Industrial Digital Transformation and A Proposal to Rebuild Digital Trade Agenda

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With the Fourth Industrial Revolution, a digitally connected global era has begun. Leading global companies are harnessing innovative technologies such as internet of things, big data, artificial intelligence, robotics and digital twin to revolutionize manufacturing process. This transformation is resulting in the creation of new business models and value-added products. It is time to shift the paradigm of trade by reforming the old mindset dominated by tangible goods. While current trade agreements contain some rules on digital trade, the scope of discussions lag behind the business reality of industrial digital transformation. This article purports to rebuild the objectives and priorities of global digital trade negotiations, by reflecting recent hyper-connectivity and hyper-intelligence. It proposes eight items for digital trade negotiations: digital transformation (DX) in trade, digital manufacturing services, internet access and traffic cost sharing, data trust for interoperability, artificial intelligence (AI) governance, cybersecurity and trade, big-tech platform regulations, and digital business taxation.

Keywords: digital transformation, digital trade, digital service, data flow, artificial intelligence, cyber security, big-tech platform

1 INTRODUCTION

While the globalization of traditional trade which characterized the late twentieth century have lost momentum; the new era of 'digital globalization' is coming by the fourth industrial revolution (4IR) and digital transformation (DX). As the world is more interconnected than ever, the usage of cross-border bandwidth and data flows have grown rapidly. Industries change the way of doing business across borders, bring down the cost of communication connecting supply chain and creating new markets using digital technologies. Individuals are participating in globalization directly through digital platforms to learn, find, work and showcase their talent as well as build personal networks.[1]

Such technology development affects the landscape of global trade. First, digitalization is changing how we trade. New technologies are leading to a rising

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1 *Digital Globalization: The New Era of Global Flow*, McKinsey Global Institute (2016).

Kim, Ho-cheol. 'Industrial Digital Transformation and A Proposal to Rebuild Digital Trade Agenda'. *Journal of World Trade* 58, no. 1 (2024): 87–114.

number of digitally ordered small packages crossing borders, changing how services are produced and delivered, and posing various regulatory challenges. Emerging technologies, such as artificial intelligence (AI), distributed ledgers or additive manufacturing have the potential to make further changes. Second, digitalization is changing what we trade. It is enabling new digital services in manufacturing, supplying for example, smart factory control system, big data analytics, remote predictive maintenance, fleet management, and cyber-security solutions. Also, it changes the tradability of already existing services and enabling a greater bundling of goods and services. Third, data flow across borders is at the core of new and rapidly growing digital business models. Data help organize flows of goods and services, make electronic payments feasible, and enable human-robot interaction.[2]

But unfortunately, the international trade regime of World Trade Organization (WTO) has been unchanged since its inception. It failed to update its rules as well as make outcome in the following negotiations, which leaves the WTO to be far lagged behind the industry trends of DX. While governments and trade negotiators are making their efforts to draw up new rules for the digital era through plurilateral works, the discussions have been limited to data transfer and online platform liability issues, leaving the recent industrial digital transformation (iDX) largely under-reflected in the negotiations. It is right time to take a step back and assess what we have done so far, which policy challenges we are facing, and how we can make a way forward. In this context, this article deals with trade policy issues related to industrial digital globalization, focusing on the 4IR technologies and newly emerged digital services in manufacturing sectors, with a view to proposing key agenda set for any form of future digital trade negotiations.

2 INDUSTRIAL DIGITAL TRANSFORMATION

2.1 Basic concept

The 4IR, put forward by Klaus Schwab in his article of 2016, is representing the current trends of technology-induced innovation. Schwab explained the concept of 4IR as follows[3]:

> The First Industrial Revolution used water and steam power to mechanize production. The Second used electric power to create mass production. The Third used electronics and information technology to automate production. Now a Fourth Industrial Revolution is building on the Third, the digital revolution that has been occurring since the middle of

[2] L. Gonzalez & M. Jouanjean, *Digital Trade: Developing a Framework for Analysis*, OECD Trade Policy Papers No.205 (2017).

[3] Klaus Schwab, *The Fourth Industrial Revolution: What It Means, How to Respond*' (World Economic Forum 14 Jan. 2016).

> last century. It is characterized by a fusion of technologies that is blurring the lines between the physical, digital, and biological spheres.

The 4IR is the digital revolution that has the potential to raise global income and improve the quality of life around the world, with major impacts on business, governments and people. On business, the introduction of new technologies create entirely new ways of serving consumer needs and significantly disrupt existing industry value chains. A key trend is the development of technology-enabled platforms that combine both demand and supply to multiply into many new services. On governments, new technologies are increasingly pressing to change their current approach to public engagement and policymaking, by embracing agile governance. It will also profoundly impact the nature of national security, blurring the distinction between war and peace, combatant and noncombatant, and violence and nonviolence. On people, it affects our sense of privacy, our notions of ownership, our consumption pattern, how we spend time, and how we develop relationships. The tracking and sharing of information about us is a crucial part of the new connectivity, which intensifies debates about fundamental issues relating to the control over data.[4]

'DX' or 'iDX' is another expression of the 4IR. According to Industrial Internet Consortium (IIC), DX leverages connected things to transform process and operations to produce better outcomes. It is a business objective, which means the innovative and principled application of digital technologies, and the strategic realignment of the organization towards the improvement of business models, industrial models, and processes and ultimately the creation of entirely new ones. A distinguishing aspect of iDX is the convergence of information technology (IT) and operation technology (OT) in the factory. The innovative use of sensor-driven data and data-driven actuators empower the creation of better business outcomes. The availability of new technologies induces enterprises to consider transforming their businesses in ways that have not been possible.[5]

Digital revolution is driven by new emerging digital technologies. There are many useful analysis on key drivers enabling DX. An WEF research has identified seven technologies: AI, autonomous vehicles, big data analytics & cloud, custom manufacturing & 3D printing, internet of things & connected devices, robots & drones, and social media & platforms.[6] A SAP report viewed that industry 4.0 is powered by the industrial internet of things and cyber-physical systems, built on nine technology pillars: big data & AI analytics, horizontal & vertical integration, cloud computing, augmented reality, industrial internet of things, additive

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4 *Ibid*.
5 *Digital Transformation in Industry White Paper*, Industrial Internet Consortium (2020).
6 *Digital Transformation Initiative, In Collaboration With Accenture*, World Economic Forum (2017).

manufacturing, autonomous robots, digital twins and cybersecurity.[7] For the set of technologies that enable global trade to be more efficient, WEF considers two layers: a first level of transforming systems from analogue to digital and a second level in which trade process optimization occurs. Emerging 4IR technologies enable this second layer.[8] The World Trade Report showed particular interests in IoT, AI, 3D printing and Blockchain.[9] In the context of manufacturing, IioT, AI and digital twin technologies play key roles.

2.2 Global leading trends in industries

The WEF showcases many innovative companies through global lighthouse network. A white paper looking at common thread among those leading manufacturers suggested three ways of driving value: customers-centricity, seamless connectivity across functions, and continuous connectivity across organizations. First, the companies are transforming their interaction with customers. By placing the customer at the centre of process design and operations, they improve both the initial purchase experience and use of the product over its lifetime. Second, seamless data exchange and transparency across functions reduces friction, allowing for more efficient decisions and communications. Third, the technologies enable unprecedented data collection, exchange and processing, which allows companies to create new systems in the manufacturing space.[10]

As such, the factories are getting hyper-connected and hyper-intelligent through digital technologies, and it can be described as 'intelligent manufacturing' or 'autonomous manufacturing'. IIoT brings together data from various sensors embedded in machineries and production systems like Programmable Logic Controller (PLC), and integrates into a centralized hub, which provides real-time visibility and operating conditions. Together with AI applications, it enables the full automation of operation to optimize its efficiency, the enhanced quality control by detecting defects on time, and the prevention of asset failure by predictive maintenance. Also, as consumers expect more personalized offering accommodating their individual needs and specific requirements, companies are struggling to capture this value by transforming manufacturing with advanced technology and digitalization. This vision of autonomous manufacturing can be

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7 'What is industry 4.0?', SAP, available at sap.com.

8 *Mapping TradeTech: Trade in the Fourth Industrial Revolution*, Insight report, World Economic Forum (Dec 2020).

9 *World Trade Report 2018, The Future of World Trade: How Digital Technologies are Transforming Global Commerce*, World Trade Organization (2018).

10 *Global Lighthouse Network: Insights from the Forefront of the Fourth Industrial Revolution*', In collaboration with McKinsey & Company, World Economic Forum 19 (Dec. 2019).

realized by autonomous mobile robots (AMR) moving materials, flexible modular production system, virtual simulating optimal production path, and changing over production overnight.[11]

Supply chain management is being transformed from a linear model in which instructions flow from supplier to producer to distributor to consumer and back, into an integrated model in which all participants are connected and data flows in multiple directions through digital platform, which is termed as 'supply chain 4.0'. It enables the production process more responsive to consumer demand. In this new supply chain, the internet provides the virtual warehouse to customers and IoT applications are used to facilitate customers-managed inventory or vendor-managed inventory. Digital tags transfer information to the distribution centre; then, if customers make an order electronically though a company's online website, the system instantly duplicates it in the vender's system. An overarching software solution within the supply chain control centre, conceived as 'digital platform', collect data gathered in the whole system and run analytics using big data techniques. Distributed ledger technology allows multiple players to maintain copies of the same information in various locations.[12]

Manufacturers are becoming service solution providers using digital technologies. The term 'servitization' has been introduced to conceptualize the phenomenon that manufacturers are increasingly adding services components to tangible products or bundling services with the goods they sell. An often-cited example of traditional servitization is Xerox, which successfully reformed its business model by bundling equipment with various services to differentiate their products from competitors. With digital revolution of 4IR, this concept has been further evolved, where digital technologies enable new innovative production processes and digital services. One example is 'Nike+' which introduced running shoes with customized data services, allowing customers to design and personalize their own shoes. By integrating methods of data collection and analysis, manufactures can refine goods and offer a complete package to meet individual needs.[13]

In automotive sector, traditional value chain of original equipment manufacturers (OEMs), suppliers, retailers and the aftermarket is being disrupted by newly emerging digital mobility solution providers. Tesla, an electronic car manufacturer, gathers data from their car's sensors and cameras; then it uses to refine their self-driving assist system through over-the-air (OTA) updates, which Tesla sells to its customers as value-added services. Apple, through OEM partnerships, gives drivers

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[11] F. Betti, *Davos 2023: 4 Ways Artificial Intelligence Could Transform Manufacturing*, World Economic Forum (9 Jan. 2023).

[12] M. Ferrantino & E. Koten, *Understanding Supply Chain 4.0 and Its Potential Impact on Global Value Chains*', in *Technological Innovation, Supply Chain Trade, and Workers in a Globalized World*, WTO global value chain development report 2019 (World Trade Organization 2019).

[13] Shin-yi Peng, *A New Trade Regime for the Servitization of Manufacturing: Rethinking the Goods-Services Dichotomy*, 54(5) J. World Trade 699–726 (2020), doi: 10.54648/TRAD2020030.

wireless access to certain iOS features directly from the vehicle's built-in infotainment system. Michelin leases tires combining tire monitoring service using telematics and predictive analysis.[14] Hyundai motor, a Korean OEM company, has announced a new roadmap named 'Strategy 2025', in which transforming into smart mobility service provider is declared as a new key strategic area that will be fostered for its future businesses. Digital services and contents will be more personalized and offered through an integrated platform.[15]

In machinery sector, against the backdrop of rising global competition, commoditization and price pressure, leading companies are looking for digital-based business models, shifting from 'hardware only' to 'hardware, software and services package'. For example, Siemens, an industrial manufacturing company, is extending its portfolio to software and services for mechanical design, system simulation, process operation and lifecycle analytics, including an equipment-as-a-service model with the suite of software and hardware, renting the sensors and controllers needed to connect machine to the edge using digital technologies. DMG Mori, a global machine tools company, offers one-stop service with turnkey solutions for manufacturing automation that optimizes customers' productivity.

In healthcare industry, digital technologies can support remote care and reduce friction costs between stakeholders via online services, including digital bill, medical assistance, online teleconsultations, and online medications. Covid-19 has made it more pressing than ever to integrate online and offline offerings and to establish integrated health ecosystems. The digital healthcare ecosystems of the future are expected to deliver a personalized and integrated experience to patients using big data and advanced analytics, including self and virtual care, remote monitoring, social networks, daily life activities, financing support and others. The focus of healthcare is being shifted from providing medical treatments and pharmaceuticals to preventing diseases and effectively managing chronic conditions.[16]

2.3 Implications on international trade

Technological change has constantly played a key role in shaping the landscape of global economy and international trade. As OECD explains, it is fair to say that international trade has gone through three stages. The first is 'traditional trade' that was spurred by falling transport costs which enabled the separation of production and consumption across borders. The second is 'GVC trade', which has arisen from

[14] *Digital Transformation of Industries: Automotive Industry*, World Economic Forum (Jan. 2016).
[15] *Hyundai Motor Unveils 'Strategy 2025' Roadmap to Transition into 'Smart Mobility Solution Provider'*, Hyundai Motor Group press release (4 Dec. 2019).
[16] S. Singhal, B. Kayyali, R. Levin & Z. Greenberg, *The Next Wave of Healthcare Innovation: The Evolution of Ecosystems* (McKinsey & Company 2020).

further reductions in transport and coordination costs enabling businesses to unpack its production process across borders and exploit locational advantages. The third is the age of 'digitally enabled trade', driven by growing digital connectivity and intelligence, which are not only increasing access to foreign markets through the transfer of data or information, but also changing tradable nature of services in a way that has not been imagined. The global economy is now in the new era of digitally enabled trade.[17]

The hyper-connectivity and hyper-intelligence which are driving the IDX are also accelerating the pace of digitalization in trade. Regarding 'how we trade', e-commerce and online marketplaces have become important channels for businesses and trade agreements are struggling to accommodate these new digital realities. Electronic transaction, digital communication with customer and supply chain management are requiring a well-founded legal framework and internet access for business activities via electronic means. Governments make efforts to provide the interoperable system for electronic signature, contracts, and payment that have the same legal effect as their paper-based counterparts; and to maintain the open access and use of internet network with reasonable costs. The new ways of business, such as real-time data collection and AI analysis, remote monitoring and control, and seamless customer communication, require the increased interconnectedness of people, devices and system through digital networks, which be affected by network congestion and significant costs.

As to 'what we trade', the digital revolution is leading to a significant increase in the trade of digital products and services, such as software, smart factory tools, and cloud-based services, through changing the tradability of existing services as well as creating new types of digitally enabled business models, which has led to a shift towards service-oriented trade in manufacturing sector. The goods-services dichotomy in the international trade law, which set out different commitments and regulatory frameworks to the trade of tangible and intangible products, is now facing a serious challenge. Also, the increased use of autonomous driving and AI technologies is raising the issues of AI governance in global trade, to ensure that the decision-making processes and algorithms used by these technologies are explainable and accountable, and that the development of AI systems are aligned with ethical principles.

The iDX makes 'data' a key asset in cross-border trade. With the rise of digital services in manufacturing, data is becoming an essential part of business operations. There are commercial benefits to the collection and analysis of customer data. AI analytics tools can be further refined using manufacturing data generated from different industries. Also, in order to facilitate digital trade, it is important to ensure

[17] Gonzalez & Jouanjean, *supra* n. 2, OECD publishing .

cross-border flow of data. But at the same time, advanced technologies raise various legitimate policy concerns, including sensitive data protection, cyber security, big-tech dominance and digital taxation. There are growing mistrust that companies are not taking sufficient attention to the sensitivity of data. In the lack of multilaterally agreed norms, nations are developing different policy stances and domestic regulations, leading to the prevalence of protective measures which impede free flow of data.

3 DIGITAL TRADE AND INTERNATIONAL RULES

3.1 Digital trade

Theoretically, trade is considered to be digital if some transaction is conducted through electronic means. Goods and services can be ordered online over the internet, paid for via digital means, and in some case, can be delivered digitally. In dictionary, 'digital' means 'using or relating to digital signals and computer technology' and 'trade' means 'the activity of buying and selling, or exchanging, goods and/or services between people or countries'. A joint report by OECD, WTO and IMF defined digital trade broadly as 'all trade that is digitally ordered and/or digitally delivered',[18] and USITC defined as 'the delivery of products and services over the internet by firms in any industry sector, and of associated products such as smartphones and internet-connected sensors'.[19] While there is no consensus even in the literature, we may define 'digital trade' as 'all activities of commerce crossing the borders using the internet and digital technologies'.

Digital trade encompasses both digitally ordered trade and digitally delivered trade. OECD defined 'digitally ordered trade' as 'the international sale or purchase of a good or service, conducted over computer networks by methods specifically designed for the purpose of receiving or placing order', often referred as 'e-commerce', and 'digitally delivered trade' as 'international transactions that are delivered remotely in an electronic format, using computer networks specifically designed for the purpose'.[20] For the purpose of analysis in this report, the digitally delivered trade can be further divided into three categories by combining a product dimension: digital delivery of existing services, digitalizing existing services and newly digitally enabled services. Thus, we may say that there are four types of digital trade: the first is to order by electronic means and deliver physical goods or services cross the borders (e.g., online purchase); the second is to deliver existing services

[18] *Handbook on Measuring Digital Trade*, OECD, WTO & IMF (2020).
[19] *Global Digital Trade 1: Market Opportunities and Key Foreign Trade Restrictions*, US International Trade Commission 33 (Aug. 2017).
[20] OECD, WTO & IMF, *supra* n. 18.

by electronic means cross the borders (e.g., online banking); the third is to transmit digitally encoded products cross the borders (e.g., e-book); the fourth is to export new digital solutions over the internet (e.g., OTA).

3.2 International rules

The rules of the WTO are technology-neutral as to the medium through which trade is conducted. The disciplines contained in the General Agreement on Tariffs and Trade (GATT) and the General Agreement on Trade in Services (GATS) do not distinguish between different technological means through which goods or services are delivered. The Agreement on Trade Related Intellectual Property Rights (TRIPS) is also extending its protections to online digital content. The technology-neutrality principle is a convenient way to keep old law relevant to newly emerging trade. However, with the prevalence of iDX, we are observing such temporary gap-filling approach is at a breaking point, as illustrated below.

As to the Annex 1A agreements on trade in goods including GATT, Customs Valuation Agreement (CVA) and Technical Barriers to Trade Agreement (TBT), existing rules apply to trade in all goods, without distinguishing whether they are transacted electronically or whether they include embedded services. The WTO rules provide a well-established set of disciplines to electronically ordered goods, and governments utilize the *de minimis* threshold for duty-free treatment. Nonetheless, it is questionable whether non-service digital products be of importance in the market and whether the current rules are applicable to new servitized digital businesses. In this light, there are arguments that the goods or services dichotomy in the WTO system is not effective to new digital business models combining manufacturing and services. For example, when an exporting company sells machinery equipment with embedded software and allows the importing company in another country to choose relevant service subscriptions after taking possession of the goods, it becomes unclear whether it be treated as a part of goods or a separate service.[21]

With respect to the Annex 1B agreement on trade in services, the GATS applies to all measures affecting trade in services. However, it should be noted that the scope of GATS obligations is different with the GATT. The market access and national treatments are applicable only for the service sectors and modes of supply where the member has made commitments in its national schedule of concession attached to the GATT. When applying GATS commitments to newly emerged digital services, member countries are tend to interpret and categorize differently according to their preferences, which creates legal uncertainty about digital trade. There can be no objection to extend the application of existing commitment to the existing services

[21] WTO, *supra* n. 9, at 156–161.

with different ways of transactions in accordance with the principle of technological neutrality; however, newly enabled types of digital trade have not existed when the WTO was launched. Controversy is possible over whether it is appropriate to impose extended obligations for digital products that did not exist at the time of market-opening negotiations. Especially, the GATS has the positive approach that only imposes obligations on service sectors promised to be open, and it is a very complex issue of how to classify new digital services into the decades-old list of service sectors. In addition, governments have enacted a number of domestic measures to regulate how companies handle data from its citizens, protect consumers' privacy on the internet, address national security concerns and enhance domestic law enforcement. Unfortunately, the current rules fail to serve a possible mean to clarify the boundaries of what is permissible under the principles of the WTO system.[22]

The Annex 1C agreement on trade-related intellectual properties, the TRIPS sets comprehensive disciplines for the protection of intellectual property rights (IPR) by incorporating pre-existing World Intellectual Property Organization (WIPO) conventions. In the case of digital downloads purchased by consumers, the Intellectual Property (IP) system plays a critical role to enable commercial transaction. While the agreement does not address e-commerce or digital trade, it is interpreted as a legal baseline to be applicable. New developments in the WIPO can be taken into account in order to avoid conflicts within the overall IP system, as explained in *United States – Section 110(5) of the Copyright Act*, Nevertheless, new online business models such as search engines, news aggregator or social media platforms are in the legal uncertainty and heavily rely on limitation and exception clause.

There has been continued efforts about e-commerce at the WTO. The 1998 Ministerial Declaration on e-commerce put in place a moratorium on customs duties to electronic transmissions, by stating that members would 'continue their current practice of not imposing customs duties on electronic transmissions',[23] and it has been renewed roughly every two years at the WTO Ministerial Conference. It also launched the Work Program on Electronic Commerce (WPEC), mainly designed to build understanding around the trade-related aspects of e-commerce and examine the relation between e-commerce and WTO agreements.[24] While the discussions are ongoing, the work programme has not meant to provide new and improved disciplines to digital trade.

Amid no progress in the multilateral negotiations, countries have used the venue of preferential trade agreements (PTAs) to shape the regulatory environment and address new trade barriers related to digital trade. Since the first inclusion of e-commerce

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22 *Ibid.*, at 151–155.
23 WT/MIN(98)/DEC/2.
24 WT/L/274.

clauses at the Free Trade Agreement (FTA) in 2001, e-commerce or digital trade provisions have gradually spread over the PTAs, and recently, e-commerce or digital trade are regarded as an important element in FTA negotiations.[25] The main elements of e-commerce or digital trade in these FTAs can be summarized as follow: the first category is the legal framework for e-commerce (e.g., electronic signatures, electronic waybills, and electronic payments), the second category is the physical infrastructure (e.g., network access) and information technology services (e.g., ISPs), the third category is the movement of goods across borders (e.g., customs duties, clearance procedures) and the transfer of data (e.g., free flow of data, prohibition of local content requirements), and the fourth category is domestic regulatory systems (e.g., electronic authentication, consumer protection, personal information).[26]

In particular, the US has forcefully pushed its digital agenda through the PTA channel. The agreements reached since 2002, including Korea – US FTA, contain critical WTO-plus provisions in the field of digital trade. Also, the diffusion of this US template affect other PTAs as well, such as Singapore – Australia FTA. The Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP), despite the US having dropped out of the agreement, reflects their efforts to secure advanced obligations on e-commerce in the chapter 14 of the agreement. While the attention is focused on data flow and weaken protection, the agreement also introduced several new provisions on consumer protection, spam control, cybersecurity and net-neutrality. After the withdrawal from the Trans-Pacific Partnership, the Trump administration moved its attention to the renegotiation of North American Free Trade Agreement (NAFTA), now referred to as the US – Mexico – Canada Agreement (USMCA). The USMCA has a comprehensive chapter titled with 'digital trade', which follows all critical lines of the CPTPP and creates an even more ambitious template, such as the inclusion of algorithms, the recognition of interactive computer services and open government data. The US approach towards digital trade issues has been confirmed subsequently by the US – Japan Digital Trade Agreement (DTA).[27]

3.3 Geopolitical aspects

The liberal internationalism that led free trade and globalization is in decline, and global economy is in the midst of a transformative period marked by a rise in nationalistic policies and intensified technological competition. Trade negotiators

[25] J. Monteiro & R. The, *Provisions on Electronic Commerce in Regional Trade Agreements*, WTO Working Paper ERSD-2017-11 (2017).

[26] R. Santana, *'E-Commerce: Mapping the Issues', Presentation Made During the Regional Workshop on E-Commerce and WTO Rules* (Singapore May 2017); M. Wu, *Digital Trade-Related Provisions in Regional Trade Agreements: Existing Models and Lessons for the Multilateral Trade System* (ICTSD 2017).

[27] M. Burri, *Towards a New Treaty on Digital Trade*, 55(1) J. World Trade 77–100 (2021).

tend to advance domestic interests while opening foreign markets through the reciprocity. In the new era of global tech rivalry, domestic interests in digital trade policies go beyond economic benefits and the dynamic of global geopolitics plays a crucial role. First, global powers are playing a zero-sum game. When the US was a stable power, it led free trade and a universal order. However, with the emergence of strategic competitor narrowing the gap, the US is focusing on the change of relative economic power under a zero-sum game rather than mutual benefits. Secondly, the perspective on interdependence resulting from global trade has also changed. During peacetime, interdependence promotes economic efficiency and mutual prosperity. However, in the period of strategic competition, dependence on foreign technologies means vulnerability. Countries are adopting strategies to mitigate their vulnerability by securing self-reliance and resilience through alliances with like-minded countries. Thirdly, the relationship between economy and security has been redefined. Power countries use economic tools as a means to further their security objectives. While the WTO regime puts emphasis on liberalization and limits security exceptions, the increasing demand for self-judgment in assessing the legality of security measures drives a separation of security from trade domain.[28]

Against this backdrop, three levels of strategic competition are unfolded. The first is technology competition. The key components of digital technology are first, computing hardware such as semiconductors; second, next-generation communications such as 5G/6G; and third, software skill such as AI algorithms that analyze data to create values. In case of computing hardware, while the US technology, Korea's memory chips, and Taiwan's foundry companies form a solid supply chain, China has risen to the top of 5G equipment providers with state-led nurturing under Made in China 2025 plan, and also shows rapid growth in the semiconductor industry. As the US is strengthening sanctions against China in advanced technology, geopolitical confrontation is leading to the encirclement of China's semiconductor supply chain. Regarding AI, China's AI technology has surpassed the EU and is catching up with the US With strong government support and the emergence of tech companies, China has leaped to become the top country in AI patents and is expanding its own technological standards in conjunction with the Digital Silk Road. The US government is also strengthening sanctions against China in the AI field, but China's technological competitiveness and its own ecosystem have already been established and are expanding overseas, leading to competitive fragmentation with the US.[29]

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[28] D. Drezner et al., *The Uses and Abuses of Weaponized Interdependence*, Brookings Institution Press (2021).

[29] G. Allison et al., *The Great Tech Rivalry: China v. the U.S.*, Avoiding Great Power War Project, Harvard Kennedy School (2021); S. Segal, *Degrees of Separation: A Targeted Approach to U.S.-China Decoupling – Final Report*, A Report of the CSIS Economics Program (Oct. 2021).

The second is the platform competition. The US-China competition in digital platforms began in the 2000s with operating systems (OS), moved to internet search in the 2010s, and has since spread to platform businesses in all aspects of online services such as e-commerce, fin-tech, social network, and over-the-top in the 2020s. In the early days, the OS competition was between the WinTel camp, represented by US companies Microsoft and Intel, and the Apple Macintosh camp, with the WinTel camp dominating the market. At that time, China attempted to establish its own standard by supporting the establishment of Hongqi Linux, but failed to achieve results as MS opened the source code and lowered product prices, penetrating the Chinese market. In the mobile OS market, Google's Android and Apple's iOS dominate 99% of the global market, firmly establishing their respective ecosystems. In response to Trump's trade sanctions, Huawei released its own mobile OS called Hongmeng 2.0, but it has yet to have a sufficient app store. In the internet search market, Google is the world's No.1, but is struggling in China. After Google withdrew from the Chinese market, Baidu took over the domestic market, accumulating data to combine with AI to launch various services. In e-commerce, Amazon is the global market leader, but failed to enter China, where domestic companies such as Alibaba and Jingdong.com hold most of the market share and expand their businesses into AI, fin-tech, cloud, healthcare, and more. Facebook is competing with Chinese Tencent's WeChat, while YouTube is competing with China's ByteDance TikTok in the market. Such digital platform competition is fundamentally taking place between US and Chinese companies, but is also a competition between governments that actively intervene through policy tools.[30]

The third is the Internet fragmentation. Google CEO Eric Schmidt predicted that the internet will be divided into an open internet led by the US big tech companies (Google, Microsoft, Apple, Facebook) and a controlled internet led by China (Tencent, Alibaba, Baidu, Xiaomi). The New York Times predicted that due to the divergent approaches to privacy protection between the US and the EU, the network will be split into three branches, including the addition of EU networks.[31] Even authoritarian countries that control the internet do not want to completely block the flow of data, so it is unlikely that it will result in a complete global network disconnect. However, it is clear that geography determines the destination and scope of data flows. The internet was designed to be borderless and

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[30] S. Mori, *US Technological Competition with China: The Military, Industrial and Digital Network Dimensions*, 26(1) Asia-Pac. Rev. (2019), doi: 10.1080/13439006.2019.1622871; OECD, *An Introduction to Online Platforms and Their Role in the Digital Transformation*' (OECD Publishing 2019).

[31] CNBC, *Former Google CEO Predicts the Internet Will Split in Two and One Part Will Be Led by China* (20 Sep. 2018); New York Times, *There May Soon Be Three Internets: America's Won't Necessarily Be the Best* (15 Oct. 2018).

allow data to flow freely. However, governments around the world are gradually introducing regulations on digital information providers, limiting the scope and destination of data transfer, and the use of technical control measures is also increasing. China installs the 'Great Firewall' to monitor its citizens' internet usage, block access to illegal information, and force the use of messaging apps made in China. Russia is also collaborating with China to pursue the 'RuNet' plan to build an independent internet network. Iran is known to slow down the data connection speed in the event of anti-government protests by allowing the telecommunications regulatory authorities to remotely access the network of service providers, thereby hindering social media activities and tracking the movements of protest leaders to obtain information. China and Russia have also sought to expand their national sovereignty over internet governance by rallying non-Western countries at the UN and promoting a cybercrime treaty that broadly defines cybercrime.[32]

The digital trade negotiations that the United States has led so far have focused on promoting internet openness and free flow of data, as well as establishing clear principles for government actions in cyberspace. However, in the current situation where global geopolitics is intensifying technological competition, platform competition, and internet fragmentation, the change of digital trade strategy seems inevitable. Further, the economy and security are interconnected in both directions through the securitization of economic policies and the economization of strategic competition. The reorganization of digital industry supply chains is becoming national security and strategic competition issue, as it is seen as a means to secure future technology dominance and competitive edge. In that sense, Council on Foreign Relations (CFR) argues that the US should change its previous route of universalizing internet openness to building a digital trade block and maintaining an open internet that connects the digital economies of democratic countries, in order to counter the trend of internet control, particularly from China.[33]

3.4 Towards new trade codes

There are constant efforts for developing digital trade rules by open plurilateral negotiations. A group of WTO members launched the Joint Statement Initiative

[32] Sangbae Kim, *Emerging Powers and a Middle Power: U.S.-China Competition and South Korea in Cyberspace*, SSK Middle Power Project, Seoul National University (2018).

[33] R. Knake, *Weaponizing Digital Trade: Creating a Digital Trade Zone to Promote Online Freedom and Cybersecurity*, Council on Foreign Relations, Council Special Report No.88 (Sep. 2020); H. Farrell & A. Newman, *Weaponized Interdependence: How Global Economic Networks Shape State Coercion*, 44(1) Int'l Sec. (2019), doi: 10.1162/isec_a_00351; D. Runde et al., *Digital Governance: It Is Time for the United States to Lead Again*', CSIS (2 Aug. 2021).

(JSI) on E-commerce on the occasion of the eleventh WTO Ministerial Conference in 2017, aiming to produce a binding agreement among its members. It encompasses both traditional trade topics (e.g., paperless trading) and newly emerged digital policy issues, such as cross-border data flows and localization, online consumer protection, privacy and cyber security. The themes advanced in members' proposals have been aggregated in five sections in the JSI negotiation document: (1). enabling electronic commerce, (2). openness and e-commerce, (3). trust and e-commerce, (4). cross-cutting issues, and (5). telecommunications. The first consolidated text was published in December 2020, the second in September 2021 and the third in December 2022.[34] While the participating members are doubling efforts to achieve substantial outcome by the end of this year, some countries criticize that the JSI goes against consensus-based decision-making and weaken multilateralism at the WTO, questioning the legality of JSI outcome.[35]

Digital trade rule-makings are also conducted in other forums. Firstly, the Digital Economy Partnership Agreement (DEPA), an independent agreement dedicated to digital trade, was signed by Singapore, New Zealand, and Chile in 2020. DEPA is similar to CPTPP in terms of obligation levels such as data liberalization, but it also covers new issues such as AI, trustworthiness, and digital inclusion. Its goal is to increase the number of member countries and contribute to the conclusion of multilateral agreements such as WTO. Secondly, as a regional initiative, the Indo-Pacific Economic Framework (IPEF) led by the US put an emphasis on digital trade in Module 1. The Ministerial Statement highlights the importance of digital trade and digitalization in the region. It recognizes the need to strengthen digital connectivity and infrastructure, support digital innovation and entrepreneurship, and enhance digital skills and education. The statement also notes the importance of cross-border data flows and the protection of personal data, as well as the need for a predictable, transparent, and non-discriminatory regulatory environment for digital trade. The ministers also called for greater collaboration on issues such as cybersecurity, digital standards, and e-commerce. The US intends to conclude the agreement by the end of this year.[36] In spite of all these efforts, at the moment, the rules are largely insufficient, and new negotiations focus on incorporating existing provisions in advanced PTAs so that overall structure falls short of providing fundamental change or complete regulatory guidance in the field of iDX.

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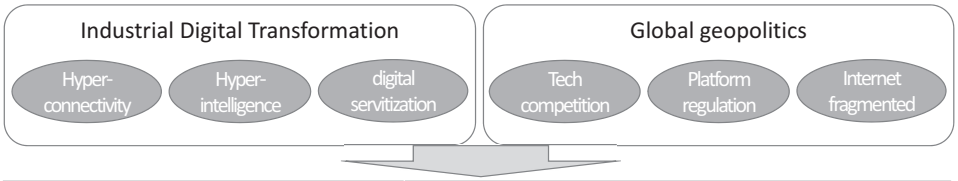
[34] INF/ECOM/62.rev1; INF/ECOM/62.rev2.
[35] WT/GC/W/819.
[36] US White House, *Statement on Indo-Pacific Economic Framework for Prosperity* (23 May 2022); USTR, *United States and Indo-Pacific Economic Framework Partners Announce Negotiation Objectives* (9 Sep. 2022).

Countries around the world are setting the promotion of their own advanced industries and the acquisition of technological superiority as their top national priorities, which they are reflecting in their economic and trade policies as well as their diplomatic and security strategies. This is expressed in various ways, such as 'economic nationalism' and 'technological nationalism'. Digital trade is at the centre of this global geopolitical shift. The global competition surrounding digital trade is leading to the blockage of advanced technology supply chains (semiconductors, 5G/6G, AI), strengthened regulation of digital platforms, and the splitting of internet networks. In terms of foreign strategy, the US IPEF and the Chinese Digital Silk Road are in conflict, while the EU is pursuing data sovereignty and strategic autonomy by establishing a digital single market. To prevent this geopolitical confrontation from becoming a risk factor for digital trade, it is important to establish a platform for international 'cooperation' among like-minded countries. In discussing digital trade from this perspective, it is necessary to consider universal principles and realistic alternatives that embrace diverse values and promote common understanding.

4 A PROPOSAL FOR NEW TRADE AGENDA

Taking into account the iDX trends (hyper-connectivity, intelligence, and service-oriented manufacturing) and the geopolitical competition (technology rivalry, platform regulation, internet fragmentation), this article tries to identify key priority tasks for future trade negotiations, with a view to facilitating cross-border expansion of digital manufacturing. The starting point is the three elements of digital trade: how we trade, what we trade and infrastructure. Then, policy challenges which require normative improvement of the international regime can be deduced from the iDX trends, namely facilitating e-transaction (relating to how we trade), opening the market for digitally enabled manufacturing services and AI solutions (relating to what we trade), and developing international guidance for internet use and access, data flow and domestic regulations (relating to infrastructure). Then, based on the four core themes of digital trade deduced from the WTO JSI negotiations, such as enabling e-commerce, openness and market access, data trust and protection, and cooperation, and taking into account global geopolitical competition, we may further specify negotiating topics and give shape to agenda. In doing so, this article would like to propose a package of eight key agenda for future digital trade negotiations: digitalizing trade procedures (so called 'DX in trade'), digitally enabled manufacturing services, internet access and traffic cost sharing, data trust for interoperability, AI governance, cybersecurity and trade, big-tech platform regulation, and digital business taxations.

Figure 1 Proposed Trade Agenda for IDX



Section		Proposed trade agenda
How	Enabling e-commerce	1. Digitalizing trade procedures (DX in trade)
What	Openness and market access	2. Digitally enabled manufacturing services 3. Internet access and traffic cost sharing
Enablers	Trust and protections	4. Data trust for interoperability 5. AI governance
	Cooperation	5. Cybersecurity and trade 7. Big-tech platform regulation 8. Digital business taxations

4.1 Digitalizing trade procedures (DX in trade)

It is important to transform the analog system of trade procedures into a new digital one that fits the changing global commerce environment with a view to maximizing opportunities for economic growth. For this purpose, it would be worth to launch a new initiative called 'DX in trade' that drives the broad adoption of digital technologies in trade procedures.

A cross-border transaction requires the exchange of thirty-six documents and 240 copies on average, and the cost of handling it may be higher than the cost of moving the containers.[37] Substituting paper with digital means has benefits to reduces processing time and cost as well as enable companies to leverage data with AI analysis and optimize document processes. Further, in order to enable digitally delivered services, it is necessary to establish commonly recognized principles for e-transactions and incorporate them into domestic legal systems of each countries, covering electronic authentication, signatures, contracts, invoices, and payment. There are various instruments for the basis of the discussions. For example, the United Nations Commission on International Trade Law (UNCITRAL) has developed the 'Model Law on Electronic Commerce (MLEC, 1996)' and the 'Model Law on Electronic Signatures (MLES, 2001)', which are based on core principles of non-discrimination,

[37] L. Fletcher, *Forget the Paper Trail: Blockchain Set to Shake Up Trade Finance*, Financial Times (3 Dec. 2019).

technological neutrality, and functional equivalence, and the 'United Nations Convention on the Use of Electronic Communications in International Contracts (Electronic Communications Convention, 2005)' was built on pre-existing UNCITRAL texts to offer the first treaty that provide legal certainty for electronic expression of consent to be bound by international contracts.[38] Also, the United Nations Centre for Trade Facilitation and Electronic Business (UN/CEFACT) provides standards for electronic document exchange (Rec 25) and single window (Rec 33–36).[39] Asia-Pacific Economic Cooperation (APEC), World Customs Organization (WCO), and others continue to discuss the issue of interoperability of single window systems connecting each country's system, centred around UN/CEFACT Rec 36.[40]

Recently, the WEF and WTO published a joint report on the promise of 'TradeTech', which means the set of technologies that enables global trade to become more efficient, inclusive, and sustainable. Noting that there remains many unseized opportunities and unexplored policies, it suggested five building blocks (referred as the 5 Gs of TradeTech). Some of them are covered by PTAs, but there are many areas missing in the agreements, including electronic transferable records, automated contracts, digital tokens, interoperability of data models, and digital identity of legal and physical persons or goods.[41] There is a merit to launch a new global initiative that clearly sets the negotiation goal to DX of trade procedures (called 'DX in trade'), built upon the agenda package suggested by the WEF.

4.2 Digitally enabled manufacturing services

It is necessary to create an open environment for global trade in new digitally enabled services that combine digital technology with manufacturing. When applying existing GATS rules to new digital services, there have been disputes over determining service classifications and mode of supply, and arbitrary interpretation may obstruct the creation of new markets. It needs to be explored

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38 UNCITRAL has prepared a suite of legislative texts to enable and facilitate the use of electronic means to engage in commercial activities, which have been adopted in a broad range of states, available at the UNCITRAL website (uncitral.un.org).

39 Rec 25 Use of the UN Electronic Data Interchange for Administration, Commerce and Transport Standard (UN/EDIFACT), TRADE/WP.4/R.1079/Rev.1; Rec 33 Single Window Recommendation, ECE/TRADE/352/Rev.1; Rec 34 Data Simplification and Standardization for International Trade, ECE/TRADE/400; Rec 35 Establishing a legal framework for international trade Single Window, ECE/TRADE/401, Rec 36 Single Window Interoperability, ECE/TRADE/431, available at the UNECE website (unece.org).

40 *Study on Single Window Systems's International Interoperability: Key Issues for Its Implementation*, APEC (Aug. 2018).

41 WTO & WEF, *The Promise of TradeTech: Policy Approaches to Harness Trade Digitalization*, World Trade Organization (2022).

through the negotiations a new and creative approach to generate extended openness and market access for those digitally enabled manufacturing services.

One of unresolved issues in GATS application is to classify new digital services with the decades-old list of service sectors. There are no interpretive guidelines provided by the W/120 or the Secretariat regarding the methodology for classification. Although the provisional Central Product Classification includes explanations for each item, it does not provide criteria for judgment in cases where the situation is unclear.[42] Willemyns has analyzed three methodologies. The first is the functional approach, which classifies services based on the function they serve. Corresponding to the principle of technological neutrality, the focus is on the ultimate purpose rather than the means of providing the service. The second is the textual approach, which interprets the meaning of the language used in the service schedule according to its original meaning. Although this is consistent with Article 31 of the Vienna Convention on the Interpretation of Treaties, it often does not reflect the reality. The third is the component approach, which breaks down the various technical components of digital services and classifies them based on the most important components. But, it may be difficult to classify platform operators as advertising services just because they are the primary source of revenue. Keeping in mind that the functional approach will lead to more legal certainty and constructive liberalization of new digital services, members needs to develop a concrete methodology.[43]

On the other hand, newly emerging digital services may be restricted if the existing strict service regulations are applied. For example, in 2013, Uber attempted to enter the Korean market but failed due to violating current laws. Uber Black provided luxury limousine services with contracted limousine companies, but violated Article 34 of the Passenger Transport Service Act (prohibition of paid transportation, etc.). For new digital manufacturing services, other than applying existing GATS licenses and domestic regulations in accordance with the principle of technological neutrality, we may think about creating a new separate category with a view to expanding market access. There is a scholarly idea to establish a new service supply type (tentatively named 'Mode 5') accommodating new digital services. It is time to think out of the box and try to make a paradigm shift toward integrated approach going beyond the existing dichotomy of goods and services.[44]

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[42] WTO Council for Trade in Services, *Guidelines for the Scheduling of Specific Commitments under the General Agreement on Trade in Services (GATS)*, S/L/92 (28 Mar. 2001).

[43] I. Willemyns, *GATS Classification of Digital Services – Does the Cloud Have a Silver Lining?*, 53(1) J. World Trade 59–71 (2019), doi: 10.54648/TRAD2019003.

[44] L. Cernat & Z. Kutlina-Dimitrova, *'Thinking in a Box: A' Mode 5 'Approach to Services Trade'*, 48(1109) J. World Trade 48:1109 (2014), doi: 10.54648/TRAD2014039.

4.3 Internet access and traffic cost sharing

As digital trade provides services through the internet, it is important to have a stable network environment and guaranteed connectivity. Furthermore, digital manufacturing services of the 4IR involve real-time communication of high-quality videos, causing network traffic and additional expense burden. Such internet network access and traffic cost issues need to be examined carefully in the negotiations.

The cost distribution between network providers, Content Providers (CPs) and internet users may affect access to and use of the internet. There are two types of providers: Internet Service Providers (ISPs) that provide connections between users and CPs that provide content based on this network. The ISP's cost of accessing the network depends on how many connections the ISP supports. Korean ISPs incur relatively high costs connecting to large ISPs, while large US ISPs provide connections to domestic companies at lower costs. This is why the cost that CPs pay to ISPs for internet connections varies depending on the country's network situation. The cost-sharing of network expenses between ISPs and CPs is also a point of contention. While CPs pay for the cost of connecting to the ISP's network, they do not separately calculate the cost of content transmission after the connection is established. When a specific CP transmits and receives content excessively, it becomes a traffic issue that the network operator, the ISP, must take burden to manage. The point of conflict is that because traffic on networks will continue to grow at an exponential rate, ISPs and policymakers are set to press US-based streaming giants to help pay for costs associated with a surge in network traffic. Net neutrality advocates would oppose it, saying that keeping the internet wide open is vital for innovation. For instance, there is a legal dispute over the years between the US CP, Netflix, and the Korean ISP, SK Broadband.[45] It is necessary to develop a new comprehensive package that goes beyond the scope of existing trade agreements and covers various aspects of internet governance such as network access, cost sharing, and address resource management, in line with the changes in digital manufacturing innovation.

4.4 Data trust for interoperability

Digital trade inherently involves data collection, processing, and transmission, making the smooth movement of data essential. However, different countries'

[45] Y. Kim, *Internet Traffic Tax or Net Neutrality?*, The Korea Times 16 (Jan. 2023); S. Kim, *Netflix and SK Broadband Battle Over Who Pays in South Korea*, The Diplomat (6 Aug. 2021); I. Aquiar & J. Waldfogel, *Netflix: Global Hegemon or Facilitator of Frictionless Digital Trade?*, 42(3) JCE (2018), doi: 10.1007/s10824-017-9315-z.

sensitive information data regulations and varying standards are complexly intertwined, and recently, discussions on data sovereignty have been spreading. Therefore, it is necessary to focus on trust and interoperability related to data movement and develop international principles.

Countries are re-examining their previous approaches leaning to data openness amid technology competition and global geopolitics. Emerging countries such as China and India are strengthening control over the overseas transfer of data through the Internet. The EU's GDPR is influencing personal information protection regulations in other countries, establishing its position as a global norm. In the US, there is a skeptical view regarding whether the existing negotiation direction based on streaming services of platform operators or overseas business of financial institutions is compatible with the Biden administration's worker-centred trade policy. An ideal digital trade framework should facilitate free data flow, digital innovation, and healthy competition without interfering with policy objectives to regulate the internet. Trade negotiators need to adjust their positions rebalancing open data access with digital trust. In order to draw proper attention, the WTO may lead discussions with relevant institutions such as IETF (Internet Engineering Task Force), W3C (World Wide Web Consortium), IEEE (Institute of Electrical and Electronics Engineers), ICANN (Internet Corporation for Assigned Names and Numbers), and ITU (International Telecommunication Union) and create a platform for international consensus.[46] The concept of 'data free flow with trust (DEFT)' proposed at the G20 in 2019 and further developed at the G7 Hirosima Summit in 2023, is useful and the approach to build momentum among major countries such as the G7 and G20 and then develop into trade norms through the WTO, APEC, and others looks appropriate.[47]

Ensuring interoperability is particularly important for digital manufacturing services. The IIoT and industry 4.0 application requires the connection of many devices and systems to collect and share high-quality data across OT and IT platforms. The OT encompasses manufacturing execution system, meters, valves, sensors and motors, etc. The most common protocol are PROFINET, PROFIBUS, EtherNet/IP and Modbus. The growing complexity of operation processes has become a major challenge for smart manufacturing. For example, it is required to connect Computer Numerical Control (CNC) cutting machines and collaborative robots in unmanned process of manufacturing site and real-time data must be exchanged seamlessly. If the equipment has not been digitized or data processing methods are not interoperable,

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[46] A. Mitchell & N. Mishra, *Regulating Cross-Border Data Flow in a Data-Driven World: How WTO Law Can Contribute*, 22 J. Int'l Econ. L. (2019), doi: 10.1093/jiel/jgz016.

[47] Fumiko Kudo et al., *Every Country Has Its Own Digital Laws. How Can We Get Data Flowing Freely Between Them?*, WEF (20 May 2022); *Data Free Flow With Trust (DEFT): Paths Towards Free and Trusted Data Flows*', White Paper, WEF (2020).

data will not flow. Suppose company M, which has supplied protocol and PLCs to the factories of company S, operates its own closed club. If other company outside the loop wants to supply a co-bot to connect semiconductor-production equipment, it needs to coordinate protocols with company M to secure interoperability. Trade agreements may address such anti-competitive practices.

4.5 AI GOVERNANCE

AI technology is the core of the iDX, and as its application area expands to all industries, a broad range of new digital manufacturing solutions or services will become available. It is necessary to establish a proactive international governance framework through trade negotiations and systematize cooperation between countries.

AI decision-making raises new issues that are different from those faced by humans. Firstly, AI differs from humans in terms of emotions, empathy, and the basis of judgment. Particularly, when its algorithm and training data are biased or ethically inappropriate, AI can make important decisions in directions that are not desired by society. We should not leave the system to function as black box, but make more transparent so as to be understood and explained. Secondly, there are issues of regulatory application and liability for AI decision-making that is transmitted in real-time across borders. In particular, AI systems trained by data of exporting country may make incorrect decisions due to different local conditions.[48]

Can the WTO commitments apply to AI decision-making? On the one hand, the GATS does not limit itself to the technologies in use at the time of inception. The WTO Appellate Body has made it clear that the GATS applies to electronically mediated services in *China-Audiovisual Products* case. For example, a generic commitment for market access for insurance services can be interpreted to cover AI-based decision-making as well. On the other hand, the GATS limits service providers to natural or legal persons, so AI cannot be a service provider. Even if the agreement were applied to AI-based services according to the principle of technological neutrality, AI would have difficulty meeting the qualification requirements required by domestic regulations. Some may argue service regulation often focuses on not only the provider but also the process used, as it may be difficult to regulate the service directly. Licensing requirements, for instance, seek to assure that the individual has the relevant education, ethics, and experience. There is a need to clearly establish principles for applying and interpreting WTO norms to AI technology.[49] In a new world where AI is everywhere, it is crucial to have

[48] J. Ferencz et al., *Artificial Intelligence and International Trade: Some Preliminary Implications*, OECD Trade Policy Paper N.260 (2022).

[49] A. Chander, *Artificial Intelligence and Trade*, in *Big Data and Global Trade Law* (Cambridge University Press 2021).

corresponding governance and compliance process in place. In particular, amid growing concerns about applications of generative AI, such as ChatGPT, governments and international organizations are accelerating discussions on responsible use and governance. The G7 are reviewing the agenda of AI governance to encourage internationally accepted AI standards and align on key principles. Experts advocate that interoperable regulatory frameworks that are risk based, context specific, agile and collaborative can effectively address AI's challenges.[50]

4.6 Cybersecurity and trade

In digital trade, the prevention of damage to, unauthorized use of, and exploitation of electronic information and communications system is required.[51] The diffusion of digital technologies makes cybersecurity concerns ever-present. It is time to develop international principles so that domestic regulations in each country do not become unreasonable barriers to digital trade.

There has been security concerns that Chinese companies could use its growing share of digital equipment markets to spy for its government. The first major issue was 5G network where the US government is wary of installing hidden backdoors for spies to access sensitive data. The US Commerce Department added Huawei to its blacklist in 2019; and the Federal Communications Commission ordered US carriers to remove equipment made by them from their networks in 2020. Huawei criticizes the US restrictions that they are to safeguard American dominance of global tech rather than about cybersecurity.[52] Another contentious issue was social media with AI algorithm, spotlighting to the Chinese-owned video app, TikTok. The US CFI began investigating the national security implications of TikTok's collection of American data in 2019, and Trump threatened to ban the app entirely over concerns that its data harvesting threatens to allow the Chinese government access to the US personal and proprietary information. The Biden administration demanded that TikTok be sold, or face a ban in the US While TikTok is denying the alleged sharing of user data with the Chinese government, US lawmakers fear that the Chinese government will be able to get its hands on data through Byte Dance under the whims of its authoritarian regime.[53]

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[50] Gregory Allen & Akhil Thadani, *Advancing Cooperative AI Governance at the 2023 G7 Summit*, A Report of the CSIS AI Council (Apr. 2023).

[51] For the concept of 'cybersecurity', the ITU defines as: 'the collection of tools, policies, security concepts, security safeguards, guidelines, risk management approaches, actions, training, best practices, assurance and technologies that can be used to protect the cyber environment and organization and user's assets'.

[52] Bloomberg, *How Huawei Landed at the Center of Global Tech Tussle*, The Washington Post (20 May 2022).

[53] Claudia Biancotti, *The Growing Popularity of Chinese Social Media Outside China Poses New Risks in the West*, PIIE (2019); Andrew Ross Sorkin et al., *Biden's TikTok Problem: A BuzzFeed Report Raises*

As autonomous driving is gradually commercialized, warnings about data leakage are increasing. It is possible to launch a cyberattack by exploiting vulnerabilities in the API used to connect connected cars to the cloud. There is also a concern that backdoor chips or software may be installed through suppliers that supply cameras, sensors, and control panels. Delivery robots for autonomous driving can also capture personal and spatial information through cameras while traveling and transmit it to the cloud. There are also cases where an SME import smart manufacturing tools as rental package without acknowledging they are transmitting process data to the foreign supplier.[54] It would be useful to analyze specific cases of infringement and the degree of risk by categorizing cyber security into personal data, industrial data, and spatial data, while exchanging information on measures taken by each country to discuss international principles. Forms of cyber security risks to be reviewed include defence industry, critical infrastructure, industrial espionage, and information manipulation.[55]

4.7 Big-tech platform regulations

Digital platform services are facing increasing regulatory concerns over the abuse of dominant market positions due to their winner-takes-all structure. It needs to pursue international regulatory coordination reflecting competition law principles in trade norms.

In the past, regulation of digital platforms has developed based on market economy and self-regulation principles, focusing on online third-party liability exemption and consumer protection. However, recently, regulatory pressures on big-tech platform companies have been mounting from both the US and European authorities. In the 2016 US presidential election process, there was a growing dissatisfaction within the Democratic Party regarding Russian intervention and dissemination of fake news through Facebook, Twitter, and other platforms. In 2019, the US Senate began critically reviewing section 230 of the Communications Decency Act, the basis for online liability exemption provisions. The Democrats also demanded the removal of Article 19.17(3) of the USMCA agreement being negotiated at the time, which exempted liability for

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Questions About Biden's Approach to TikTok and Chinese Deal-Making (The New York Times 21 Jun. 2022).

54 *Understanding the Digital Security of Products: An In-Depth Analysis*, OECD Digital Economy Papers No.305 (2021).

55 J. Meltzer, '*Cybersecurity and Digital Trade: What Role for International Trade Rules?*', Brookings Global Economy & Development working paper (2019); Neha Mishar, *The Trade: (Cyber)Security Dilemma and Its Impact on Global Cybersecurity Governance*, 54(4) J. World Trade 567–590 (2020), doi: 10.54648/TRAD2020025.

good-faith efforts to restrict access or remove posts. In 2020, the US Congress published a report on 'Competition in Digital Markets' which criticized the abusive use of the monopoly position of online platform companies. Based on this, in 2021, the Congress introduced package bills to regulate platform companies. The EU is also strengthening the application of competition law to US big tech companies. In 2019, Google was fined 1.4 billion euros for unfair competition practices in the online advertising intermediation market. The Digital Markets Act (DMA), which came into effect in November 2022, designates global platforms that meet certain criteria as gatekeepers and imposes obligations such as prohibiting high-ranking of their own products, providing a search engine selection option when purchasing new devices, and allowing the deletion of pre-installed platform software.[56] Considering the shift in international trends, it is now time to consider international principles of competition law to regulate platform monopolies, ensuring to facilitate digital trade innovation.

4.8 Digital business taxations

Digital services are provided virtually through the internet, so regulatory measures are imposed in the form of domestic taxation rather than customs duties. In case that such fiscal measures are introduced in a way that effectively discriminates against foreign companies, it would be necessary to develop generally applicable norms and standards.

Since 2012, major countries have been considering ways to introduce a 'digital tax' by treating digital platforms themselves as virtual permanent establishments (PE) through the OECD Base Erosion and Profit Shifting (BEPS) project. While the Trump administration had a strong conflict with France over this issue, the G7 summit in 2019 agreed on the principles for digital tax collection, and the OECD/G20 Inclusive Framework (IF) on BEPS was established. In 2021, the statement on the two-pillar solution to address the tax challenges arising from the digitalization of the economy was announced, and 139 countries signed it, obligating each country to tax the companies with taxable sales generated within its own jurisdiction and to introduce a minimum of 15% corporate tax. Meanwhile, many countries are still implementing or introducing a 'digital service tax' (DST), which taxes total income rather than corporate income. According to the 2021 tax deal, each country has decided to abolish their DST, but the target and timing are not clearly specified. Furthermore, there is a growing discussion about imposing a 'digital data tax', which charges for data usage, based on a license-based

[56] J. Crisanto, J. Ehrentraud, A. Lawson & F. Restroy, *Big Tech Regulation: What Is Going on*, FSI Insights, BIS (2021).

consumption tax instead of income tax, considering foreign digital companies as consumers.[57]

5 CONCLUSIONS

With the 4IR, a real-time, digitally connected global era has begun. Leading global companies are applying innovative technologies such as AI, robotics, IoT, big data, and digital twin to traditional manufacturing to create new business models and value-added products. Tesla's OTA subscription service, which provides periodic remote software performance improvements based on customer driving data after selling autonomous vehicles, is a typical example. Each country is actively utilizing its unique combination of values and interests, such as economic freedom, advanced technological superiority, data sovereignty, and cyber security, to secure the leadership of the digital economy and aggressively employ economic strategies tailored to its own situation.

We need to shift the paradigm of trade by moving away from the old mindset that viewed digital trade only as 'data openness' and instead focus on the DX of manufacturing and overseas expansion. The future of advanced manufacturing lies in exporting packages that integrate online platforms for ordering and consultation, and a combination of manufacturing and services. We should also pursue trade norms that are suitable for advanced manufacturing based on AI and big data, with remote after-sales service management capabilities. Therefore, we need to identify and pursue the task of developing appropriate trade norms for advanced manufacturing.

This paper explores the scenarios of overseas expansion for advanced manufacturing industries in the era of DX (hyper-connectivity, intelligence, and service-oriented manufacturing) and identifies current issues and interests in terms of trade paradigms (e-commerce), targets (converged services, AI solutions), and infrastructure (networks, data, domestic regulations). Based on the current status of digital trade norms and the geopolitical competition (advanced technology supply chains, platform regulations, internet fragmentation), the paper selected 'e-commerce', 'openness', 'trust', and 'cooperation' as core keywords for digital trade. The paper proposes eight key agenda for a digital trade package, focusing on DX in trade, digitally enabled manufacturing services, internet access and traffic cost sharing, trust for interoperability, cybersecurity and trade, AI governance, big-tech platform regulations, and digital business taxation, examining the direction of follow-up discussions.

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[57] WEF, *Digital Trade in Services and Taxation*, White Paper (2021); Lucas-Mas et al., *Tax Theory Applied to the Digital Economy: A Proposal for a Digital Data Tax and a Global Internet Tax Agency*, Work Bank (2021); C. Noonan & V. Plekhanova, *Taxation of Digital Services under Trade Agreements*, 23 J. Int'l Econ. L. 1015–1039 (2020), doi: 10.1093/jiel/jgaa031.

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