



WORLD TRADE  
ORGANIZATION

# WORLD TRADE REPORT 2020

Government  
policies to promote  
innovation in the  
digital age



What is the World Trade Report?

The World Trade Report is an annual publication that aims to deepen understanding about trends in trade, trade policy issues and the multilateral trading system.

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What is the 2020 Report about?

The 2020 World Trade Report looks at the role of innovation and technology policies in an increasingly digitalized world economy, and explains the role of the WTO in this changing context.

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## Disclaimer

The *World Trade Report* and its contents are the sole responsibility of the WTO Secretariat, except for the opinion pieces, which are the sole responsibility of their authors. The Report does not reflect the opinions or views of members of the WTO. The authors of the Report also wish to exonerate those who have commented upon it from responsibility for any outstanding errors or omissions.

# Abbreviations and symbols

AD	antidumping	MERCOSUR	Southern Common Market
AI	artificial intelligence	MFN	most-favoured nation
APEC	Asia-Pacific Economic Cooperation	MNC	multinational corporation
ASEAN	Association of Southeast Asian Nations	MSME	micro, small and medium-sized enterprise
BEPS	base erosion and profit-shifting	OECD	Organisation for Economic Co-operation and Development
CARICOM	Caribbean Community	PPE	personal protective equipment
CPTPP	Comprehensive and Progressive Agreement for Trans-Pacific Partnership	R&D	research and development
CVD	countervailing duties	RTA	regional trade agreement
EAEU	Eurasian Economic Union	SCM	subsidies and countervailing measures
ECIPE	European Centre for International Political Economy	SEZ	special economic zone
EEA	European Economic Area	SME	small and medium-sized enterprise
FDI	foreign direct investment	SOE	state-owned enterprise
FTA	free trade agreement	STEM	science, technology, engineering and mathematics
GATS	General Agreement on Trade in Services	TBT	technical barriers to trade
GATT	General Agreement on Tariffs and Trade	TPR	Trade Policy Review
GBARD	government budget allocations for R&D	TRIMS	Agreement on Trade-Related Investment Measures
GDP	gross domestic product	TRIPS	Trade-Related Aspects of Intellectual Property Rights
GNP	gross national product	UNCTAD	United Nations Conference on Trade and Development
GPA	WTO Government Procurement Agreement	UNECE	United Nations Economic Commission for Europe
GPT	general-purpose technology	UNEP	United Nations Environment Programme
ICT	information and communication technology	UNESCO	United Nations Educational, Scientific and Cultural Organization
IEC	International Electrotechnical Commission	UNICEF	United Nations Children's Fund
IoT	Internet of Things	UNIDO	United Nations Industrial Development Organization
IP	intellectual property	USMCA	United States-Mexico-Canada Agreement
IPA	investment promotion agency	WHO	World Health Organization
ISO	International Organization for Standardization	WTO	World Trade Organization
ISP	internet service provider		
IT	information technology		
ITA	WTO Information Technology Agreement		
ITC	International Trade Centre		
ITU	International Telecommunication Union		
LDC	least developed country		
LLU	local loop unbundling		

# Foreword by Deputy Directors-General Agah, Brauner, Wolff and Yi



In the digital age, a growing number of governments have adopted policies aimed at boosting growth through innovation and technological upgrading. The domestic economic fallout linked to the COVID-19 pandemic is leading countries to strengthen these policies. This report looks at these trends, and at how trade and the WTO fit in. It shows that there is a significant role for international cooperation to make countries' pursuit of such goals more effective, while minimizing negative spill-overs from national policies.

Historically, governments have sought to use policy to enhance long-term economic growth or societal welfare. These policies have always had to balance multiple objectives, from attempts to correct real or perceived market failures, to the dual task of managing change in mature sectors, while promoting emerging industries and technologies. Over the past two decades, countries have targeted these objectives with increasingly outward-oriented policies, in recognition that openness by access to larger markets and increased competition leads firms to innovate. Trade and trade policy have historically been important engines for innovation. The certainty and predictability in global market conditions fostered by the multilateral trading system has made a major contribution to innovation and technology diffusion globally, notably by underpinning the rise of global value chains. Countries have accessed advanced technology by importing capital goods, technologies and building knowledge through partnerships and global value chain participation. The economic literature and experience in many countries highlight that innovation, productivity and other key objectives of government policies are best served by broadly open global markets.

Today, a defining feature of government policies is to support the transition towards the digital economy. This transition has become the key objective of so-called "new industrial policies", whose conceptual basis and content have been partly reshaped by the distinct features of the digital economy. As data becomes an essential input, firms rely more on intangible assets than on physical ones. Digital firms are more scalable, reach global markets faster, and

large players may expand globally without the amount of physical investment previously necessary in other sectors. Success in the digital economy underscores the need for openness, for access to information and communications technology (ICT) goods and services, open-source technology, foreign markets, collaborative research projects, and in general for the diffusion of knowledge and new technology.

Spurring innovation in the digital field, whether "new in the world" or "new in the country", is at the core of many new industrial policies adopted in countries at all levels of development in recent years. Governments typically justify these interventions on the grounds of market failures in financing innovation and entrepreneurship, the existence of economy-wide spill-overs for general-purpose technologies, the public nature of knowledge, and the presence of network externalities. The Report finds that some of the policy instruments being employed are relatively new (data policies, some collaborative research and development support, knowledge diffusion through agglomeration, technological hubs) while others are more conventional (tariffs for infrastructural equipment, investment and tax incentives, innovation-based procurement and intellectual property policies).

The Report observes that many developing countries have adopted proactive policy frameworks to promote digital development and technological innovation, with a view, *inter alia*, to catching up on infrastructure, developing the digitization of production and building domestic capacity for a software/app economy which relies on open-source technologies. Innovation in the digital field is widely sought by countries at all development levels. Provided they continue to catch up on internet infrastructure and the right policy and business environment, least-developed countries stand to gain increasingly in digital service exports, participation in global value chains, and the economic inclusion fostered by affordable mobile services.

The Report notes that government policies retain "defensive" aspects, particularly in mature non-digital sectors subject to intense competition and technological transition. The greatest concentration

of “protective” policy instruments is seen in these sectors, aiming to manage the transition and address employment concerns.

In the digital field, the WTO and its existing rulebook already support innovation directly and indirectly in many ways: directly, by eliminating tariffs on internet and telecommunications infrastructure products through the Information Technology Agreement (ITA) and extending these benefits to non-ITA members, by liberalizing internet services through the telecommunications agreement, and by stimulating e-commerce with the moratorium on duties on cross-border digital flows, as well as by providing a robust and stable framework for the development of global and open standards, intellectual property protection and other critical rules based on the principles of non-discrimination, transparency and reciprocity; and indirectly, through the improved resource allocation and efficiency that come with open trade, which frees up resources that can be devoted to new cutting-edge pursuits.

The WTO agreements reached a quarter-century ago proved to be remarkably forward-looking in providing a framework that helped foster the development of an ICT-enabled economy in countries across all levels of development, while preserving policy space for countries to pursue different models of digital development.

Just as it has fostered broadly open, predictable and competitive markets in the wider global economy, the WTO can in the years ahead play an important role in reducing uncertainty in markets for digital goods and services. But this will mean updating the WTO framework to address new challenges and demands. For example, the rising importance of data leads to growing demands for shared international understanding on data transfer, localization and privacy. International cooperation would be useful to foster innovation and interoperability and to reduce tensions in ways that would make international markets function more predictably.

This report looks at how international cooperation – at the WTO, on Aid for Trade and elsewhere – can address these challenges and maximize the positive spill-overs from governments' policies to promote innovation. While, in many instances, digital markets enhance competition and generate positive spill-overs for the rest of the economy, the Report also warns that the winner-takes-all characteristics of certain digital industries could lead to policy responses that raise tensions between countries and introduce unnecessarily high market barriers. Here, international cooperation could play a particularly valuable role in limiting negative spill-overs.

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# Executive summary

## A. Introduction

In the digital age, a growing number of governments have adopted policies aimed at boosting growth through innovation and technological upgrading. The domestic economic fallout linked to the COVID-19 pandemic is leading countries to strengthen these policies. This report looks at those trends, and at how trade and the WTO fit into them. It shows that international cooperation could play a significant role in making countries' pursuit of such goals more effective, while minimizing the negative spill-overs from national policies.

The shift towards digitalization and knowledge-based economies highlights the increasing importance of innovation and technology to economic growth. Under the so-called "new industrial policies", government policies aim at shifting domestic production towards new, enabling digital technologies, while at the same time facilitating the modernization of mature industries.

At each phase of policymaking, governments have to balance multiple objectives, from attempts to correct real or perceived market failures, to the dual task of managing change in mature sectors, while promoting emerging industries and technologies. Over the past two decades, economies have met these objectives with increasingly outward-oriented policies, in recognition of the fact that openness – access to larger markets and increased competition – leads firms to innovate.

The digital age further underlines this need for openness. Trade and trade policy have historically been important engines for innovation. The certainty and predictability in global market conditions fostered by the multilateral trading system have made an enormous contribution to innovation and technology diffusion globally, notably by underpinning the rise of global value chains. Countries have accessed advanced technology by importing capital goods, by means of technologies, and by building knowledge through partnerships and global value chain participation.

Today, a defining feature of government policies is to support the transition towards the digital economy, which is one reason why more and more governments adopt knowledge-based strategies. However, international cooperation is necessary if outward-oriented policies are to be effective. In the context of

"new industrial policies" and related policies geared towards innovation, and the transition towards the digital economy, some of these strategies can have positive spill-overs for other countries – generating growth, creating new markets and encouraging technology diffusion. At other times, these strategies can have negative spill-overs – distorting trade, diverting investment, or promoting unfair competition.

The challenge for WTO members is to provide a framework of shared rules that encourages positive-sum outcomes and discourages zero- or negative-sum ones. This is not a new challenge. The system that was created after the Second World War was designed precisely to reconcile international rules with national policy space and flexibility.

## B. Defining innovation-oriented government policies and their evolution in the digital age

In many countries, government policies attempt to improve the business environment or to tilt the structure of economic activity toward sectors, technologies or tasks that are expected to offer better prospects for economic growth or societal welfare than would occur in the absence of such intervention. Governments are generally motivated to implement policies at the sectoral level in order to boost long-term growth, increase incomes and productivity, and, in doing so, promote entrepreneurship, innovation, technology transfer, skill development and competition as specific policies to achieve these objectives.

Over time, there have been several phases of government policies, with considerable variance across economies. In the early days, industrial policies were narrowly defined as policies that aimed to build capacity mainly in the manufacturing sector. The 1980s marked a gradual shift away from policies based on import substitution, infant industry protection and direct intervention into the production process, towards more outward-oriented policies. Some countries anticipated that shift even earlier.

In the 1990s, industrial policies further embraced open economy requirements: skills upgrading, acquisition of technological capacity, reduction of business and trade costs, and infrastructure development, for example, as important medium-term objectives. Industrial and trade policies aimed

to improve the international competitiveness of firms and their integration into global value chains. Governments also introduced strong horizontal, or cross-sectoral, objectives aimed at providing the infrastructure for economic growth, although the horizontal focus did not completely displace sectoral policies, which remained a prominent feature of industrial policies.

By the turn of the millennium, the notion of industrial policy had shifted significantly, with the concept of "industrial" extending beyond the manufacturing sector and evolving towards a model of greater strategic collaboration between the private sector and governments, characterized by the relatively large presence of public-private partnerships and programmes to boost research and development (R&D).

Since the 2008-09 financial crisis, there has been an undeniable resurgence of government policies aimed at fostering change in the allocation of resources by economies, as reflected in the number of economies in which such policies have been developed and in the ambition of policy plans. "New industrial policies", "Industrial 4.0", "digital transition plans" have been designed in a context of profound industrial reorganization and parallel to the emergence of ground-breaking digital technologies and advanced manufacturing supply chains. For many countries, the principal aim is to modernize their economies, including their traditional manufacturing sectors, in a way that promotes the shift from mechanical and analogic production to digitally enabled production processes and services.

Hence a key and defining feature of "new industrial policies" is their prime focus on innovation, technological development and upgrading in the digital field.

Innovation can be understood as the transformation of an invention into marketable products and services, new business processes and organizational methods, as well as the absorption, adaptation and dissemination of novel technologies and know-how. Innovation-oriented government policies are therefore public interventions to support the generation and diffusion of innovation.

In practice, technological upgrading and the digitalization of production processes and services are embodied in the economic development plan of many countries, while in others, a specific digital development plan and an innovation plan complements an industrial strategy. Many developing countries have adopted proactive policy frameworks

to promote digital development and technological innovation with a view, for example, to catching up on digital and telecommunications infrastructure, developing the digitalization of production and building capacity for a software/app economy reliant, in the main, on open-source technologies.

Providing an overview of industrial and innovation policies in the digital space, this report examines how policy instruments evolve, distinguishing what is truly new from what simply adapts policy instruments already at use in "traditional sectors". Certain policy tools and instruments are clearly integral to the digital economy: data policies, R&D support applied to digital technologies, skill and knowledge diffusion; other policy instruments such as investment incentives and intellectual property rights regimes are more "conventional" and need to adapt when applied to the digital sector.

"New industrial policies" can also display "defensive" aspects, particularly in non-digital sectors, which are the most mature, and which may be subject to competition and technological transition. A snapshot of the use of government policy tools, based on public sources including the WTO Trade Monitoring Database, complemented by the Centre for Economic Policy Research (CEPR)'s Global Trade Alert database, shows the relatively active use of industrial and trade policy instruments of a "defensive" nature in traditional sectors such as minerals, metals and chemical industries, and to a lesser extent in textiles and clothing, electrical machinery, and transport equipment. This is notably the case for new border measures including import tariffs, export duties and non-tariff measures, which account for one-third of the policy measures implemented since the 2008-09 financial crisis. The analysis of domestic support measures is less clear, as many of the domestic support measures are horizontal in nature. Where they are identifiable, sector-specific support measures tend to focus on sectors such as transport equipment, minerals and metals.

Investment policies, which are still at the heart of industrial strategies, are characterized by a trend to offer incentives and attract foreign direct investment (FDI), notably in increasingly popular special economic zones (i.e. areas in a country in which the business and trade laws differ from those of the rest of the country). Fiscal and financial incentives, such as tax or tariff exemptions and subsidized services, are the most prevalent investment promotion tools among economies of all development levels. Meanwhile, FDI policies adapt to the characteristics of the digital economy, in which firms no longer need to serve foreign markets by building large manufacturing capacity and

hence firms' criteria to invest abroad emphasize skills and the quality of digital infrastructure.

The novelty of government policies in the digital age is perhaps in the requirement for a better articulation of the various policies supporting the establishment of a new digital supply chain. While ambitions to innovate in digital technologies may vary from one economy to another, many countries – including least-developed countries – do have explicit digital strategies to make the most of the digital technologies, with a view to producing software, providing e-services and/or participating in e-commerce. The concept of innovation in some developing countries may differ somewhat from that of the few frontier countries in this field, as in these cases innovation indicates adopting existing technologies rather than inventing new ones. For these countries, their objectives include catching up with more technologically advanced economies and building alternative capacity for software/domestic "app" economies which can rely on open-source technologies.

Several features of the digital economy underline the evolution of this new phase of industrial and innovation policies. As data become an essential input in every aspect of economic activity, many digital technologies have the potential to alter economies and redefine innovation, and they are thereby considered to be general-purpose technologies. In particular, digital technologies foster collaboration and help to form innovative ecosystems. Firms in the digital economy rely less on physical assets and more on intangible assets. This makes firms much more scalable (i.e. capable of expanding), allowing them to reach global markets, and some market players have come to hold dominant positions in the digital sector.

As a result of these special features, government policies have been evolving in such a way as to encourage innovation in the digital space. Open and transparent data policies are an integral part of innovation policy, as actors need a clear framework for data use, transfer and protection. Government support in building and upgrading telecommunications infrastructure serves as an enabling condition to scale up digital services. Government policies also aim to foster innovation by supporting the promotion of science, offering specific mission-oriented or broad R&D support, developing innovation hubs, promoting digital literacy and skills, and encouraging e-government services as well as innovation procurement. Policy design has to be collaborative and adaptive to allow for the coordination of many more policy fields and favour more experimentation. Collaboration with the private sector is also being sought more systematically.

In the assessment of domestic policies surrounding digital technologies and related activities, a careful examination has to be made. Many national policies in the digital area, such as those which seek to improve the digital infrastructure, offer R&D support in general-purpose technologies, and develop digital skills, tend to be horizontal in nature, and hence are deemed, according to the economic literature, to be *a priori* less economically distortive than policies targeted at specific industries or firms. Policies which aim to create national champions and target specific industries may be more trade-distortive, and call for enhanced international cooperation.

Government policies today are increasingly oriented towards the promotion of innovation in the digital sectors. Over the past decade, R&D expenditure in services linked to information and communication technologies has grown from 10.8 per cent to 14.2 per cent of global R&D spending. Governments support innovation and the development of the digital economy through a mix of traditional policy instruments and new regulatory approaches. Traditional policy instruments range from direct and indirect public funding for R&D to the elimination of import tariffs (including under the WTO Information Technology Agreement), innovation- and digital-oriented public procurement, local content requirement measures, the development of standards and the promotion of high-tech clusters and tech hubs.

The specific features of the digital economy have also led numerous governments to broaden their policy toolboxes and develop new regulatory approaches. These new approaches aim to foster digital innovation through instruments like regulatory sandboxes (i.e. where businesses can draw on the expertise and advice of a regulator and test their products under less stringent regulatory requirements) and data-sharing schemes. They also aim to address digital challenges through interventions like data flow restrictions, data localization requirements and taxation.

## C. Innovation policy, trade and the digital challenge

There are several arguments in the economic literature supporting the role of government in fostering innovation, some of which specifically apply to the digital economy. The report identifies five types of market failures in innovative activity that rationalize government intervention.

First, the outcomes of innovation have the characteristics of public goods. Public goods are supplied in inefficiently low quantities by the market

because private returns are lower than social returns. For example, like a public good, data can be used by several firms at the same time without experiencing any reduction in value. Thus, firms that collect and process data may not be able to fully capture the benefits, resulting in a disincentive for data collection and sharing. However, government policies can incentivize the collection, processing and sharing of data, while balancing these benefits with the protection of private information.

Second, digital innovation can generate large benefits for the whole economy by using and diffusing general-purpose technologies. Such technologies, like the steam engine and electricity, generate a growing range of applications and produce positive, economy-wide spill-overs, such as a greater availability of affordable computers and internet connections, which generate complementary innovation.

Third, innovative activity is characterized by asymmetric information between the potential innovator and the potential financier, because the innovator typically knows more about the activity than the financier. This can make it difficult for the latter to predict returns from a potential investment in innovative ventures. As a consequence, a lack of funding may inhibit firms from investing in innovation. However, governments can support projects with a high risk of no immediate result but potentially long-term outcomes, as well as improving financing for new firms and reducing their regulatory burden.

Fourth, complex activities, like innovation, are subject to coordination failures among the various stakeholders. Government action can help coordinate the different parties involved in the innovation process, ensuring that all the required complementary advances have been developed and are available in the market. For instance, to support the economic development of the digital economy, the government may need to intervene to coordinate the co-financing of communication infrastructures.

Fifth, digital technologies are also characterized by significant network externalities or effects, that is, the value of a network increases with additional users. In the presence of network externalities, governments may want to intervene because there can be a gap between the private and the social value of joining a network, limiting the size of networks in an inefficient manner. Government intervention can also address the risks of anti-competitive behaviour and of any single technology dominating the whole market.

The toolkit of policies to promote innovation is vast, because many factors affect innovation activity in

the economy. Innovation policies typically aim to enlarge market size and increase R&D, ensuring the appropriability of research investments by filling (or reducing) the gap between the social and private returns to innovation, and increasing innovation investment to above the inefficiently low levels delivered by the market. Policies also aim to ensure that markets are contestable (i.e. open to competition) and to prevent the abuse of dominant positions, anti-competitive behaviour and technology lock-in (i.e. when technologies that have become obsolete remain in place).

It is worth noting there is no one-size-fits-all approach to innovation policy. Different sets of policies are relatively more appropriate for countries at different levels of economic development. At early stages of development, governments may favour investment-based strategies, while home-grown innovation becomes more important as an economy grows and approaches the world technology frontier (i.e. the most recent technological innovations). Coupled with open and competitive markets, innovation policy can help countries to escape the middle-income trap by selecting and fostering the most innovative entrepreneurs.

Open and transparent trade policies contribute to innovation through improved access to foreign markets and increased competition, which provide firms with incentives to invest more in R&D. This is true for both developed and developing economies: a study of 27 emerging economies shows that both competition from foreign firms and linkages with foreign firms, through importing, exporting or supplying multinationals, increase product innovation, the adoption of new technologies and quality upgrading (Gorodnichenko, Svejnar and Terrell, 2010). Imports of capital goods and intermediate inputs improve productivity, product quality and diversity; the interaction between domestic and foreign firms, through backward and forward linkages, favours technological diffusion; face-to-face interactions within international production and research networks help the diffusion of tacit knowledge and promote knowledge spill-overs. Open and transparent data policies are also important contributors to innovation in the digital age.

Other government policies can be beneficial for innovation. The economic literature highlights that R&D tax credits tend to increase R&D spending and, in some cases, increase patenting activity. Government research spending and procurement have a generally positive impact on innovation. Recent research shows that public funding of university research leads to more patents being filed by private firms. Government

research grants allocated in a competitive way to private firms generally succeed in stimulating private R&D. The effect is particularly prevalent for small firms, which are more likely to experience external financial constraints. Governments can also have a large impact on innovation through procurement policies, especially those directed towards sectors and firms with high technological content.

To achieve desirable social goals, such as to share economic benefits widely and tackle climate change, there may be a role for government in developing radical innovation. Breakthroughs in technological developments are often achieved in the framework of mission-oriented innovation policies, in which the state is both the funder and the customer, with specific public agencies often performing the role of coordinators of vast R&D efforts. Although such policies are difficult to evaluate, they may be justifiable in and of themselves.

The importance of intellectual property rights (IPR) regulation is bound to increase in the digital age because many digital products are replicable at zero cost and are of a non-rival nature (i.e. one person's use of these products does not prevent other people from using them). Strict and enforceable IPRs are central and can increase the attractiveness of a country for digital firms. Recent studies show that patent protection increases the availability of innovation in the pharmaceutical industry. Open source software makes it possible to organize production in a decentralized manner among individuals who cooperate with each other and share resources and outputs, thus contributing to digital innovation.

Human capital fosters economic growth by increasing the productivity of existing technologies and providing an essential input into the innovation process, leading to the generation or diffusion of new technologies, particularly in the digital economy. Education, in particular in science, technology, engineering and mathematics (STEM), is associated with higher levels of innovation activities. Policies to increase the supply of STEM graduates and attract highly skilled immigrants have been shown to boost innovation, and highly skilled scientists and engineers from developing countries who have emigrated abroad to work can also generate net positive gains in their home countries when they go back to their home countries or when they connect with local entrepreneurs there.

Competition policy aimed at making markets contestable is generally beneficial to innovation. Studies have shown that product or service market regulation reduces the intensity or the efficiency of R&D in the same sector or in downstream sectors.

Several studies show that the removal of market entry barriers fosters innovation, including in digital sectors. Although it may be preferable to concentrate resources to foster growth at early stages of development, competition benefits long-term growth.

Other policies that create an innovation-friendly environment include building and maintaining telecommunications infrastructure and favouring agglomeration and early exposure to innovation. This report examines some insights into the wider economic implications of innovation policy, in particular in terms of overall impact on welfare and effects on inequality within countries.

Innovation policies in one country can, and do, have an impact on other countries. Such cross-border spill-overs can be both positive and negative. Innovation created in one country as a result of innovation policy tends, for instance, to diffuse internationally. This boosts foreign productivity and facilitates follow-up innovations abroad. However, innovation policy also improves the competitiveness of domestic producers. This lowers the intervening country's import demand in the targeted sector and increases global supply. As a result, the terms-of-trade of foreign competitors with a comparative advantage in this sector deteriorate.

The cross-border effects of innovation policy arise through a variety of channels from knowledge spill-overs, profit-shifting, supply-and-demand effects and competition for scarce resources. Many innovation policies benefit foreign countries, as they improve innovation, welfare and productivity not just at home but also abroad, for instance by enlarging the publicly accessible pool of knowledge or by boosting demand for foreign research. Assessments of the net effect of innovation policy are scarce, but experience suggests that policies are more beneficial if they are transparent and non-discriminatory. In the digital age, cross-border spill-overs are likely to intensify due to the knowledge intensity and network externalities associated with digital industries.

## D. International cooperation on innovation policy in the digital age

Innovation policies, like other components of government policies, serve domestic policy objectives. They can generate both positive and negative international spill-over effects. In both regional and multilateral fora, governments have negotiated disciplines which regulate the use of policy instruments with a view to maximizing these positive cross-border spill-overs and to limiting the negative ones, without impeding the pursuit of legitimate public policy objectives.

Multilateral and regional disciplines have contributed to shaping innovation policies for many years, with continued relevance in the digital age.

The WTO agreements reached a quarter of a century ago proved to be remarkably forward-looking in providing a framework that helped to foster the development of an ICT-enabled economy in countries across all levels of development, while preserving policy space for countries to pursue different models of digital development. Since its inception, the basic principles of the General Agreement on Tariffs and Trade (GATT) (and, today, those of 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 more sophisticated and detailed disciplines contained in the WTO agreements.

For example, the Information Technology Agreement (ITA) has applied a non-discriminatory, progressive elimination of tariffs on ICT goods, making essential technologies, tools and infrastructure equipment, notably internet infrastructures, more affordable.

The Technical Barriers to Trade (TBT) Agreement ensures that regulatory measures are transparent, non-discriminatory, and not unnecessarily trade-restrictive. It has contributed to the emergence of global, open source standards of digital technologies.

The Government Procurement Agreement (GPA) requires that domestic public procurement procedures be conducted based on principles of transparency, non-discrimination and procedural fairness, while allowing for innovation-based policies to operate under these principles.

The General Agreement on Trade in Services (GATS) has allowed WTO members to design and implement innovation policies, provided that they do so in a transparent and non-discriminatory manner, and within the confines of their specific commitments, stimulating the liberalization of telecommunications and internet-based services.

The Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS) requires a common minimum level of intellectual property protection and enforcement, flanked by non-discrimination provisions, transparency requirements and binding dispute settlement. It ensures that

incentives for innovation and the creation of intangible assets are comparable across WTO members' economies.

These WTO 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 have proved to be flexible enough to enable and promote innovation, while ensuring that all WTO members enjoy the benefits of free trade by providing certainty regarding trade rules.

Regional trade agreements (RTAs), too, address the new trade-related issues and challenges of innovation in the digital age. Although only a limited number of provisions in RTAs explicitly address industrial and innovation policy, these explicit provisions help to enhance the coordination of industrial and innovation policy, as well as scientific and technological cooperation. Many other provisions in RTAs can both constrain and support industrial and innovation policy in the digital age. While some of these provisions replicate or build on existing WTO agreements, other provisions establish new commitments. These new obligations cover various issues, including data protection and localization, competition and intellectual property in the digital era.

In addition, various international organizations play an important role in international cooperation on innovation by favouring harmonization and mutual recognition of standards and regulatory frameworks, addressing IP-related issues as well as tax and competition issues, tackling challenges in ICT infrastructure, and supporting digital inclusion and the participation of micro, small and medium-sized enterprises (MSMEs).

Digitalization and digital innovation policies are also creating new needs in the context of international cooperation. Just as it has fostered broadly open, predictable and competitive markets in the wider global economy, in the years ahead the WTO has an important role to play in reducing uncertainty in markets for digital goods and services. This will require new and updated international disciplines on innovation policy instruments.

For example, the increasing importance of data as an input in production and of the fluidity of data is leading to increasing demands for new international rules on data transfers, data localization and privacy. As digital equipment industries become pivotal by producing general-purpose technologies

and enabling downstream industries, international cooperation to encourage national governments to support innovation could bring benefits to the global economy. At the same time, the winner-takes-all characteristics of certain digital industries could lead to policy responses that raise tensions between countries and introduce unnecessarily high market barriers.

Building on this analysis and based on the limited evidence regarding cross-border spill-overs of innovation policies in the economic literature, this report examines more closely how international cooperation can address these challenges and maximize the positive spill-overs from governments' policies to promote innovation.

International cooperation in the WTO and RTAs can contribute to the promotion of digital innovation by helping governments 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 the latter an engine of development.

One question is whether, in the digital world, it makes sense to explore ways to expand the flexibility for governments to use R&D subsidies with important positive international spill-overs. International cooperation may help to design mechanisms to share the benefits arising from innovation policies between countries. In the absence of such mechanisms, national governments may not provide enough support for innovation, as they may fear that most of the benefits from the innovation they support will leak abroad.

International cooperation could help to promote innovation in the digital world by encouraging and facilitating investment in broadband infrastructure or digital industry. FDI promotes innovation in host countries through direct investments to develop R&D and backward 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 WTO's 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, too, can help governments to adopt more open trade and investment policies in the information and communications technology sector which, if supported by an adequate regulatory

framework, could help to attract FDI, develop 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, RTAs or other international agreements could also help to open markets further to the supply of R&D services and other skilled professional services by suppliers from other WTO members, per mode 4 of the GATS (i.e. the presence of natural persons).

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 countries to share the benefits arising from international flows of data. Limitations on 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 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 in order 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 purposes 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 particular, RTAs and organizations such as the International Competition Network (ICN), the United Nations Conference on Trade and Development (UNCTAD) and the Organisation for Economic Co-operation and Development (OECD).

Finally, the report discusses the economic arguments both in favour of 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. Although, as already mentioned, there is little empirical evidence on the extent of the spill-over effects of innovation policies and thus of the consequences of granting developing countries more policy space to conduct innovation policies, it can be observed that some developing countries have displayed spectacular growth, suggesting that the cross-border spill-overs of their national policies may have similarly expanded.