regionally, for example in agglomerations such as Silicon Valley, such positive gains can be accrued on an international level as well.

Digital tools and increased access to international research are key not only for innovation curation but have increased international collaborative research. Globalization has led countries and the private sector to prioritize global issues (e.g. climate change, food security, matters of public health), and this has increased the need for international collaborative research for solutions to these issues.

Universities can act as a link between the international research frontier and regional stakeholders. In addition, international collaborative solutions and research initiatives can be an effective tool in addressing issues of inequality between developed and developing countries, such as the digital divide, where cooperation in scientific research and policies can be linked to developmental goals.

While initiatives to encourage international cooperation in academia are mostly carried out by national governments and academic institutions themselves, international organizations can facilitate cooperation and knowledge transfer with tools such as forums. For example, the OECD holds the Global Science Forum to provide policy consultations and recommendations for senior policy officials in the area of scientific research. The Global Science Forum addresses the scientific dimensions of social issues and explores opportunities for international cooperation in research. Regional policy initiatives are effective as well. For example, the European Commission implemented the Horizon 2020 research and innovation programme. The programme serves primarily a funding tool, which centralizes EU research initiatives, facilitating higher international cooperation within the European Union and globally.

3. Do we need more cooperation on innovation policies in the digital age?

The digital age leads to changes in technology and the organization of production, provoking changes in the structure of the economy, which, in turn generate changes in national policies. This may require a change in international disciplines. This subsection addresses the question of whether innovation policies generate new international spill-overs in the digital age and whether there is scope for more international cooperation to either encourage or mitigate these new spill-overs.

Section D.3(a) describes the changes in technology, the structure of the economy, and the national policies which may call for changes to international cooperation, as well as the arguments for and against more policy space for developing countries. This discussion serves as a theoretical framework for the discussion of international cooperation in different specific areas in Section D.3(b), such as support measures, IP protection, competition policy and data policies.

(a) Technological, economic and regulatory changes in the digital age

(i) *Technological changes*

As discussed in Sections B and C, several changes to the organization of production associated with the emergence of digital technologies are relevant for the international coordination of innovation policies. These changes are: the growth in importance of data as a key input in the digital economy; the prominent role of general-purpose technologies in the digital age; the increasing impact of network externalities (i.e. when the use of a network by others makes it more attractive to use the same network for an individual user); and the rise of scale economies.

First, data have become a key input in production in virtually all sectors of the economy. New possibilities for handling data have also made them core inputs for innovation in many sectors (Guellec and Paunov, 2018). An important feature of data is that they are non-rival, i.e. the use of data by one consumer will not be at the expense of consumption by others. Some scholars argue that, in practice, data are only partially excludable because private agent collectors of data have insufficient incentives to store data in an excludable way (Carrière-Swallow and Haksar, 2019). The non-rivalry and partial excludability of data make it resemble a public good. However, data are not a

pure public good, as a pure public good typically benefits all members of a society and individuals cannot be excluded from using it.

Second, digital technologies tend to be general-purpose technologies (Jovanovic and Rousseau, 2005). This means that they can be applied in a wide range of sectors. Examples are AI, Blockchain, and IoT, which are widely employed in many sectors. These digital technologies tend to employ large amounts of data as input and the applications of these technologies have drastically reduced the costs of searching, sharing and analysing data (Guellec and Paunov, 2018). Once available, digitalized data can be shared instantaneously among any number of actors, no matter what the geographic distance.

Third, the digital economy, like other more traditional networked industries such as energy, telecommunications and railroads, is characterized by network externalities. Network externalities can be both direct and indirect (Tirole, 2019). Direct network externalities emerge from the desire for users to be on the same network as the people they know (as with a social network). The digital economy also comes with indirect network externalities, because bigger platforms can develop better applications and better search algorithms, given that there are more users.

Fourth, as in some of the traditional networked industries, scale economies are large in the digital economy, because most digital services are characterized by high fixed costs and low marginal costs. This is the case for example for a search engine or for the development of a new application, where the initial cost of development can be high while the marginal cost of additional production is close to zero. It is also the case, for example, for the AI-based software used in self-driving cars. Once developed, the additional cost of deployment is rather small.

(ii) *Economic effects*

The changes in the technology and organization of production described in the previous subsection have the economic effects outlined below.

Regarding the role of data as an increasingly key input in production and innovation, it is difficult to organize a market for data with transparent transaction prices and clear ownership rights (Ciuriak, 2019b). Currently, consumers of digital services are typically involved in a direct exchange without monetary transactions. Consumers tend to hand over information to digital platforms and providers of digital services in exchange for digital services. Some examples are the streaming of music,

the use of search engines and social networks, or rebates in exchange for data. In these digital settings, two-sided markets emerge, with digital platforms delivering apparently free services to customers and raising revenues from advertisers and market parties interested in communicating with customers and in their data.

Another economic effect of the role of data as key input is related to its fluid nature. Fluidity renders data ubiquitous and allows it to transcend distance and national boundaries. Hence, digital innovation is global in reach and potential impact. There are important consumer/producer gains from serving global markets, with scale economies and network benefits from digital innovations that naturally extend beyond national boundaries, including the lower unit cost of serving a larger, international market.

The fact that more technologies are general-purpose implies that positive spill-over effects of innovation activity become bigger, both between sectors within a country and internationally between countries and sectors.⁶⁸

Network externalities and scale economies lead to winner-takes-all market outcomes and thus a greater concentration of market power (see also Section C.4). Hence, the digital economy leads to natural monopolies, as has been the case in the conventional economy for services and goods supplied through networks such as fixed line telephone providers and the supply of electricity. While these conventional networks are bound by physical capabilities, and their effectiveness often diminishes with distance, many digital economy networks have an international, either global or regional, reach. Network externalities cross borders: there is a strong advantage from joining a network because consumers in other countries are already employing the same network. This is the case for the services of companies such as the GAFAMs (i.e. web giants such as Google, Apple, Facebook, Amazon and Microsoft).

(iii) National policy implications

As explained in the previous paragraph, the non-rival nature of data leads to imperfect market outcomes. Jones and Tonetti (2019) argue that the way ownership of data is defined is important for economic growth, because of the non-rival nature of data. They claim that forbidding the use of data to guarantee privacy would lower economic growth, because the positive benefits of data would not be exploited. Jones and Tonetti (2019) argue that from a welfare perspective it would be best to give ownership rights of data to the consumers generating the data, so that consumers

can trade the privacy concerns of the wider use of their data off against the productive use of non-rival data.

The previous subsection also described how network externalities lead to market concentration and two-sided market settings. Although there is a lot of static market concentration, the digital economy is displaying a substantial amount of dynamic competition, because market leaders change frequently. Examples are Google replacing AltaVista and Facebook replacing MySpace. However, the phenomenon of buy-out of newcomers by incumbent firms is stifling this type of dynamic competition, with digital markets still characterized by a large degree of market concentration (Motta and Peitz, 2020).⁶⁹ Competition authorities around the world are attempting to adjust their policies to the new market settings in the digital economy.

The fact that digital technologies are general-purpose and generate cross-sectoral spill-over effects gives national governments strong incentives to promote these technologies in order to promote their positive spill-over effects. Innovation has become a more central policy objective. Governments in developing and developed countries increasingly see it as key to stimulating productivity, competitiveness, employment and growth.

As also described in Section C.4, a larger concentration of market power and winner-takes-all outcomes may lead to an increased desire by large countries to conduct strategic innovation policy, fostering the appropriation of monopoly profits in the global economy, i.e. profits of firms with a dominant market position in global markets.⁷⁰

The fact that digital technologies are general-purpose implies that these technologies could increasingly be classified as dual-use (i.e. both for civil and defence purposes). Dual-use technologies are subject to additional export controls for reasons of national security.⁷¹ For example, the technology for telecommunication networks such as 5G is employed across the entire economy and thus also by segments of the economy which are argued to be important for national security. Furthermore, since technologies are digital, they are potentially able to absorb sensitive information. Classifying more technologies as dual-use may lead to additional restrictions to the free flow of trade, technology and capital.

(iv) Implications for international cooperation in the digital age

The described changes to the organization of production and their economic and national policy effects have important implications for international

disciplines in the digital age. The rising importance of data as input in production and its fluidity has led to increasing demands for new international rules on data transfer, data localization and privacy. The increasingly blurred boundaries between goods and services imply that demands could emerge for a re-examination of the disciplines in areas where the provisions that apply to goods trade differ most significantly from those that apply to services such as on subsidies and the movement of natural persons.⁷²

As discussed in the previous subsections and in Section C.4, cross-border spill-overs resulting from innovation are likely to intensify in the digital age for several reasons.

First, more innovation is taking place in digital industries with more important knowledge spill-overs, strengthening the case for governments to support innovation and for international cooperation to expand positive international spill-overs and encourage national governments to support innovation.

Second, the positive network effects of innovation policies in digital equipment industries for downstream digitally enabled industries across the world increase as digital equipment industries become more and more pivotal by producing general-purpose technologies, and the uptake of digital technologies across industries increases. This also strengthens the case for governments to support innovation and for international cooperation to encourage national governments to support innovation and to facilitate positive international spill-overs. At the same time, however, the “winner-takes-all” characteristics of many digital industries lead to heavily concentrated markets and large monopoly profits which lend themselves to the applications of strategic innovation policy. This, in turn, calls for cooperation measures aimed at limiting the negative cross-border effects from such policies.

There is a risk that the general-purpose nature of many digital technologies may encourage governments to classify an increasing share of technology as dual-use. Some scholars argue that this could lead to a decoupling of technologies in different countries. According to Petri (2019), under decoupling, the risk of negative spill-overs through appropriation of global monopoly profits might be smaller, because markets would not be global anymore. However, decoupling would also limit positive international spill-over effects from innovation and thus be a drag to global economic growth. In this context, Ciuriak (2019a) argues that a digital Article XXI is necessary to deal with the security risks of the digital economy. The growth of IoT and its linkages with many crucial sectors such

as telecommunications, transportation and the power grid could lead to national security vulnerabilities. According to Ciuriak (2019a), the existing Article XXI of the GATT, which refers to an “emergency”, is not appropriate for such national security vulnerabilities.

A complete assessment of innovation policies and their consequences for international cooperation would need to take both positive and negative effects into account in order to reach a balanced and efficient outcome. For a number of reasons, it is difficult to assess whether cross-border effects from innovation policies imply net benefits or net losses for third countries (see Section C), implying that it is not easy to determine the best policy to cooperate internationally.

First, the effects are highly context-specific. Different effects pull in different directions, and different country characteristics, such as market share in targeted products or the country’s position in global value chains, have a large impact. Moreover, governments enact policies that aim to promote or limit both positive and negative cross-border effects. For instance, local content requirements prevent positive demand effects from benefitting foreign upstream industries. IP protection chapters in international trade agreements can limit knowledge spill-overs, as can merger and acquisition screenings based on nationality, or eligibility criteria based on nationality, for subsidies or government procurement.

Second, policies as different as R&D subsidies and antitrust laws can create a whole range of cross-border effects, from knowledge spill-overs to supply or demand effects, and it depends on the details of these measures which effects dominate (see the examples in Section C). Moreover, the net negative international spill-overs of a policy intervention could be more than offset by its positive domestic welfare effects.

A crucial trade-off is the one between positive spill-over effects on technological progress in other countries, on the one hand, and the negative spill-over effects because of appropriation of monopoly profits, on the other hand. Borota, Defever and Impullitti (2019) compare the strategic profit-shifting effect of policies to promote domestic innovation with their positive spill-over effects on other countries. They find that the positive external effects of innovation subsidies, through higher growth and higher consumer surplus, dominate the international business-stealing effect (profits shifting to the country providing the subsidies).⁷³ These results support earlier results by Haaland and Kind (2008), who also show that cooperative levels of subsidies are larger than non-cooperative levels.

Borota, Defever and Impullitti (2019) also show that the gains from cooperation are larger if there is FDI between cooperating countries. The reason is that, with FDI, international innovation spill-overs would be larger through foreign affiliates. In a similar way, the trade-off between the negative spill-over effects through the appropriation of monopoly profits and the positive spill-over effects through the impact on innovation in other countries would change significantly if countries cooperated on tax policy. In such a case, the strategic advantage of appropriating monopoly profits in the digital economy would become smaller. This would make the innovation spill-overs relatively more important, implying that a higher level of innovation promotion would be optimal.

The results in Borota, Defever and Impullitti (2019) are highly relevant for one of the most important questions at hand: do innovation subsidies generate net positive or net negative spill-overs, if the positive effects on innovation are compared to the negative profit-shifting effects? Borota, Defever and Impullitti (2019) seem to suggest that domestic innovation subsidies are, on the whole, positive. However, this does not imply that we can conclude that all policies fostering domestic innovation are beneficial for other countries. Although the results are derived in a quality ladder model in which the firm producing the highest quality good captures the entire market, thus featuring “winner-takes-all” outcomes, technological leaders change frequently in such a model, thus limiting monopoly profits. The question is whether this is also the case in the current digital markets, with the network externalities and acquisitions of technological leaders limiting competition.⁷⁴

Many digital innovation policies, such as improving (digital) infrastructure, stimulating R&D activities in general purpose technologies, or digital skills development, tend to be horizontal and thus not targeted at specific industries. These policies are typically less distortive than policies that are targeted at specific industries, even if they can generate positive and/or negative international spill-overs. Also, a distinction can be made between policies with only minimal, indirect spill-over effects, such as education policy, and policies with larger, more direct spill-over effects, such as trade restrictions. Finally, policies differ in terms of the size of spill-over effects in proportion to domestic policy objectives.

Rodrik (2020) criticizes the dominant approach, arguing that the case for international cooperation based on the existence of cross-border spill-overs is weaker than what most economists claim. In his view, global cooperation is justified in only two instances: with global public goods featuring

a commons problem (excessive use of public or common resources), and in the presence of “beggar-thy-neighbour” policies featuring negative cross-border spill-overs. An example of the former is climate change mitigation policies, with the costs borne by individual countries and the benefits enjoyed by all countries. An example of the latter is import tariffs imposed by large countries to obtain terms of trade gains with the risk that countries end up in a sub-optimal equilibrium with high tariffs imposed by all countries.

Rodrik (2020) claims that many internationally regulated policies are more “beggar-thyself” than “beggar-thy-neighbour”. An example is subsidies. The international spill-over effects of subsidies are positive, because subsidies drive down global prices. At the same time, they are costly for countries providing them, because the costs of the subsidies are larger than the gains for the producers receiving them. Hence subsidies are more “beggar-thyself” than “beggar-thy-neighbour”, according to Rodrik. He argues that, for such policies, restrictive international disciplines are not desirable, because local knowledge is often essential to take the best policy decisions, national policy makers should have the autonomy to take their own decisions, and capture by special interests is at least as likely at the supra-national level as at the national level.

For the reasons mentioned, being reserved about international cooperation on policies with weak global public good or beggar-thy-neighbour features seems a solid approach. As mentioned in the overall introduction to this section, the autonomy of countries to pursue domestic policy objectives should be traded off against the negative spill-over effects of such policies, and the presence or absence of negative spill-over (or “beggar-thy-neighbour”) effects is a matter of degree and thus open to discussion. The example of subsidies is illustrative in this respect. As discussed earlier in this subsection, R&D subsidies generate positive spill-over effects on other countries, but they can also generate negative spill-over effects through the appropriation of monopoly profits in winner-takes-all markets. Rodrik (2020) lists other examples of policies mainly implemented for domestic reasons and not to beggar the neighbour, such as weak IP protection, industrial policies and data localization policies. For each of these policies, the size of spill-overs is subject to discussion.

(v) *The policy space argument*

Since the beginning of the 21st century, the political and scholarly debate regarding the impact of advancements in international trade disciplines on

"policy space" has intensified. Policy space is defined as the margin of manoeuvre available to governments to adopt the most appropriate mix of economic policies to achieve their development goals and thus deal with international disciplines (Hoekman, 2005; Mayer, 2009). It has been argued, in particular, that provisions in regional agreements and multilateral disciplines prevent developing-country governments from using government policy instruments which would otherwise help them achieve their development objectives (Akyüz, 2008; DiCaprio and Gallagher, 2006; Page, 2007). For example, Singh and Jose (2016) point out that currently developed countries were not constrained in their use of government policy to promote economic development, but that such policies are now curbed by legal agreements, such as those governed by the WTO.

When considering economic contributions to the policy space discussion, it is important to keep in mind the context.

First, as explained in Section B, all WTO members pursue some form of government policy, focused increasingly on innovation. This signals a broad consensus among WTO members regarding the fact that such policies are useful and that governments should be allowed to use them, even if they need to be disciplined by WTO rules. The question of how much policy space developing countries should have is thus not about whether governments should be allowed to use innovation or even industrial policies or not.

Second, Section D.2 explained how existing WTO disciplines represent a negotiated compromise aimed at allowing member governments to pursue legitimate development policy objectives while at the same time limiting the negative spill-overs of members' policies on their trading partners. Existing WTO rules prohibit the use of certain instruments, discipline the use of others, and impose no restriction on the use of yet other instruments. Moreover, they provide special flexibilities for developing countries. The policy space debate focuses on whether some of these rules – in particular those on local content requirements and on subsidies – are too restrictive and prevent developing countries from using policy tools that would help them achieve their development objectives.

From an economic perspective, the policy space debate raises two main questions in relation to innovation policies. The first question concerns the relative effectiveness of different innovation policy tools, that is, the question of the optimal design of innovation policies. If there is a strong case for developing countries to use some of the policy tools that are subject to more stringent disciplines, then

there may be a case for additional flexibilities. The second question concerns the nature and size of the international spill-overs associated with the different policy tools.

With regard to the first question, Section C showed that while some innovation policies tend to raise domestic and overall welfare in particular when they address market failures, there are cases where innovation policies have negative international spill-overs that may more than offset the positive domestic welfare effects. Similarly, Section C showed that there is no consensus regarding the optimal design of innovation policies. Part of the reason for this lack of consensus is that these questions are empirical, and the empirical evidence on the effects of innovation policies is thin.

With regard to the second question, Section C also showed that, while a number of innovation policy instruments can have negative international spill-overs, empirical evidence on the size of these spill-overs is scarce. However, the rapid economic growth of some emerging countries with active industrial policies could raise the negative spill-over effects. Because of their bigger role in the global economy, the impact on other countries of policies with negative spill-over effects has become larger. This is the case, for example, for subsidies, weak protection of IPRs, or weak enforcement of competition law.

A few economic arguments have been invoked specifically in favour of more policy space for developing countries to conduct innovation policies, to ensure that they have fewer commitments in the multilateral trading system. First, policies to promote technological development are likely to be different for countries close to and far from the technology frontier, the most advanced level of technology in the world (Aghion *et al.*, 2005; Landesmann and Stollinger, 2019). Countries close to the technological frontier may tend to focus on promoting R&D activities and on the efficient interaction between public and private research efforts. Countries further away from the technological frontier, by contrast, may attempt to benefit from the "advantage of backwardness" (Gerschenkron, 1962) through the absorption of technology from countries at the technology frontier, for example through trade, foreign direct investment and direct technology transfers. This requires different types of policies, for example in the area of IPRs.

Second, it can be argued that market failures are bigger for countries with lower levels of development and thus require more corrective policies. Aghion, Boulanger and Cohen (2011) argue that capital market imperfections limiting the growth of sectors with high growth potential and knowledge spill-

overs on the rest of the economy are more severe for developing countries. Empirically they show that the positive impact of sectoral state aid on both the share of exports and the number of patents is larger for countries that are less financially developed. Hence, in less financially developed countries there is a stronger argument to support sectors with high growth potential and knowledge spill-overs.

Third, agglomeration forces become stronger in the digital services-based economy (Eckert, 2019). High-skilled workers and companies in digital industries tend to flock together in large cities with many other workers and companies with the same specialization. This has been documented within economies. However, similar agglomeration forces are active at the international level, thus potentially leading to economic divergence between the core of the global economy and the periphery. Therefore, countries in the periphery need policy space to avoid being stuck in the periphery of the digital economy.

Fourth, low-income countries tend to be specialized in products with low value-added, low technology growth, and few technological spill-overs into other sectors. Many low-income countries also have low levels of export diversification, which is harmful for economic development. Innovation policy could be useful to build up capabilities in more sophisticated products. This means that low-income countries could benefit from larger-scale government intervention to change patterns of comparative advantage. Rich countries tend instead to be already specialized in sophisticated goods and thus need less policy space to conduct innovation policy. Policies to change the pattern of comparative advantage might be at odds with the obligations of countries in the multilateral trading system, for example on IPRs, local content requirements and subsidies. This fourth argument is related to the first argument, because countries trying to get closer to the technological frontier will attempt to do so by changing their pattern of comparative advantage.

The main economic argument against more policy space aligns with the main arguments against the use of industrial policy in general: if government failure is omnipresent, industrial policy will be counterproductive. In such cases, governments will be captured by special interest groups leading to support of vested interests and subsidies to inefficient firms stifling dynamics in the economy. It would then be better to tie the hands of national policymakers limiting the use of different types of (industrial) policies. Exemptions from international commitments for developing countries would only backfire, as they constrain national policymakers less and thus give more space to national interests.

The literature on the reform lock-in effects of membership of international organizations provides arguments for why it can be beneficial for countries to have multilateral trade commitments (Drabek and Bacchetta, 2004; Francois, 1997; Lamy, 2012; Staiger and Tabellini, 1999).

The conclusion of the discussion on policy space is that there are economic arguments both in favour and against more policy space for developing countries to pursue innovation policies. The weight of these arguments depends on the context and the specific policies examined. To keep this section brief, this report does not go into the details of specific policies. However, although there is little empirical evidence on the extent of the spill-over effects of innovation policies, and thus of granting developing countries more policy space to conduct innovation policies, it can be observed that some developing countries have displayed spectacular growth rates, thus increasing their weight in the global economy.

There is also a risk that countries will introduce additional national policies to shelter themselves from the international spill-over effects of other governments' policies. This might lead to further protectionism, thus limiting the free flow of goods, services and capital. As a matter of fact, such measures have already been taken or are under discussion. Two examples can be given. First, in some countries there is a discussion about reforming competition and merger policies with the aim of maintaining competitiveness *vis-à-vis* countries with pro-active industrial policies (Jenny and Neven, 2019). Phrased differently, merger policy should be adapted to take into account the spill-over effects of industrial policies, such as subsidies by other countries. Second, many countries are starting to screen foreign investments more intensively (UNCTAD, 2019). This is happening partly as a response to the industrial policies of trading partners.

(b) Thinking ahead about cooperation on innovation policies

In light of the changes in innovation policies and their effects brought about by digitalization, and of the fact that existing multilateral and, to a large extent, regional rules were negotiated before the digital era, this subsection asks whether the current multilateral trading system adequately supports innovation and addresses discriminatory temptations.

(i) *Support measures*

In the digital economy, financial support for R&D represents the instrument of choice of innovation


 OPINION
PIECE

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INDUSTRIAL POLICY, INNOVATION AND GLOBAL RULES

Industrial policy is back with a vengeance. The COVID-19 pandemic has highlighted for many countries the need to develop reliable domestic (or at least regional) supply chains for medical products. The employment shock that accompanied the lockdowns has also rendered the good-jobs challenge (i.e. employment challenge) that most countries faced even before the crisis even more acute. And the rise of China as a technological leader in many domains has pushed governments in the United States and Europe into more active industrial and innovation strategies in response. As this valuable report puts it, “a defining feature of new industrial policies is the focus on innovation, technological development and upgrading, and the role of investment in promoting it” (see Section B.2(c)).

The foundational agreements of the present world trade regime – and the World Trade Organization itself – are the product of an intellectual legacy that is increasingly inappropriate to the existing needs of the world economy. Under the narrative that prevailed throughout the 1990s and 2000s, governments’ roles in directing economic activity were limited, economic prosperity was best pursued through deep economic integration, with restrictions on what governments could do behind their borders, and most large economies in the world were converging toward similar market-economy principles. None of these hypotheses looks compelling in today’s world.

In a world where economic policies diverge, and health crises and technological transformations have severe implications for labour markets and hence for social peace, the global economy needs to be constructed on different principles. In particular, there must be healthy respect for national sovereignty, and the limited political capital for international cooperation

must be spent on areas where the returns from establishing global regimes are truly high. As I have argued elsewhere (Rodrik, 2020), these are the areas characterized either by global public goods (such as efforts to tackle climate change or pandemics) and by “beggar-thy-neighbour” policies (such as the exercise of monopoly power or tax havens).

As this report argues, the spread of digital technologies is creating all kinds of new ways for a nation’s policies to create spill-overs for other nations. Knowledge, after all, is the quintessential public good that knows no borders. It is not clear, however, whether this fact strengthens the case for more global rules. On the other side of the argument, we also have to contend with the facts that markets for technology are inherently imperfect, that these market imperfections call for more government intervention, and that the scope for disagreement among countries on which policy interventions are legitimate and desirable becomes considerably broader.

While international dialogue to sort out some of these disagreements and to ensure that governments understand the motivations and reasoning of others is always useful, there is no guarantee that such dialogue will always produce agreement on rules. And under these circumstances, we may need to resign ourselves to the reality rather than push for the impossible (or sign toothless agreements).

Existing WTO disciplines in the areas of subsidies, local content rules, TRIPS and government procurement all raise potential problems from this perspective.

Imagine that a government identifies a data-intensive activity as a source of important technological externalities for

the home economy, and encourages that activity through subsidies, local content requirements or government procurement, in a manner that falls afoul of international trade rules. Should a trade partner or international organization be allowed to second-guess whether (a) these policies have valid economic justification (i.e., whether there is a plausible positive externality), and (b) the government has selected the right policy intervention in light of the administrative and political realities on the ground? My answer would be no, insofar as such policies are not true “beggar-thy-neighbour” policies. If the government has made the right choices, the policy should be allowed to stand, even if there are negative spill-overs which may affect other nations. And if the government is making a mistake, it will be that government’s taxpayers and consumers who will bear the brunt of the costs.

Another example where there might be a stronger argument for global rules is the abuse of market power in international markets. Suppose a government restricts the export of an advanced technology in which it has near-monopoly power globally, and does so in order to raise prices on world markets (and not for national security reasons). This would be a clear instance of a beggar-thy-neighbour policy. International rules against such conduct – a version of global anti-trust – would be appropriate.

My point is that we cannot assume that more international spill-overs automatically implies the need for more international rules. The lesson from the post-1990s push for hyper-globalization is that international rules can overshoot. We should not repeat the mistake in an era where national sovereignty will exert stronger centrifugal pressures – for good as well as bad reasons.

policies (see Section B). Available evidence suggests that such financial support promotes innovation, which may be underprovided in the absence of government intervention. It also shows that cross-border effects from innovation are likely to intensify in the digital age (see Section C). At the same time, R&D subsidies are covered by the disciplines of the SCM Agreement (see Section D.1) and by provisions on subsidies in RTAs which tend to replicate what is found in the SCM Agreement. The issue of subsidies in the context of digital trade is not addressed explicitly in RTAs.

One area of possible reform in support of innovation with positive international spill-overs relates to expanding the flexibility for governments to use R&D subsidies to address agreed and targeted global public policy objectives (Curtis, 2016). As explained in Section D.2, the SCM Agreement included certain R&D subsidies in the non-actionable category, but the provisions regarding non-actionable subsidies, which only applied provisionally for five years, ending 31 December 1999, were not extended. In the current context, R&D subsidies, such as publicly funded research grants to scientific laboratories at universities, which have not been challenged in a significant way because they are considered pre-competitive or non-specific, could become an issue of contention as they become more common. As pointed out by Maskus and Saggi (2013), in the era of global investment networks, the number of grants which generate knowledge that, for a paid licence, ends up in the hands of private enterprises that develop products for trade, may increase. Before expanding the policy space to explicitly permit R&D subsidies that address global public policy objectives, a first step would be to clarify, upon further study, the relationship between public research grants and subsidies disciplines under the SCM Agreement.

Another, more general, argument in favour of re-examining the disciplines on subsidies in the data-driven economy is that data has very strong "public good" characteristics and thus generates risk-return metrics that favour public investment over private investment (Ciuriak, 2019b).

A concern with regard to support for innovation relates to the risk that governments may either attempt to restrict positive international spill-overs arising as a result of their support, or provide less support than would be globally optimal. The benefits from R&D subsidies, including the lower unit cost of serving a larger (international) market may extend beyond national boundaries.

As noted by Maskus and Saggi (2013), this is because knowledge is difficult to appropriate in one location

and international leakages of the benefits from R&D subsidies and investment may even be higher with global investment networks. Successful start-ups having benefited from government support may be acquired by foreign multinationals, raising questions about the location of the benefits arising from these start-ups. The embodiment of value in intangible assets (intellectual property), the intangible character of digital products transacted across borders, and the prevalence of electronic payments, all facilitate the circulation of revenue, which can end up in tax havens.

Where this is the case, national policymakers will need to figure out how to ensure that their own citizens (and taxpayers) acquire the benefits from national policies, and to fight the perception that most of the benefits (e.g. income-generated benefits, productivity gains or job creation) leak abroad (Guellec and Paunov, 2018). This raises the question of how governments will address the issue of territoriality. How the benefits are shared will have a strong influence on the efficiency of policies, but also on their legitimacy.

International cooperation may help to share the benefits arising from knowledge or from international flows of data (see the discussion below) linked to national policies between countries. In the absence of appropriate sharing mechanisms, national governments may not provide enough support to innovation if they fear that most of the benefits from the innovation they support will leak abroad. Maskus and Saggi (2013) propose an agreement on access to basic science and technology to foster the international dissemination of publicly funded research. Patents, being the result of such publicly funded research, would be put in common research pools.

(ii) *Intellectual property*

This report has analysed the contribution of the IP system, and the WTO TRIPS Agreement in particular, to the productive functioning of the innovation ecosystem. Given that the text of the TRIPS Agreement was largely settled almost three decades ago (WTO, 2015), prior to the first impact of internet uptake on global commerce, it is remarkable that the essential principles for governance of the knowledge economy set out in TRIPS remain broadly adaptable to the dramatically transformed innovation landscape witnessed today.

Nonetheless, given the far-reaching impact of digital disruption for the IP system, it would seem timely, at least in technical terms, for a fresh consideration of TRIPS in its contemporary context. Indeed, TRIPS negotiators have provided for regular, biennial

reviews of the overall agreement, which has offered opportunities to take account of new technological developments. Equally, the WTO Work Programme on E-commerce includes consideration of a range of IP matters with bearing on the TRIPS Agreement.

Some issues have been raised in the TRIPS Council: for instance, a 2016 submission to the TRIPS Council called on members to assert the principle that "exceptions and limitations available in physical formats should also be made available in the digital environment."⁷⁵ However, substantive work on these matters in the regular TRIPS Council has been limited, and the prospects are slim in the short term for a systematic review and update of the TRIPS Agreement as such. Yet, outside the WTO, norm-setting activity has proceeded apace in areas which have a direct bearing on TRIPS and which respond to technological innovation.

The year after TRIPS entered into force, the World Intellectual Property Organization (WIPO) concluded the WIPO Copyright Treaty and the WIPO Performances and Phonograms Treaty (the WIPO Internet Treaties),⁷⁶ which updated and applied standards for copyright and related rights to the digital environment, in a manner complementary to and coherent with the TRIPS Agreement's standards; the majority of WTO members have ratified and given effect to these multilateral treaties.⁷⁷

More recently, numerous RTAs have been concluded with provisions on IP that go well beyond the requirements of the TRIPS Agreement (see Section D.2), for instance with specific attention to the protection and enforcement of IP rights in the online environment (WTO, 2018a) and the regulation of digital products (which are often defined in terms of IP rights), as well as responding to other technological developments such as the emergence of biotech medicines and the increasing use of traditional knowledge in the innovation ecosystem. The approach such agreements take to questions such as internet service liability for IP infringement, and the exhaustion of IP rights that apply to traded digital products, may be critical in shaping the future market for creative content (Meier-Ewert and Gutierrez, 2020).

Hence, even in the absence of general momentum towards a substantive review of TRIPS, there is much to be gained from a systematic, inclusive understanding of the overall trends in norm-setting for the digital environment that has been undertaken through various bilateral and regional avenues, to lead to a clearer understanding of their accumulated impact for the regulation of digital trade (Burri, 2020).

More generally, effective policymaking for sustainable and inclusive innovation will require a solid foundation of understanding of the linkages between trade and innovation with sustainable development, and the roles of the IP system in reinforcing this linkage (Taubman, 2020). The linkages between trade policy, innovation policy and the IP system are complex, diverse across countries and sectors, and in constant evolution, and require extensive collaborative networks across national jurisdictions. At the international level, therefore, an important challenge is to understand and to recognize the complexity and diversity of approaches, while at the same time working internationally in a way that is "holistic, realistic, and inclusive in a global context" (Taubman, 2020).

Fortunately, it is now possible for this understanding to be founded on a growing body of empirical data and practical experience. For instance, as described above, the TRIPS Council now has on record a rich catalogue of innovation policies reported by a diverse range of members, illustrating how the IP system has been deployed in diverse contexts to promote innovation.⁷⁸ Developed-country members have filed almost 200 reports on technology transfer measures in connection with their obligations under TRIPS Article 66.2. While detailed systematic analysis of these two sources of practical experience has, so far, been limited, they exemplify the prospects for developing more grounded and inclusive insights into the range of policy measures being applied in an adaptable way to ensure innovation contributes to sustainable development across the WTO membership, as well as identifying coherent themes and potential normative gaps or areas for clarification and progressive development.

Hence, in considering TRIPS and innovation, it is important to consider both the general principles of TRIPS, or what the international rules say, and how WTO members have operated in diverse ways within the TRIPS framework to implement their innovation policies and to promote their innovation goals.

This more systematic groundwork for policy development should equip members and policymakers with a greater capacity to adapt and apply existing tools more effectively to achieve contemporary goals for inclusive and welfare-enhancing innovation, as well as creating the means for greater access to global markets for innovators and creators in remote or resource-poor locations. These prospects are enhanced as greater access to the internet is coupled with a burgeoning trade in IP rights as such, as IP transactions form part of global value chains and even trade in IP, as such, now that content such as music, books and cinematic works can be traded

free of the traditional media (such as discs and tapes) on which they used to be distributed (Field, 2015). For example, the “app economy” – enabled by digital platforms on which software applications are traded directly – offers access for small innovators or microenterprises to global markets that did not exist 10 years ago (Taubman, 2020).

National IP systems therefore continue to be adapted and refined within the framework of TRIPS, responding to the current needs of the knowledge economy, even in the absence of parallel adaptation of the provisions of TRIPS itself. Many WTO members have updated and developed their IP rules to respond to the opportunities and the new parameters produced by the digital economy, and have notified these developments to the TRIPS Council. The innovative eTRIPS gateway now provides systematic access to this rich vein of material. Implementing the broad principles of the TRIPS Agreement in the current knowledge economy remains compatible with the exploration of diverse and nationally tailored policy options in relation to innovation and achieving domestic diversity within a rules-based framework. This approach would respond to the principle, set out in the UN 2030 Agenda for Sustainable Development, that called for respect for “each country’s policy space and leadership to implement policies for poverty eradication and sustainable development, while remaining consistent with relevant international rules and commitments.”⁷⁹

(iii) Competition

As discussed in Section C, the digital world poses new challenges to regulators and competition authorities in their work to ensure that markets foster and deliver innovation efficiently (Anderson *et al.*, 2020). In that regard, while e-commerce has the potential to increase competition within retail markets, several characteristics of digital markets and electronic platforms have raised new questions and concerns in relation to anti-competitive practices intrinsic to traditional markets, such as abuse of dominance, anti-competitive agreements and mergers.

First, there may be a heightened risk of the abuse of dominance, created by a combination of Big Data and machine-learning, that can amplify network effects, strengthening leaders’ dominance and deterring further market entry (OECD, 2016). These may lead to “winner-takes-all” markets (Gökçe Dessemond, 2019) and geographical concentration, and may ultimately hinder innovation, to the detriment of consumers. Second, technology and/or digital platforms that permit or oblige firms to monitor and adapt prices raise additional questions in relation to anti-competitive

agreements (OECD, 2017). Third, with regard to mergers, questions over the competitive effects of the acquisition of innovative start-ups or nascent firms by dominant incumbents have sparked a debate on how effective merger control regimes can reduce the risk of so-called “killer acquisitions”, in which firms acquire nascent competitors only to discontinue the target’s innovation projects, thereby pre-empting the emergence of future competition (OECD, 2020). Furthermore, new zero-pricing models have put in question traditional parameters focusing on monetary aspects, such as prices or turnover values, and put in evidence the value of innovation and data privacy as public goods in need of protection (OECD, 2018b).

In this context, both government regulation and competition law enforcement have an important role to play in ensuring competition and helping to diffuse innovation. Governments may adopt pro-competitive regulatory regimes, e.g. to foster knowledge-sharing by improving access to data, while also ensuring adequate levels of consumer protection, taking into account consumers’ need for data privacy and security. Similarly, exceptions to the application of competition policy in order to support innovation can be put in place (e.g. regarding technology transfer agreements, joint ventures and/or merger control). Competition enforcement action can help to keep markets open and prevent anti-competitive practices from acting as barriers to trade (Anderson *et al.*, 2019). In the digital age, competition authorities are called upon to make complex enforcement decisions (OECD, 2018b). Regarding digital platforms, for instance, it is necessary to take proper account of the dynamics created by such platforms as two-sided markets, with consumers enjoying free services (in exchange for access to their data) on one side of the market, and advertisers facing platforms as business partners with considerable market power on the other side. In the same vein, the potential for dynamic competition, i.e. the possibility of monopoly positions becoming eroded over time as a result of technological advances, needs to be taken into consideration (Motta and Peitz, 2020).

While digital markets, in particular in combination with the global opportunities created by international trade liberalization, can lead to enhanced competition in many instances, their potentially global reach can also result in dominant positions by market leaders, anti-competitive agreements or mergers harmful to competition that adversely affect several economies at once (World Economic Forum, 2019). Relevant firms can thus come under scrutiny in multiple jurisdictions. In turn, this presents a risk of conflicting decisions, based on assessments of the competitive situation in each jurisdiction and potentially

according to varying assessment criteria. In that regard, cooperation between competition authorities can help in coordinating competition responses and exchanging best practices (Anderson *et al.*, 2018a; Anderson *et al.*, 2019; Baldwin, 2014).

At the same time, as previously discussed, global markets have brought into focus the links between competition policy and industrial and innovation policies (OECD, 2009). Some countries consider that merger policy should be adapted to provide more leeway to build and support companies large enough to contest global markets and create markets for innovative products. Other countries have voiced concerns about using competition policy for strategic industrial policy aimed at appropriating monopoly profits in the global market through the support of national champions. In this context, international dialogue and cooperation can help to enhance mutual understanding and awareness of policy effects. Relevant cooperation and experience-sharing has taken and is taking place in various fora, such as in the context of international trade negotiations, in particular RTAs (see section D.2.(b)(iii)) and, in the past, in the WTO Working Group on Trade and Competition,⁸⁰ but also through the work of organizations such as the International Competition Network (ICN), UNCTAD and the OECD.

(iv) Investment in infrastructure and human capital

An important component of digital innovation policies consists in building digital capabilities and digital infrastructure (see Sections B and C and WTO, (2018)). Public funding is the primary source of finance, followed by private sector investment and public-private partnerships, respectively. To promote and facilitate investment in broadband infrastructure or the digital industry, governments also focus on improving the enabling (sectoral) regulatory framework. Other measures include investment incentives, investment facilitation, digital standards, and clusters and incubators for digital business development. Governments also invest in other infrastructure areas (such as electricity supply, trade logistics, delivery, tracking and payment systems) which complement the digital infrastructure.

Foreign direct investment promotes innovation in host countries through various channels, including through direct investments to develop R&D in host countries (e.g. establishment of R&D and tech labs), backward linkages (i.e., domestic companies becoming suppliers of MNCs, which in turn require the adoption, adaptation and eventually creation of new technologies and new techniques), and

forward linkages (i.e. domestic firms acquiring more sophisticated inputs from MNCs). However, these benefits of FDI do not accrue automatically. To reap the maximum benefits from FDI, a sound policy environment for investors, including one consistent with GATS obligations and commitments on commercial presence (mode 3), is paramount.

The 2017 Joint Ministerial Statement on Investment Facilitation for Development, issued by a group of WTO members at the WTO Ministerial Conference in Buenos Aires, as well as the subsequent Joint Ministerial Statement in November 2019, may also be seen against this backdrop. The initiative on investment facilitation, which does not cover market access, investment protection and investor-state dispute settlement, focuses on the development and promotion of more transparent and efficient investment frameworks. The focus on investment facilitation comes with the recognition that in today's integrated global economy, expanding investment flows depend on simplifying and speeding up procedures, not just liberalizing policies. Indeed, in many cases the bottlenecks, inefficiencies and uncertainties that investment facilitation seeks to address arise from red tape, bureaucratic overlap, or out-of-date procedures, which serve no clear policy purpose but can become costly impediments to investment.

The focus of the structured discussions on investment facilitation for development, currently involving 104 members, has therefore been on the elements of a framework that would:

- improve the transparency and predictability of investment measures (e.g. publication/notification of investment-related measures, enquiry points/single windows, notification of investment-related measures, and opportunity for prior comment on draft laws and regulations);
- streamline and speed up administrative procedures and requirements, such as the procedural aspects of investment applications, approval processes, formalities and documentation requirements, fees and charges, and the establishment of one-stop shop/single windows;
- enhance international cooperation, information-sharing, the exchange of best practices, and relations with relevant stakeholders, including dispute prevention; and
- facilitate greater developing-member and LDC participation in global investment flows.

In addition to the development of their digital infrastructure, many governments, in developing and developed countries alike, are undertaking substantial investment in human capital through training and skills development to facilitate the effective uptake and usage of digital technologies. Various governments are offering adult learning programmes focusing on digital skills development and complex cognitive skills such as information processing and problem solving.

A key dimension of the digital divide is that of the divide between developing and developed countries, in terms of access as well as skills for effective usage of digital technologies. Bridging the digital divide between poor and rich countries would contribute to the convergence of “digitally advanced” economies and “digitally lagging” economies and help to realize fully the potential of ICT as an engine of socio-economic development.

Building on unilateral efforts, international cooperation has a major role to play in this context. First, as explained in WTO (2018a), international cooperation, in particular in the context of the WTO, including in the form of Aid for Trade, can help governments to adopt more open trade and investment policies in the ICT sector which, if supported by an adequate regulatory framework, could help them to attract FDI, develop their digital infrastructure, and bridge the digital divide between poor and rich economies. Second, cooperation, in terms of technical assistance and capacity-building efforts undertaken by developed and richer developing countries and international organizations, can help to facilitate digitalization in developing countries.

According to UNCTAD (2018), while developing countries used targeted policies to encourage technology transfers from foreign firms through FDI, this has become much more complicated in the digital economy, where technology and data analytics are sometimes considered trade secrets (e.g. Kowalski, Rabaioli and Vallejo (2017)). As trade secrets are increasingly being protected in trade and investment agreements, it is difficult for governments to use the traditional FDI policies for encouraging transfers of digital technologies such as algorithms.

The rules applied to source-code-sharing are another example. Source code, the list of programming commands necessary to understand and modify how software works, is usually protected by copyright and is often kept confidential to protect proprietary information. Some recently negotiated trade and investment agreements incorporate specific provisions on treatment of source code, including the commitment not to require the transfer of, or access

to, software source code owned by a person of the other party, as a condition of the import, distribution, sale or use of such software, or of products containing such software, in their respective area. Issues related to source code and transfers of technology have been raised in the context of the WTO Work Programme on E-Commerce and the Joint Statement Initiative on E-Commerce which involves 82 members (in August 2020) working towards WTO negotiations on trade related aspects of electronic commerce aimed at further enhancing the benefits of e-commerce for businesses, consumers and the global economy.

(v) *Movement of natural persons*

The empirical evidence discussed in Section C.3 suggests that highly skilled migrants positively contribute to innovation in the knowledge economy. Developed countries generally put in place policies to attract highly skilled migrants, but attraction of highly skilled migrants is also an important policy objective in several developing countries. In developing countries, however, innovation is more likely impacted by emigration rather than by immigration of highly skilled individuals, as diasporas can generate net positive gains for the migrant's home countries.

Facilitating the temporary mobility of technically trained and entrepreneurially skilled personnel, research professionals and graduate students between countries may have some advantages compared to encouraging permanent migration when it comes to promoting innovation (Maskus and Saggi, 2013). First, evidence suggests that the temporary relocation of such personnel between countries is an important vector of international technology transfer. Second, the temporary mobility of skilled personnel among R&D and production facilities may facilitate the development of global innovation networks. Last but not least, it may help avoid the perceived pitfalls of permanent “brain drain”, depriving developing countries of talent.

A number of governments have already committed to opening their markets to the supply of R&D services and other (skilled) professional services by other members, through WTO, RTA or labour market arrangements (e.g. the presence of natural persons, per GATS mode 4) and guest worker programmes (see Section D.2). Despite this progress, however, significant restraints remain in place and it can be costly and difficult to get the required work visas. The GATS clearly offers a framework for the negotiation of further commitments under mode 4 between WTO members (see Section D.2(b)). Otherwise, a concept proposed by Maskus and Saggi (2013) would be to facilitate the free circulation of technical and

entrepreneurial talent among the member nations of an innovation zone, permitting them to be deployed freely in the associated innovation networks.⁸¹ However, ways to structure such an arrangement in a manner consistent with GATS obligations, such as MFN, and scheduled commitments would need to be taken into consideration. As much as possible, the certification of skills acquired in different professions and in different countries would need to be recognized by the other members.

(vi) Government procurement

As discussed in Section D.2, the GPA and government procurement chapters in RTAs can positively contribute to innovation procurement by opening domestic government procurement markets to innovative goods and services from foreign suppliers and establishing international rules that enable and facilitate innovation procurement.

The Committee on Government Procurement has undertaken important work relevant to innovation policies in the framework of committee work programmes that were agreed at the conclusion of the GPA renegotiation in 2012.⁸² The topics of the work programmes include sustainability in government procurement, increasing participation in government procurement procedures by MSMEs, and the collection and reporting of statistics.

The Work Programme on Sustainable Procurement examines the objectives of sustainable procurement: ways in which the concept of sustainable procurement is integrated into national and sub-national procurement policies, and how sustainable procurement can be practised in a manner consistent with the principle of “best value for money” and with international trade obligations. The concept of sustainability in government procurement covers a number of aspects and has various meanings in different jurisdictions, such as the protection of the environment, social dimensions (e.g. human rights and/or working conditions and proactive measures to support the participation of particular social groups), and creating sustainable economic opportunities (e.g. innovation research/investment, open competition, supply chain competitiveness and the promotion of small businesses).⁸³ Overall, the Work Programme on Sustainable Procurement provides an opportunity for all interested parties to carry forward the discussion regarding these issues and to identify how sustainable procurement can be used as a tool to facilitate access to innovative goods and services and stimulate innovation.

In relation to the integration of MSMEs into government procurement markets, the GPA's design already

creates opportunities for innovative entrants in several ways and can thus facilitate MSME participation in international procurement (see Section D.2.(b)(vii)). The Work Programme on SMEs seeks to explore how GPA parties can facilitate SME participation in government procurement while complying with international trade obligations and avoiding discriminatory measures that distort open procurement. The discussions in the framework of this work programme indicate that the approaches of GPA parties to promoting SME access to procurement markets differ. There is thus scope for further cooperation and reflection on which policies are most conducive to achieving greater SME participation and stimulating SME innovation.

In the framework of the work programme on the collection and reporting of statistical data, GPA parties are, among other things, actively involved in discussions on potentially introducing the expanded use of innovative electronic tools for compiling, presenting and exchanging information on government procurement in the GPA context. Such discussions build on GPA parties' experience with e-procurement tools and the ongoing technological advances.

(vii) Data management

Data have become a central element of economic activities, and data policies an integral part of innovation policies and a growing number of jurisdictions have passed new regulations to address data-related policy issues such as data privacy, consumer protection, and national security. As discussed in Section C, in light of the relative novelty of this field and the corresponding scarcity of studies, it is important to examine the relationship between data policies and innovation further to understand what the long-term effects of such policies are and to further substantiate the evidence that has been collected thus far.

Data privacy protection

WTO (2018) argues that if lax privacy policies can confer an advantage on domestic digital industries relative to digital industries in countries with stricter policies, there may be a need for international cooperation on data privacy protection aimed at avoiding a race to the bottom, i.e. a situation where governments deregulate their business environment (or reduce tax rates), in order to attract or retain economic activity in their jurisdictions (see Section C). If further research confirms that, indeed, weaker privacy protection favours domestic innovation, the rationale for cooperation against a race to the bottom on privacy protection will be reinforced.

Provisions related to personal data found in the e-commerce chapters of RTAs range from commitments to adopt measures to protect personal data to cooperation. A more specific type of provision, often complementing the commitment to adopt measures to protect personal data, refers to taking into account international standards or practices in developing standards of personal information protection or measures for the protection of personal information. A limited number of RTAs, mostly negotiated by the European Union, include a chapter dedicated to personal data protection. Many of these provisions are idiosyncratic, establishing specific principles, such as purpose limitation, data quality and proportionality, transparency, security, right to access, rectification and opposition, and restrictions on onward transfers. Other provisions address the protection of sensitive data and enforcement mechanisms.

Data localization

As discussed in Section C, the limited available evidence clearly supports the idea that, for data to flourish as an input to innovation, it benefits from flowing as freely as possible, given necessary privacy protection policies. This may, at least in part, explain why binding rules on cross-border data transfers and localization restrictions have been introduced in a number of RTAs (see Section D.2(b)) and have been discussed in the context of the Trade in Services Agreement and WTO e-commerce negotiations.

At the same time, however, UNCTAD (2018), together with a number of other experts, argues that most developing countries do not have policies regarding the control and use of data, and that before accepting any restrictions of their policy space in this area, they should develop their own national data policies. Mayer (2018) suggests that the absence of well-defined data policies risks causing developing country data to be controlled by whomever gathers and stores data and then has exclusive and unlimited rights to those data. Along similar lines, Gehl (2018) argues in favour of a balanced national data governance regime to avoid the risks of purely free or heavily regulated data policies, which in his view may stifle innovation. UNCTAD (2018) argues that localization rules were extensively used by the developed countries in the earlier phase of digitalization, and are still being used, and that rules that restrict the use of data localization provisions would limit the ability of governments to gain from FDI to build their national digital technological capacity and skills. Ideally, the design of national data policies should be informed by sufficient evidence on the effects of data policies on innovation and welfare.

In fact, rather than constraining governments, international cooperation may help them develop their national policies. As discussed in relation with support measures, with enough information on the effects of data policies, international cooperation may help share the benefits arising from international flows of data linked to national policies between countries. In the absence of appropriate sharing mechanisms, national governments may be reluctant to provide foreign multinationals with access to national data (e.g. from the public health system) if the benefits generated by the exploitation of such data are not shared (Guellec and Paunov, 2018).

(viii) Digital trade/trade in services

Trade is an important vector of technological transfer and innovation (see Section C). Eliminating obstacles to digital trade in particular has a role to play in promoting digital innovation. Section D.2 discussed how international cooperation fosters innovation and addresses the negative externalities brought about by restrictive policies affecting digital trade in goods and services.

Despite evidence of the benefits of open and non-discriminatory policies and the adverse effects of restrictive policy and regulation, trade restrictions are still maintained and erected by some governments to protect local industries, including digital platforms, from foreign competition and/or to foster the emergence of “national champions” (see Section B and WTO, 2018a). Requirements for majority domestic equity ownership in ICT firms, minimum quotas for local employment, various forms of performance and/or local content requirements (not only with regard to the use of local services and/or service suppliers but also with regard to locally produced hardware components) are some examples. R&D services, ranging from equipment purchases and testing protocols to grant management and accounting and beyond, are often heavily regulated in favour of domestic providers (Maskus and Saggi, 2013). These policies restrict access for and the operation of foreign services suppliers, and they may also take a toll on innovation as well as on the broader economy.

International cooperation in the WTO or in RTAs can help governments to open up and stimulate competition in their digital services sectors, which can make an important contribution to the promotion of digital innovation. The WTO and RTAs also have a role to play in preventing the introduction and possible spread of barriers to cross-border digital trade, and in making cross-border digital trade an engine of development. A number of issues, including

the extension of the moratorium on the imposition of customs duties on electronic transmissions, are under discussion at the WTO in the context of the Work Programme on E-Commerce. At the same time discussions are proceeding amongst a growing number of WTO members in the context of the Joint Statement Initiative on E-Commerce (see WTO, 2018a).

The global economy may also benefit from more international cooperation on the use of export controls, import restrictions or investment screening for dual-use digital technologies, given the general-purpose nature of many of those technologies.

The GATS obligations and commitments and their enforcement through dispute settlement can help tackle trade barriers that stifle innovation to the detriment of consumers and user industries (e.g. creation of local monopolies, forcing local transaction processing, restrictions on branch network expansion, restrictions on introduction of new products), while ensuring a balance between public policy objectives and trade liberalization.

Trade in services discussions among WTO members contribute to cooperation on innovation-related policies at the multilateral level. Among the issues that have been addressed in recent months in WTO bodies such as the Council for Trade in Services are cybersecurity measures. Discussion has focused on how such measures might interfere with trade by, for example, *de facto* discriminating against foreign suppliers, and how they should, instead, be designed in a manner that is least trade-restrictive. If so, these measures would also avoid creating obstacles to innovation in such an important realm of development of technological solutions. In addition, discussions related to classification of evolved ICT services have taken place in the GATS Committee on Specific Commitments over a number of years.

While there is no doubt that the private sector will continue to find innovative ways through which ICTs can contribute to economic growth, "governments and international organisations have a crucial role in both enabling this to happen and ensuring that the poor and marginalised can benefit" (Unwin, 2017). Moreover, many of the policy and legal responses that arise from an unanticipated shift in services trade from commercial presence to cross-border supply, have a variety of interjurisdictional consequences for both trade and innovation policies. Enhanced efforts at collaboration among governments will help complement and coordinate national initiatives (Tuthill, Carzaniga and Roy, 2020).

(ix) Tax policy

International capital tax bases have become increasingly mobile in the last decades. This has been caused by two phenomena. First, changes in regulation have made capital more mobile. Second, in the digital economy economic transactions consist of increasing flows of services supplied online and the increased online supply of a few so-called digitalized products that were once, or can also be, conveyed on physical carrier media. This trend has made it easier for companies to shift their tax base around and locate their statutory profits in low tax areas.

The more mobile tax base has provoked two policy reactions. First, tax rates on capital have decreased substantially over time as countries have attempted to keep an attractive tax environment (Devereux *et al.*, 2002; Egger, Nigai and Strecker, 2019). Second and more recently, governments are attempting to come up with different ways to tax the revenues of (large) companies in the digital economy.

Both policies have an important industrial policy component although for the first policy this is more obvious than for the second. Tax policy *vis-à-vis* (international) companies aims at creating an attractive business environment and can thus be seen as a type of horizontal government policy. The decline in the capital tax base is considered to be problematic from an equity perspective, as it has raised taxes on less mobile tax bases such as labour.

Attempts to tax large companies in the digital economy seem to be partly focused on raising enough tax revenues in the digital economy but they may also have a direct industrial policy angle. The largest digital companies globally mainly come from a small number of countries, and so attempts to tax their revenues by other countries have been considered by these countries as attempts to target their companies with additional taxes in markets with winner-takes-all characteristics.

In this context, as discussed previously in this report, governments use two tax incentives that directly target innovative activity: R&D tax credits and super deductions, and IP boxes (reduced tax on the profits from innovation). While, in theory, patent boxes may incentivize R&D, in practice they induce tax competition by encouraging firms to shift their IP royalties into different tax jurisdictions (Bloom, Van Reenen and Williams, 2019; Hall, 2020). In most developed economies, the share of company assets that is intangible has grown in recent years. As many of these intangibles, which are often IP covered by some form of exclusivity right, do not have a physical location,

they can easily be moved to a low tax jurisdiction (Dischinger and Riedel, 2011; Mutti and Grubert, 2009). This allows firms to pay royalties for the use of the IP to the low-tax country, creating income there and cost in the high-tax country, reducing the total taxes to be paid (Bartelsman and Beetsma, 2003). In response to this strategy, governments tend to lower tax rates on their income in an effort to persuade firms to keep their IP assets at home to retain skilled jobs and R&D in the country. Wasteful tax competition has been found both for US states and across the OECD and the European Union.⁸⁴

Overall, three conclusions can be drawn from a review of the literature on R&D tax incentives (Hall, 2020). First, tax incentives for innovation should be even larger than they are already. Second, those for larger economies are more important for global welfare. Third, given the existence of cross-border spill-overs and the need to avoid wasteful tax competition, these policies would achieve higher welfare if they were better coordinated between countries. In fact, countries are already working on coordinating their tax policies in the OECD (See Section D.2(c)). According to Hall (2020), the nexus requirement of base erosion and profit-shifting has already eliminated the ability to simply benefit from transferring patents.⁸⁵ As a result, the impact of patent boxes on patent ownership transfer may disappear in the future.

4. Conclusions

This section has considered international cooperation and disciplines relevant to digital innovation policies.

Section D.2 showed how the multilateral trading system makes a major contribution to innovation worldwide and to the diffusion of technologies by stimulating competition from foreign firms and linkages with foreign firms through importing, exporting or supplying multinationals. Through multiples rounds of tariff reductions and through disciplines incorporating basic principles such as non-discrimination, transparency, reciprocity, or the prohibition of unnecessarily trade-restrictive measures combined with a preservation of policy space for addressing important societal concerns, the GATT and the WTO have promoted trade and, thereby, innovation. WTO disciplines, while pre-dating the emergence of digitalization, continue to promote trade and innovation in the digital world. Moreover, the multilateral trading system provides certainty, while also promoting cooperation and enabling flexible responses to new problems. The WTO agreements thus ensure certainty and flexibility, which are crucial for deploying innovation-related policies.

Section D.2 went on to review how RTAs address innovation policy. It found that, while only a limited number of RTAs include provisions explicitly addressing industrial and innovation policy, many other provisions in RTAs can both constrain and support industrial and innovation policy in the digital age. While some of the latter provisions replicate or build on existing WTO agreements, many other provisions establish new commitments. These new obligations cover various issues, including data protection and localization, competition and IP in the digital era.

Finally, Section D.2 describes how various international organizations play an important role in international cooperation on innovation by favouring harmonization and mutual recognition of standards and regulatory framework, addressing IP-related issues as well as tax and competition issues, tackling challenges in ICT infrastructure, and supporting digital inclusion and MSME participation.

Section D.3 discussed where and why digitalization and digital innovation policies are creating new needs for international cooperation and possibly for new and updated international disciplines on innovation policy instruments. It argued that the rising importance of data as an input in production and of data fluidity leads to increasing demands for new international rules on data transfer, data localization and privacy. It also argued that the positive network effects of innovation policies in digital equipment industries for downstream digitally enabled industries across the world increase as digital equipment industries become pivotal, by producing general-purpose technologies, thus strengthening the case for international cooperation to encourage national governments to support innovation. At the same time, however, it warned that the “winner-takes-all” characteristics of many digital industries could lead to applications of strategic innovation policy, which would in turn bring about a necessity for cooperation measures aimed at limiting the negative cross-border effects from such policies.

Building on this analysis and based on the limited evidence regarding cross-border spill-overs of innovation policies available in the literature, Section D.3 examined more closely the need for international cooperation in a number of specific areas.

International cooperation in the WTO and RTAs can contribute to the promotion of digital innovation by helping governments to open up and stimulate competition in their digital services sectors. The WTO and RTAs also have a role to play in preventing the introduction and possible spread of barriers to cross-border digital trade and in making it an engine of development.

One question raised is whether, in the digital world, it may make sense to explore ways to expand the flexibility for governments to use R&D subsidies with important positive international spill-overs.

It is also argued that international cooperation may help design a mechanism to share the benefits arising from innovation policies between countries. In the absence of such a mechanism, national governments may not provide enough support for innovation, if they fear that most of the benefits from the innovation they support will leak abroad.

International cooperation could help promote innovation in the digital world by encouraging and facilitating investment in broadband infrastructure or the digital industry. FDI promotes innovation in host countries through direct investments to develop R&D, backward linkages and forward linkages. To reap the maximum benefits from FDI, a sound policy environment for investors, consistent with GATS obligations and commitments on commercial presence, is paramount. Ongoing discussions regarding the joint statement initiative on investment facilitation, aimed at expanding investment flows by simplifying and speeding up procedures, could further promote investment in broadband infrastructure or the digital industry. Aid for Trade can help governments to adopt more open trade and investment policies in the ICT sector which, if supported by an adequate regulatory framework, could help them to attract FDI, develop their digital infrastructure, and bridge the digital divide between poor and rich economies.

Empirical evidence suggests that highly skilled foreign workers positively contribute to innovation in the knowledge economy. Policies to attract highly skilled migrants have been put in place in both developed and developing countries. Commitments in the context of the WTO or RTAs or other international agreements could also help further open markets to the supply of research and development services and other (skilled) professional services by suppliers of other members, through the presence of natural persons (GATS mode 4).

Data policies have become an integral part of innovation policies, and a growing number of jurisdictions have passed new regulations to address data-related policy issues such as data privacy, consumer protection, and national security. It is important to examine the relationship between data policies and innovation further to understand what the long-term effects of such policies are. With enough information on the effects of data policies, international cooperation may help share the benefits arising from international flows of data between countries.

Limitations to data flows, or data localization policies, often stem from privacy or security concerns, and therefore an effort to harmonize standards for data protection across countries or to develop mutual recognition criteria could build trust, and help prevent the spread of excessively restrictive data policies or a possible race to the bottom in terms of privacy and security standards.

While, in many instances, digital markets can lead to enhanced competition, their potentially global reach can also result in dominant positions by market leaders, anti-competitive behaviour or mergers and acquisitions harmful to competition. International dialogue and cooperation on competition policies may help to enhance mutual understanding and awareness of policy effects. Global markets have brought into focus the links between competition policy and industrial and innovation policies. Some tensions exist between, on the one hand, the desire to adapt competition and merger policy to provide more leeway to build and support companies large enough to contest global markets and create markets for innovative products, and on the other hand, concerns about using competition policy for strategic industrial policy purpose aimed at appropriating monopoly profits in the global market through the support of national champions. In this context, international dialogue and cooperation can help to enhance mutual understanding and awareness of policy effects. Relevant cooperation and experience-sharing has taken and is taking place in various fora, such as in certain RTAs and in organizations such as the International Competition Network (ICN), UNCTAD and the OECD.

Finally, both economic arguments in favour and against more policy space for developing countries to pursue innovation policies are discussed in this section. The weight of these arguments depends on the context and the specific policies examined. Although there is little empirical evidence on the size of the spill-over effects of innovation policies and thus of granting more policy space to conduct innovation policies to developing countries, it can be observed that some developing countries have displayed spectacular growth, suggesting that the cross-border spill-overs of their national policies may also have expanded.

Endnotes

- 1 All WTO legal texts may be consulted via https://www.wto.org/english/docs_e/legal_e/legal_e.htm.
- 2 National treatment is the principle of giving other countries' goods, services or intellectual property rights treatments no less favourable than the one provided to one's own nationals. GATT Article III requires that imported products be treated no less favourably than the same or similar domestically produced goods once they have passed customs. GATS Article 17 and TRIPS Article 3 also deal with national treatment for services and intellectual property protection.
- 3 The Human Genome Project is a multinational consortium that produced publicly available research results on the human genome and, in the process, resulted in advances in, for example, genomic sequencing and data handling technologies that have had important commercial applications as well as important applications in medicine. For example, the rapid sequencing of virus genomes is speeding up the search for therapies and vaccines to deal with new viruses.
- 4 Pursuant to GATS Article XV, WTO members recognize that, in certain circumstances, subsidies may have distortive effects on trade in services and they have entered into negotiations with a view to developing the necessary multilateral disciplines to avoid such trade-distortive effects and to address the appropriateness of countervailing procedures. Those negotiations have not concluded so far.
- 5 The approach in the SCM Agreement with respect to "specificity" reflects the expectation that subsidies carry the potential to be more trade-distorting the more specific they are. In this regard, in economic terms, the more closely targeted a subsidy is towards its intended beneficiaries, the more concentrated its relative price effect will tend to be. In many circumstances, this could be taken to imply a higher probability that the subsidy is distorting. A subsidy to a single industry rather than to many industries, for example, could impart a narrow advantage. The more broadly subsidy recipients are defined, then, the more "spread out" and shallower will be the likely subsidy impact.
- 6 Assistance was further limited to a specific list of costs exclusively used for research (personnel, instruments, equipment, land, buildings, consultancy services, overheads, materials and supplies).
- 7 LDCs are designated as such by the United Nations (see Article 27.2(a) in conjunction with Annex VII(a) of the SCM Agreement). Also relevant is WTO official document number WT/MIN(01)/17, Decision adopted at the Doha Ministerial Conference on 14 November 2001, paragraph 10.5.
- 8 These are treated like LDCs until their GNP per capita has reached US\$ 1,000 per annum. Once this threshold (calculated in constant 1990 US\$) has been reached for three consecutive years, they are treated like other developing members in accordance with Article 27.2(b) of the SCM Agreement (transition period of eight years from date of entry into force of the WTO Agreement, i.e., through end-2002). Also relevant is WT/MIN(01)/17, Decision adopted at the Doha Ministerial Conference on 14 November 2001, paragraphs 10.1 and 10.4.
- 9 Article 27.2(b) of the SCM Agreement. Also relevant is 1 WT/MIN(01)/17, Decision adopted at the Doha Ministerial Conference on 14 November 2001, paragraph 10.5.
- 10 Sauv  (2016) highlights that governments can adopt alternative industry support measures without violating the TRIMs Agreement.
- 11 For further details, see https://www.wto.org/english/tratop_e/inftec_e/inftec_e.htm.
- 12 GATT, Trade in Pharmaceutical Products, 25 March 1994, official document number L/7430. Available at https://www.wto.org/gatt_docs/English/SULPDF/91770009.pdf.
- 13 The Pharma Agreement is a dynamic agreement with a built-in negotiating mandate: participants agreed to regularly review the Agreement to update and expand the list of products covered. A fifth review should start any time.
- 14 Australia, Brunei Darussalam, Canada, Chile, Lao People's Democratic Republic, Myanmar, Singapore, Uruguay, Joint Ministerial Statement affirming commitment to ensuring supply chain connectivity amidst the COVID-19 situation, 6 April 2020. Available at <https://www.mti.gov.sg/-/media/MTI/Newsroom/Press-Releases/2020/03/Updated-Joint-Ministerial-Statement-on-supply-chain-connectivity-as-of-6-april.pdf>.
- 15 Available at <https://perma.cc/WWG4-JRAC>.
- 16 Communication from New Zealand and Singapore, "Response to the COVID-19 Pandemic: Ensuring the Free Flow of Trade in Essential Goods for Combating the COVID-19 Pandemic", 16 April 2020, WTO official document number G/C/W/777. Available at <https://docs.wto.org/>.
- 17 See the introductory statement at an informal meeting of EU trade ministers of 16 April 2020 (https://ec.europa.eu/commission/commissioners/2019-2024/hogan/announcements/introductory-statement-commissioner-phil-hogan-informal-meeting-eu-trade-ministers_en). In June 2020, the Ottawa Group also circulated a comprehensive proposal for permanent and tariff elimination on healthcare goods, proposing to expand coverage of and participation in the existing ITA and pharmaceutical sectoral initiatives. It is also proposed to accelerate certain trade facilitation reforms and to simplify import licensing procedures (see WTO official document number WT/GC/217 – available at <https://docs.wto.org/>).
- 18 We use the term "technical standards" for easy reference only and as shorthand for a wide range of regulatory measures, including those covered and defined by the TBT Agreement (Annex 1.1, 1.2 and 1.3, respectively): "technical regulations" (mandatory), "standards" (voluntary) and "conformity assessment procedures". However, these three terms may be also be used when a point concerns a specific type of TBT measure only.
- 19 For more details, see the TBT Handbook at https://www.wto.org/english/res_e/publications_e/tbttrade_e.pdf
- 20 For a summary of these technologies, see WTO (2018a), pages 28-35.
- 21 So far, most COVID-19-related TBT notifications were reported as temporary (i.e. often applying for a period of six months), and covered a wide range of products, including personal protection equipment (PPE), medical equipment, medical supplies and medicines. The objective of these notifications broadly fell into three main categories: streamlining certification procedures, ensuring the safety of medical goods, and making food available by relaxing technical regulations. For further information on TBT and COVID-19, see the WTO information note of 20 May 2020, "Standards, Regulations and COVID-19 – what actions taken by WTO members?", available at https://www.wto.org/english/tratop_e/covid19_e/standards_report_e.pdf.
- 22 One example is Canada's "Regulations Amending the Food and Drug Regulations" (notified to the TBT Committee in 2017. See WTO official document number G/TBT/N/CAN/525).

- 23 Participants: Australia, Brazil, Canada, Japan and the United States. The International Medical Devices Regulators Forum and its Medical Device Single Audit Program aim to reduce duplication and promote more efficient and effective use of regulator resources for faster approval of innovative devices.
- 24 Notifications made under Article 10.7 of the TBT Agreement. See <http://tbtime.wto.org/en/AgreementNotifications/Search>.
- 25 WTO official document number G/TBT/1/Rev.14.
- 26 WTO official document number G/TBT/1/Rev.14.
- 27 WTO official document number G/TBT/1/Rev.14.
- 28 For further discussion on research regulations, see Maskus and Saggi (2013).
- 29 For further details on how AI impacts international trade, see WTO (2018), page 140.
- 30 "Dual-use" regulations can include other technologies, such as nuclear power. See, for example, WTO official document number G/TBT/N/CZE/198/Add.1, notified to the TBT Committee by the Czech Republic:
- "The purpose of the proposed legislation is to establish an updated list of dual-use nuclear items in relation to Prevention of Technical Barriers obligations laid down in the new Atomic Act and to existing State supervision of dual-use items, including the authorisation of export and import. The implementing decree also lays down new content requirements for documentation for licensed activities and the scope of registered data on dual-use items and how it is retained, including its delivery to the State Office for Nuclear Safety. [...]"
- 31 For instance, a recent European Commission Report (EC Report, 2020a) on the safety of AI, IoT and robotics describes the key benefits of these technologies as follows:
- "Beyond productivity and efficiency gains, AI also promises to enable humans to develop intelligence not yet reached, opening the door to new discoveries and helping to solve some of the world's biggest challenges: from treating chronic diseases, predicting disease outbreaks or reducing fatality rates in traffic accidents to fighting climate change or anticipating cybersecurity threats."
- 32 International cooperation on AI was also the object of the 8-9 June 2019 "G20 Ministerial Statement on Trade and Digital Economy" (<https://www.mofa.go.jp/files/000486596.pdf>), the annex of which lays down the "G20 AI Principles", which in turn, drew from the OECD AI Principles (<https://www.oecd.org/going-digital/ai/principles/>), adopted in May 2019 by the OECD member countries.
- 33 For additional details, see the integrated Government Procurement Market Access Information Resource (e-GPA) portal of the WTO, available at <https://e-gpa.wto.org>.
- 34 See https://www.wto.org/english/tratop_e/serv_e/telecom_e/tel23_e.htm.
- 35 See https://www.wto.org/english/tratop_e/serv_e/12-tel_e.htm.
- 36 See https://www.wto.org/english/tratop_e/serv_e/telecom_e/tel23_e.htm.
- 37 See WTO official document W/2/Rev.1, 16 January 1997, also included in the GATS scheduling guidelines, S/L/92, 28 March 2001 (<https://docs.wto.org/dol2fe/Pages/SS/directdoc.aspx?filename=q:/S/L/92.pdf&Open=True>).
- 38 See https://www.wto.org/english/tratop_e/covid19_e/covid19_e.htm.
- 39 See <https://patents.google.com/> and <https://patentscope.wipo.int/search/en/search.jsf>.
- 40 Permissive licence available at <https://www.medtronic.com/content/dam/medtronic-com/global/Corporate/covid19/documents/permissive-license-open-ventilator.pdf>.
- 41 See list of measures of regarding trade-related intellectual property rights, available at https://www.wto.org/english/tratop_e/covid19_e/trade_related_ip_measure_e.htm.
- 42 Source: OECD Creditor Reporting System (<https://stats.oecd.org/Index.aspx?DataSetCode=crs1>). Aid for Trade support to e-commerce for the year 2018 was calculated according to the UNCTAD analytical framework used for the E-trade for All initiative. This includes support to the seven areas of e-commerce: (1) e-commerce assessments, (2) ICT infrastructure and services, (3) payments, (4) trade logistics, (5) legal & regulatory framework, (6) skills development and (7) financing for e-commerce.
- 43 Other relevant provisions found in RTAs include tariffs reduction commitments on innovation-related products. For instance, tariffs applied by non-participants to the WTO Information Technology Agreement (ITA) on products covered by the ITA remain generally high. Their level of tariff concessions on ITA products has not recorded significant changes over the years. This is true both for the level of bound tariffs and the binding coverage (i.e. the percentage of tariff lines inscribed in the schedule with a bound duty) (WTO, 2017). However, the preferential tariffs of some of these products are lower than the MFN tariffs for some non-participants to the ITA.
- 44 Other common provisions on subsidies establish transparency and countervailing duty disciplines (Rubini, 2020).
- 45 Some RTAs without any provisions on subsidies related to services trade, such as the RTA between Australia and Singapore, incorporate a provision calling for future consultation and negotiation on subsidies related to trade in services.
- 46 As discussed in Section D.2(b)(iii), recent RTAs incorporate specific provisions on competition and state-owned enterprises.
- 47 Unlike many other areas discussed in this subsection, IP commitments agreed in RTAs must be provided to all WTO members.
- 48 Some RTAs further expand the enforcement obligations by requiring that border authorities have ex officio authority to detain suspected counterfeit or pirated goods, and to order their destruction.
- 49 See https://www.wipo.int/copyright/en/activities/internet_treaties.html.
- 50 Other digital IP issues covered include programme-carrying satellite and cable signals, digital trademark protection, internet domain names management, liability of internet service providers and government use of software (WTO, 2018).
- 51 In the context of some bilateral investment treaties, certain industrial policy measures were the subject of investor-state dispute settlement (ISDS) procedures. In recent years, some bilateral investment treaties have, however, been modified to clarify the nature of protection afforded to investors, limit the recourse to ISDS or abrogate the ISDS provisions.
- 52 Other provisions found in RTAs could be relevant to investment and industrial policy. For instance, strict rules of origin in RTAs can lead to the re-localization of certain parts of productions to avoid facing additional tariffs (Francis, 2019).
- 53 Unlike the TRIMS Agreement, these performance requirements provisions often apply to both goods and services industries.

- 54 Most global value chains remain regional rather than global in character, though less so in services than in manufacturing.
- 55 See https://www.wto.org/english/tratop_e/serv_e/12-tel_e.htm.
- 56 See https://www.wto.org/english/tratop_e/serv_e/telecom_e/tel23_e.htm.
- 57 Other regulatory practices related to anti-competitive behaviours of major suppliers, although covered by the Reference Paper's general competition safeguard, but not explicitly mentioned, include requirements of operators to: allow customers to retain the same telephone number (number portability) and to use an equal number of digits to access telecommunications services (dialling parity); ensure interoperability of roaming on mobile networks; and guarantee non-discriminatory access to facilities owned or controlled by major suppliers and needed to supply telecommunications services, including submarine cables, satellites, and poles and ducts.
- 58 Beyond RTAs, the exchange of personal data for commercial purposes has been negotiated in specific agreements by some countries (e.g. the EU-US Privacy Shield Framework).
- 59 The Additional Protocol to the Pacific Alliance Framework Agreement further explains that the provision prohibiting requirement concerning the location of computing facilities shall not prevent a party from conditioning the receipt of an advantage or continuing to receive an advantage in accordance with the provision on performance requirements found in the agreement's investment chapter.
- 60 The main provision in the CPTPP regarding the electromagnetic compatibility of information technology equipment products requires each party to demand positive assurance that these products meet a standard or technical regulation for electromagnetic compatibility to accept a supplier's declaration of conformity.
- 61 Official development aid, including Aid for Trade, is also a means by which some countries cooperate on issues related to industrial policy. For instance, the Japan International Cooperation Agency (JICA) manages different projects aimed at promoting industrial development, including value chain development, from agriculture and the processing industry to the manufacturing and services sectors.
- 62 ISO/TC 279 – see <https://www.iso.org/committee/4587737.html>.
- 63 See <https://www.worldbank.org/en/programs/all-africa-digital-transformation>.
- 64 See <https://www.oecd.org/tax/treaties/multilateral-convention-to-implement-tax-treaty-related-measures-to-prevent-beps.htm>.
- 65 See <https://ecomconnect.org/>.
- 66 See <https://www.unido.org/our-focus/advancing-economic-competitiveness/investing-technology-and-innovation/competitiveness-business-environment-and-upgrading/information-and-communications-technology/programmes/business-information-centres>.
- 67 See <https://etradeforall.org/development-solution/worldbank-e-trade-development/>.
- 68 This is further described in Section C.4.
- 69 Gautier and Lamesch (2020) analyse GAFAM mergers and acquisitions and find that most of their acquisitions have been driven by asset acquisitions. Firms buy valuable innovations, functionalities or R&D to strengthen their main segments. By doing so, they improve their products' ecosystems and reinforce their already strong market positions. They find no evidence that this intense merger-and-acquisition activity leads to more global competition between the GAFAM firms, nor for evidence of so-called killer mergers which attempt to stifle competition. However, they use a narrow definition of killer mergers. Mergers are only classified as killer mergers if they are in the core segment of the acquirer and if product supply of the firm taken over continues under the same brand name.
- 70 Although firms are increasingly based in multiple countries and owned by residents from multiple countries, governments are still engaged in strategic industrial policy, as described in Section B.
- 71 Export controls on dual use technologies are regulated in multilateral export control regimes such as the Australia Group, the Wassenaar Arrangement, the Nuclear Suppliers Group and the Missile Technology Control Regime.
- 72 The international regulation of specific topics such as data and services trade is discussed in more detail in Section D.3(b).
- 73 The researchers find these results in a two-country dynamic quality ladder model of innovation. Their main result follows from the finding that the international cooperative level of innovation subsidies is larger than the (Nash) equilibrium level of subsidies in which countries maximize their own welfare.
- 74 The cited model also assumes free trade, with innovation gains passing on to foreign consumers.
- 75 "Electronic Commerce and Copyright", submitted by Brazil in WTO official document number JOB/IP/19 on 12 December 2016.
- 76 See https://www.wipo.int/copyright/en/activities/internet_treaties.html.
- 77 As of August 2020, the WIPO Copyright Treaty had 107 contracting parties, and the WIPO Performances and Phonograms Treaty had 106.
- 78 See https://www.wto.org/english/tratop_e/trips_e/innovationpolicytrips_e.htm.
- 79 "Transforming our world: the 2030 Agenda for Sustainable Development", Resolution adopted by the General Assembly on 25 September 2015, A/RES/70/1 (UN General Assembly, 2015).
- 80 For further background, see https://www.wto.org/english/tratop_e/comp_e/comp_e.htm.
- 81 Maskus and Saggi (2013) propose working toward a plurilateral agreement, presumably under the auspices of GATS.
- 82 See Decision on the Outcomes of the Negotiations under Article XXIV:7 of the Agreement on Government Procurement, 30 March 2012, GPA/113 dated 2 April 2012.
- 83 See WTO official document number GPA/W/341, dated 30 May 2017 (available at <https://docs.wto.org>).
- 84 See Bloom, Griffith, and Van Reenen (2002) for the OECD; Corrado, Hulten and Sichel (2009) for 10 EU countries; and Wilson (2009) for US states.
- 85 The nexus approach requires a link between the income benefiting from the IP regime and the extent to which the taxpayer has undertaken the underlying R&D that generated the IP asset (OECD, 2015).