

The New Industrial Revolution, Global Governance Reshaping and Multilateralism*

Xie Fuzhan (谢伏瞻)

Chinese Academy of Social Sciences, Beijing, China

Abstract: *Currently, a new industrial revolution characterized by artificial intelligence, the internet of things, and digitalization is in a critical transition from initiation to all-around expansion. While injecting new dynamism into global economic growth, and promoting inclusive development and human welfare, the new industrial revolution will reshape the pattern of international competition, and provide a window period for late-moving countries to compete and catch up with developed nations. Amid the shocks of the new industrial revolution, countries must adhere to the principles of openness, multilateralism and reciprocity to share the dividends of the new industrial revolution and effectively cope with its challenges. Therefore, multilateralism, rather than protectionism and unilateralism, should dominate the mainstream of change in future global governance. The reform of existing multilateral organizations such as the World Trade Organization (WTO) must proceed under the principle of multilateralism.*

Keywords: *the new industrial revolution, global governance, multilateralism, WTO reform*

JEL Classification Codes: F01, F02, O30

DOI:10.19602/j.chinaeconomist.2019.11.01

1. Introduction

The new industrial revolution, underpinned by artificial intelligence, the internet of things and digitalization offers a vital driver for future global economic growth. It is a critical factor that influences the pattern of international industrial competition. After three decades of technology accumulation and market exploration, this new industrial revolution is sweeping across the globe. New general-purpose technologies spearheaded by new-generation information technology and artificial intelligence (Bresnahan, 2010) and enabling technologies (Fortune & Zirngibl, 2009)¹ have become increasingly sophisticated through iterative applications, propelling the emergence of leading industries such as connected vehicles, smart manufacturing, and biomedicine. These technologies have penetrated traditional industrial sectors such as textiles and energy, offering new momentum to global economic

* Correspondence: Xie Fuzhan, email: xiefz@cass.org.cn

Part of this paper was presented at the “Global Governance: Global Challenges and Global Solution in a Changing World,” co-hosted by the Chinese Academy of Social Sciences (CASS) and the Kiel Institute for the World Economy (IfW) in Germany on April 16, 2019.

¹ The concepts of general-purpose technology and enabling technology are extensively used in academic literature and policy documents, but currently have no broadly accepted definitions. In this paper, general-purpose technology refers to technologies that can be widely applied to promote economic growth and productivity. Enabling technology refers to technologies that can promote the mass engineering and commercial applications of science and technology in specific industrial sectors.

growth and inclusive development.

Given the significant influence and value of the new industrial revolution, leading industrialized countries have enacted more proactive policies to encourage the development of new technologies and new industries, and to seize the vantage point of a new industrial revolution. However, some countries are attempting to monopolize the lucrative interests stemming from new technologies and industries at the expense of fair competition and inclusive development. Their extreme unilateralism and aggressive protectionism have jeopardized globalization, multilateralism and free trade. Amid groundbreaking technological and industrial development, grim uncertainties have emerged in the world trade order. In the context of rapid changes in technological and economic paradigms, the world must cope with the challenges arising from the new industrial revolution, and China should take it upon itself to push forward the development of international order in a fairer and more reasonable direction. To this end, we must unravel the implications of the new industrial revolution for global governance, and keep abreast with the changing global governance system.

2. New Industrial Revolution Creates New Momentum for the Global Economy

An industrial revolution is a process of cluster breakthroughs and the commercial application of general-purpose and enabling technologies. It is a systematic transformation in the pattern of economic development in human society, and a leapfrogging evolution in economic development. In the previous industrial revolutions, steam engines gave rise to mechanization, electric power and steel gave rise to heavy industrialization, production lines to standardized mass manufacturing, and computer numerical control (CNC) technology to flexible manufacturing. The new industrial revolution features the groundbreaking research and application of artificial intelligence, the internet of things, and digital technology. This technological and industrial transformation is revolutionary in the sense that the cluster breakthrough and mass application of smart and digital technologies not only creates leading industries, but transforms the technology, organization, and business models of traditional industries through integration with traditional technologies and products. In this manner, the new industrial revolution will transform the global economic structure and development pattern, and unleash growth potentials.

Each industrial revolution is unique, but they share common patterns with cyclical and structural characteristics. Judging by economic history, each of industrial revolution roughly experiences the stages of initiation and expansion, and each stage lasts about two to three decades (Perez, 2007).² In the initial stage, new general-purpose and enabling technologies are invented based on the cumulative development of fundamental research. In this stage, technological innovations are driven by scientific advancements. As the technological paradigms and pathways of new technologies are yet to take shape, innovators led by start-up firms will explore diverse technological pathways and business models as they try to capitalize on potentially lucrative new technologies. With the increasing sophistication of the general-purpose and enabling technologies and their associated business models, the applications of such new technologies start to create new industries and spread to other sectors of the economy, unveiling the second stage of the industrial revolution, i.e. the stage of expansion. In the expansion stage, an industrial revolution is manifested as the rapid application and large-scale commercialization of new technologies. In this stage, therefore, technological progress is driven by demand. Since the emergence of the internet economy in the 1990s, the information economy has experienced roughly three decades of development. Currently, smart, internet-based and digital technologies are coming of age, and have become integrated with general-purpose technologies such as communication, new materials and biomedicine, giving rise to platform enterprises with frontier technologies and effective business models. Unlike the initiation

² Perez used the concept of “technological revolution,” but her description of the stages of technological revolution also applies to this paper’s analysis of industrial revolution.

stage, during the expansion stage the industrial organization starts to evolve from a highly dynamic market structure to a more stable one. These technological and economic characteristics are symbols of the transition of the new industrial revolution from the initiation stage to the expansion stage.

Technological progress and industrial transformation are important sources of human welfare. Industrial activities facilitate the rapid production and diffusion of scientific and technological knowledge, and promote the modernization of human society. The economies of scale and scope induce the agglomeration of production factors, and expedite the urbanization of human society. Information technology reduces both the spatial barriers to communication and the global division of labor for industrial production. To some extent, modern ways of life in today's industrial society and urbanization are the results of previous industrial revolutions. Characterized by the intelligent interconnections of man, machines and resources, the new industrial revolution is blurring the boundary between the physical world and the digital world, and between manufacturing and services. Modern technology creates broad potentials for efficient and environmentally friendly economic growth. Like previous industrial revolutions, the current industrial revolution will create robust growth momentum for the world economy, transform the economic structures and development patterns of countries, and offer new solutions to the dilemmas and problems confronting human society, enabling leapfrogging development. As the new industrial revolution shifts from the initiation stage to the expansion stage, these social and economic effects will emerge and gain momentum. We can expect that four major changes will occur, as explained below:

(1) The new industrial revolution will provide the world economy with new growth momentum. Since the global financial crisis in 2008, world economic growth has slowed. Income gaps have been widening across countries, sectors, regions and social groups. Wealth distribution is tilted towards the few. Rising protectionism and populism have prodded some countries to take unilateralist actions to ease their domestic economic and political woes at the expense of other countries, creating grave challenges to global governance and uncertainties to world economic growth.

Historically, the growth drivers emerging in each industrial revolution comprise the power industry, leading industry, new infrastructure industry, and induced industry (Perez, 2010). The current industrial revolution is spearheaded by artificial intelligence, big data, and cloud computing in mass commercial applications. Emerging sectors based on smart, digital, and internet technologies, such as smart manufacturing, connected vehicles, smart cities, smart power grid, and telemedicine, have become leading industries for the new industrial revolution. The more efficient, secure, reliable and stable 5G information network constitutes a critical infrastructure for the new industrial revolution. Through mutual feedback and reinforcement, enabling technologies such as artificial intelligence, the 5G network, and connected vehicles will increase the technological and commercial sophistication in these sectors, giving rise to new business models and industries that fuel global economic growth. Meanwhile, emerging technologies and business models penetrate into energy, consumer goods and equipment industries, turning them into induced industries that become modernized during the new industrial revolution and with new growth potentials unlocked. These types of industries jointly form a complete industrial system in the new economy.

(2) The new industrial revolution will change the factor input structure of the economic system. In the traditional production system, land, labor, raw materials and energy are the primary production factors, which are subject to growing supply constraints. In major industrialized countries, people's preference for leisure increases with income growth and an aging society, causing the effective supply of labor to shrink. Industrial expansion and rapid urban development highlight the scarcity of land. Growth in global consumption and heavy-chemical industrialization in developing countries increase the demand for natural resources, raw materials and traditional energy sources, while environmental constraints crimp the supply of natural resources and nonrenewable energy sources.

This factor supply-demand contradiction calls for a new production mode. Changes in the technological structure associated with the new industrial revolution will alter the relative price and the demand structure of factors, and ultimately the factor input structure of the global production system. In the new industrial revolution, automation will significantly increase the organic composition of capital (Marx, 2004), slash the demand for physical labor arising from economic growth, and replace intellectual work with artificial intelligence. Therefore, the new industrial revolution may give rise to economic growth without job creation in some countries and sectors. Characterized by artificial intelligence, internet-based applications, and digitalization, the new industrial revolution will boost enterprise production and management efficiency, and reduce the demand for traditional factor inputs such as land, raw materials and energy. More importantly, data have become a new critical factor in the economy as the new-generation information infrastructure slashes the cost of data generation, storage and transmission. Data resources have become core resources for countries and firms. Countries and firms will boast of their data resources as core assets with data-based technology development and application modes as their core competencies. Data are likely to replace traditional input factors and become the most important resource in an economic system.

(3) The new industrial revolution will change the pattern of industrial manufacturing and research and development (R&D) organizational forms. After mechanization, mass production, and flexible manufacturing, smart manufacturing will become a new dominant manufacturing paradigm, and induce a new labor structure and R&D organizational form (Lazonick, 2011). In the era of mechanized production, skilled labor was the primary labor input for production, and firm's knowledge mainly came from individual inventors. The era of mass production saw a spike in the demand of firms for operational labor. Quantitative expansion and modern management practices became the core competencies of firms. Firm innovation started to play a vital role in firm competitiveness. Large firms created in-house R&D arms to develop innovative technology. Highly specialized individual knowledge became the organizational knowledge of firms through the division of labor. As flexible manufacturing emerged after the 1970s, lean manufacturing and automation technology became the core competencies of firms. By leveraging global technology factors and creating a global innovation network, leading firms enhance their technological competence. As human society enters the era of smart manufacturing, operational labor and some types of intellectual work are likely to be replaced by automation and artificial intelligence, giving rise to the demand for AI experts in such domains as machine learning and natural language processing. Given the fast pace of innovation, firms must rely on new R&D organizational forms such as start-ups, apart from their in-house R&D teams and global innovation networks, to maintain their competitive edge in the global system of technological innovations.

(4) The new industrial revolution will provide new solutions to global issues such as economic slowdown, uneven development, widening income gaps, climate change and geopolitical tensions. For instance, green energy offers a better solution to the problems in supplying growing populations and industrialization. Autonomous driving and smart mobility offer new technological pathways for tackling traffic congestion. New business models such as e-commerce engendered by digital technology, as well as service trade facilitation, will buoy world trade. According to the *World Trade Report 2018*, released by the World Trade Organization (WTO), world trade will grow by 1.8 to 2.0 percentage points per annum until 2030. The new industrial revolution will cause the spatial decomposition and recombination of the global value chain, supply chain and industrial chain, thus deepening the division of labor, increasing efficiency, and facilitating the world's economic recovery. At the fundamental level, challenges facing the world economy stem from insufficient and uneven development. The new industrial revolution fosters the technological and economic conditions that spur world economic growth, inclusiveness, and sustainable development, thus contributing to the solution of global issues.

3. New Industrial Revolution Will Reshape the Landscape of International Competition

The new industrial revolution will become a key driver of world economic growth and improve welfare. Although the new industrial revolution benefits the whole world, the distribution of value created by new technologies and industries is uneven among countries. Industrialized countries wish to consolidate their advantage in the global economic landscape through technological progress and the development of leading industries. Late-moving countries also wish to explore unique technological pathways and business models through the window of opportunities opened by the new industrial revolution (Perez & Soete, 1988). In this sense, competition and catch-up are essential elements of the new industrial revolution.

The new industrial revolution is a process of competition and selection. In the initiation and expansion stages, an industrial revolution manifests in the competition between countries or firms at the level of technology and commerce. In the initiation stage of an industrial revolution, no country is able to dominate all technological pathways given their uncertainties and costly R&D input. The early-movers in frontier technology and fundamental research may not become the developers of a dominant technology. The short-cycle nature of information technology makes it likely for late-moving countries to catch-up through intensive learning (Li, 2016). When an industrial revolution enters the expansion stage, i.e. general-purpose and enabling technologies become mature and ready for commercial application on a mass scale, technologically advanced countries are still likely to miss the opportunity to turn their technological superiority into industrial prowess. Dominant technologies and business models come into shape through constant feedback and iterative market selection (Rosenberg, 2004). While technology leaders may fail in the commercialization stage, technology followers are likely to prevail in market competition based on their market or infrastructure advantage. The new industrial revolution creates tremendous economic dividends, and exerts a profound influence on the landscape of international industrial competition. While countries have an incentive to actively participate, the results of competition are highly uncertain due to the complex technological and economic processes of the new industrial revolution.

Countries' efforts to compete and catch-up in a new industrial revolution are ultimately reflected in the dynamic changes in the landscapes of international competition and interests. Based on the experience of previous industrial revolutions, the countries that invented general-purpose and enabling technologies are the earliest to commercialize the results of fundamental research in the initiation stage of an industrial revolution. By exploring different technical pathways, these countries strive to control the dominant technologies. As scientific research and technological prowess are mutually reinforcing, these countries spearhead the new industrial revolution in science and technology. After the new industrial revolution evolves from the initiation stage to the expansion stage with dominant technologies taking shape, countries compete in engineering and industrialization. In this stage, countries with stronger engineering capabilities and more creative business models prevail. As the source of technology for the new industrial revolution comes from a few countries, there will be a polarization in the level of technology between countries. But in this stage, technological capabilities are yet to convert into a country's industrial competitiveness and economic welfare. As the new industrial revolution shifts from the initiation stage to the expansion stage, countries like the United States, China, Japan and Germany are the key contributors to the sophistication and application of dominant technologies. As the new industrial revolution enters the expansion stage, general-purpose and enabling technologies start to be applied on a broader scale. Countries that take the lead in applying dominant technologies and induce industries benefit the most from the new industrial revolution through improvement in technological capabilities, productivity, economic growth, job creation and comprehensive national strength. In the

early stage of new technology industrialization, R&D and manufacturing are highly integrated, and concentrate in a few countries of origin. Such countries, therefore, will enjoy a trade surplus with developing countries at the periphery of the new industrial revolution, resulting in a further divergence in their economic growth levels. Technological and industrial sophistication and standardization, with domestic market saturation in the countries of origin, will prompt firms in these countries to relocate manufacturing to developing countries with lower costs and broader market potentials. This sets a new international relocation of mature industries in motion, and economic growth levels between developed and developing countries start to converge. In this stage, developing countries that actively attract foreign investment and explore international markets may enjoy a trade surplus with developed countries and regions. Nevertheless, developed countries that fail to reduce their manufacturing costs may experience the problem of industrial hollowing-out.

A new industrial revolution is a complex process of synchronous technological and economic transformations. Technological progress and industrial development are embedded in a country's institutional and policy systems. Technology breakthroughs and industrial changes will face institutional resistance due to causing disruptions to vested interests. To foster new skills, technologies, start-up firms and leading industries, countries or regions must adapt their systems and policies quickly. Only in this manner will they unlock the potentials of the new industrial revolution and benefit therefrom. By reversing deindustrialization, developed countries strive to regain their competitive advantage in manufacturing during the window period of the new industrial revolution. In recent years, advanced economies have introduced mid- and long-term manufacturing strategies based on artificial intelligence, the internet of things and digital technologies. These strategies include the United States' *Strategy for American Leadership in Advanced Manufacturing*, Germany's *Industry 4.0*, the *New Industrial France* initiative, the European Union's *Digitising the European Industry*, Spain's *Connected Industry 4.0*, Japan's *New Robot Strategy*, South Korea's *Manufacturing Innovation 3.0*, and Italy's *National Enterprise Plan 4.0*.

Over the past four decades, developing countries represented by China have created relatively complete industrial and innovation systems in a short time by playing host to industrial relocation and promoting homegrown innovation. Unlike the previous industrial revolution, China and some other developing countries with certain industrial bases extensively participate in groundbreaking research and the application of new technologies in the current industrial revolution. According to traditional developmental economics, developing countries grow their economies by using their low-cost advantage to attract industrial activities from developed countries. Industrial relocation based on the flying-geese model may help developing countries grow rapidly during their economic takeoff stage. In the long run, however, multinational firms retain their core technology in their home countries and only transfer their mature technology to host countries. Their R&D centers in developing countries are specialized in and focus on making adaptive improvements to meet local market demands. Therefore, most innovations carried out by multinational firms in developing markets are minor improvements at the application level. But after reaping dividends from the transfer of mature technologies, local firms in developing countries are unable to catch up with their peers from developed countries, resulting in the secular stagnation of economic growth in the host countries. The middle-income trap facing Latin American countries such as Brazil and Chile is manifested in the failure of local firms to develop indigenous innovations after the transfer of mature technologies from multinational firms, which has resulted in both technological and economic growth plateaus. Thus, it is fair to say that in developing countries, behind the middle-income trap is the technology trap.

To overcome the middle-income trap and catch up with developed countries at the technology level, late-moving countries must seize the opportunity of the new industrial revolution to foster homegrown innovators and develop independent product platforms and R&D systems. The new industrial revolution

gives late-moving countries an opportunity to compete with developed countries on an equal footing in emerging industries. By applying new technologies in traditional industries, late-moving countries also face a window period in which to catch up with developed countries in mature industries. When environmental performance became a key feature of automotive technology in the 1970s, Japanese automakers eclipsed their American and German peers with flexible and lean manufacturing methods. Over the past four decades, China's theoretical and institutional innovations, based on its national conditions, have greatly enriched the country's economic development pathway and model of late-moving countries (Xie, 2018). China's strategy of national rejuvenation through manufacturing, Russia's *National Technology Program*, Argentina's *National Manufacturing Program* and India's *National Manufacturing Policy* all reflect the developing countries' vision of extensively participating in and contributing to the new industrial revolution.

4. Multilateralism Remains a Dominant Direction of Change in Global Governance

Revolution of productivity and the mode of production will transform the relations of production. Each industrial revolution in the economic history of human society has unfolded with the emergence of groundbreaking technologies as well as changes in national policy systems and international governance rules commensurate with these technologies. Previous industrial revolutions were processes of joint "creative destruction" of technologies and systems. Foreseeably, the new industrial revolution will also transform institutional and industrial policies, global governance and economic paradigms while engendering groundbreaking technologies. The new industrial revolution has systematic and profound implications for national interests at the levels of technological prowess, economic growth, job creation, trade and investment, and even national security. In view of this, major industrialized countries have enacted national strategies to embrace the new industrial revolution, and have introduced proactive and diverse industrial policies to foster new technologies and industries. International conflicts of interests, and shifting strategies and policies will naturally disrupt the global governance system, challenge existing governance rules, and bring about a new equilibrium through international competition. The new industrial revolution may reshape the landscapes of national competition, reallocate interests among individual economies, transform global governance rules, cause occupational shifts and unemployment shocks, and challenge social ethics. However, these challenges may not pose any threat to the development of human society. What matters is the direction of change in the global governance system.

In the face of opportunities and challenges from the new industrial revolution, countries have embraced different value orientations for global governance and adopted different globalization strategies. Currently, most countries agree to promote international cooperation and innovation through dialogue and openness during the new industrial revolution, and to address global issues under a multilateral framework. However, some voices of discord have emerged on the international arena. In attempting to take the vantage point of the new industrial revolution, some countries have resorted to unilateralism and protectionism to obstruct the development of other countries and clamp down on technologically advanced companies from other countries, using their national clout. Such acts have destabilized the international trade order and world economic stability, pushing the relationship of competition and cooperation in the new industrial revolution towards a "zero-sum game." Such an irresponsible and narrow-minded concept of global governance impedes both the deepening of the new industrial revolution and the creation of new momentum for global economic growth. Even worse, it disrupts the multilateral framework needed for countries to meet the challenges from the new industrial revolution through concerted actions. Amid the internet technology-driven new industrial revolution, multilateralism remains the dominant institutional paradigm for countries endeavouring to share more

broadly in the dividends of the new industrial revolution. Multilateralism offers the fundamental solution to challenges from the new industrial revolution, and it's the mainstream direction and dominant rationale that must be followed in global governance reform.

First, a rational strategy for a country participating in the new technological and industrial competition is to create a more open industrial and innovative ecosystem under the principle of multilateralism. Compared to previous industrial revolutions, this new industrial revolution, characterized by artificial intelligence, the internet of things, and digitalization involves an unprecedented scope of science and technology, depth of technology integration, and complexity of market application. No country can monopolize the industrial, supply chain, value chain, and innovation systems under the new industrial revolution. Consider smart manufacturing, for instance. The United States has superiority in the underlying technology and the industrial Internet. Germany boasts an advantage in the integration of digital and physical systems. Japan is specialized in lean manufacturing. China is strong at the mass engineering and market application of new technologies. No country is able to control all the critical technologies for smart manufacturing or to develop a self-sufficient and complete industrial chain. Unlike previous industrial revolutions that originated from a handful of countries, the new industrial revolution requires more countries to directly participate in the fundamental science research, frontier technology and diverse commercial applications. The biggest beneficiaries of the new industrial revolution must be the countries that gather global science and technology factors and share the value of innovation with other countries. The countries which create more open innovative ecosystems will occupy more favorable positions in the industrial system during the new industrial revolution. Some countries have developed a monopolistic technological advantage, but they try to abuse their advantage in an attempt to monopolize the dividends from the new industrial revolution. This unilateral and protectionist act underestimates both the technological diversity in the new industrial revolution and the multilateral forces in the global governance system.

Second, countries should harmonize their competition policies under a multilateral framework and jointly tackle social and ethical problems arising from new technologies. Only in this manner will they be able to cope with challenges from the new industrial revolution and steer the new industrial revolution toward the direction of tackling major global issues. In the Internet era, the economies of scope have replaced the economies of scale to become the dominant logic of industrial organization. Due to their possession of underlying technology and core data, platform companies have become the pioneers of the industrial ecosystem of innovation and development. Once dominant technologies and industries become mature, platform companies in such domains as operating systems, chips, social networking and search engines will resort to various acts of monopoly such as bundling sales and aggressive pricing to stifle innovation and dynamism. At this moment, platform companies with market power are more likely to impede rather than spearhead innovation. Hence, the international community should create an effective mechanism for coordinating competition policy, regulating monopolies, continuously expanding the technological boundaries of the digital economy, and promoting innovative business models. Technologies such as artificial intelligence and genetic engineering, which are underpinning the new industrial revolution, involve major issues of human development such as information security and ethics, and therefore require international policy coordination. Without a multilateral framework, the new industrial revolution, as a double-edged sword, may create significant negative externalities that threaten the progress of human society.

Third, scientific research and industrial competition must follow the principles of fair competition and the rules of multilateralism for the new industrial revolution to propel world economic growth. It makes sense for countries to adjust their national innovation systems and industrial policies, based on their national conditions, to keep up with the development of new technologies and industries. However, no country should prop up its domestic industries at the expense of damaging multilateralism. Policy

diversity is not at odds with multilateralism. The politicization of economic matters and the prevalence of protectionism will only highlight the importance of multilateral rules and fair competition. Only under the constraint of multilateral rules consistent with the principles of fair competition will scientific research and the industrial competition between countries contribute to improving global welfare. Without abiding by multilateral rules, industrial policy competition in the context of the new industrial revolution has the potential to evolve into a “beggar thy neighbor” competition that harms the potency of the new industrial revolution in propelling world economic recovery. The policy adjustments and technology competitions of countries in the new industrial revolution should be fair competitions under multilateral rules rather than a rivalry in which national power overrides rules.

Lastly, the development polarization that may arise from the new industrial revolution must be tackled by introducing more inclusive multilateral rules. While substituting physical and intellectual labor and raising productivity, automation and artificial intelligence may also slow or even reverse manufacturing relocation from developed to developing countries, and thus create shocks to traditional industries and jobs in developing countries. In the short run, developing countries may see their traditional comparative advantage whittled away as developed countries are the first to benefit from the new industrial revolution. In this sense, the digital divide stemming from the new industrial revolution may further polarize the levels of world economic development. Therefore, developed countries have a responsibility to contribute to addressing development imbalances in other nations. In the process of global industrialization over the past decades, developing countries have undertaken the most onerous and polluting activities with the lowest value-added in the global industrial value chain. Since the new industrial revolution creates information products and services with marginal costs that are close to zero, developed countries may explore markets in developing countries for win-win results. Based on such an understanding, unilateralism goes against both inclusive growth and poverty reduction. It is not only necessary but possible to address global imbalances and inequities by following a multilateral approach. A multilateral framework is essential for countries that engender and benefit from the industrial revolution to assist developing countries in building up their information infrastructure, applying mature and applicable technologies, and conducting up-to-date skills training. Such cooperation will nudge the world economy towards more inclusive development. Information technology has slashed the costs of industrial chains, value chains and global infrastructure deployment, giving rise to the economies of scale, scope and networks. The new industrial revolution offers an opportunity for developed countries to assist developing countries in integrating into the global production system and the innovation network.

5. Reforming the WTO under Multilateral Principles

Multilateralism based on cooperation, mutual benefit and consultation remains the dominant direction of global governance. Yet the existing multilateral organizations and mechanisms are far from perfect. In the past, the WTO improved the dispute settlement mechanism, reformed organizational structure, and facilitated multilateral trade negotiations. Despite these contributions, the WTO increasingly found itself to be incongruous with the new international competition environment. Due to the complex and volatile patterns of international competition and diverging interests among member states under the new industrial revolution, progress in the ongoing WTO trade topics has stalled, and consensus on new topics is hard to form. These challenges have undermined the WTO's efficiency and its authority. The WTO must introduce the reforms necessary to promote fair competition and undergird the multilateral trade regime in the liberalization and facilitation of world trade. Through these efforts, the WTO should play a bigger role in world economic governance.

(1) The WTO should enhance the binding force of member states' obligations and strive to increase the effectiveness of the dispute settlement mechanism. By its nature, the multilateral trade regime is

a binding commitment of its member states to open up their markets and compete on a level playing field. Given the strategic importance of the new economy, countries are more motivated to conduct policy interventions to facilitate breakthroughs in critical technology and to foster emerging industries. Aside from traditional tariff barriers, disputes over nontariff barriers have emerged in recent years. In this context, it is relevant to enhance the WTO's binding force and dispute settlement capacity. To this end, the WTO should reform its council, committees and secretariat, and to grant them the mandate to supervise the trade policy transparency and fairness of member states. The WTO should ensure that its member states perform their reporting obligations properly, re-initiate the membership selection procedure for the Appellate Body, enhance the multilateral supervision mechanism, prevent member states from taking unilateral measures, and increase its public credibility and global governance. After improving its governance structure, the WTO should adopt an innovative dispute settlement mechanism and settle trade disputes proactively and efficiently.

(2) The WTO should adhere to the direction of multilateral governance and trade liberalization and follow an effective pathway to cope with the shocks from exclusive regionalism. Technologies based on artificial intelligence, the internet of things and automation are easier to deploy in regions with similar levels of development, giving rise to the regionalization of the global innovation value chain in the context of the new industrial revolution. The Asia-Pacific region and the European Union enjoy an efficient and vibrant supply chain system based on the regional division of labor. Regionalization stems from the deepening of the global value chain, but creates challenges to multilateral governance and global trade liberalization. Under the principles of multilateral governance and trade liberalization, countries may consider conducting multilateral negotiations under the WTO framework to seek common ground while respecting the development models of member states. "Open multilateralism" offers a solution to the exclusive regionalism facing the WTO, and would help rebuild the WTO's authority. The WTO should respond effectively to demands from industry and enhance multilateral discussions on new topics such as micro, small, and medium-sized businesses. Industrial policies introduced by countries under the new industrial revolution must meet the WTO's principles of fair competition and facilitate the effective solution of trade, investment and intellectual property (IPR) disputes under the WTO framework.

(3) The WTO should recognize the special identity of developing countries, ensure their differentiated treatment, and increase their participation. The WTO should strive to narrow the competence divide, including the digital divide, between developing and developed countries. These efforts are an important part of inclusive global development under multilateral frameworks such as the WTO. Since the new industrial revolution may stoke global imbalances, the WTO should offer assurances on the "special and differentiated treatment" clauses for developing countries. The WTO's reform should take into full account the demands and difficulties of developing countries, continue to offer differentiated treatment for developing countries in future trade and investment rules, and encourage developing countries to more proactively participate in global governance and assume obligations congruous with their development levels.

(4) The WTO should balance the relationship between IPR protection and technology diffusion, and promote open global innovations. In the new industrial revolution, developed countries are investing heavily in innovation and put a great premium on IPR protection to secure their vantage point in global competition. Nevertheless, excessive IPR protection not only stands in the way of technology commercialization and inclusive global development, it also discourages developing countries from opening up as well. The WTO should accommodate the interests of various parties, balance the relationship between IPR protection and technology diffusion, and take differentiated measures rather than a "one size fits all" approach in handling IPR disputes. More specific technical assistance should be provided to developing countries to promote the diffusion and application of advanced and mature

technologies so the new industrial revolution will benefit more countries and peoples.

(5) The WTO should address new issues such as digital trade following the trend of the new industrial revolution. Recent years have seen rapid developments in digital trade spearheaded by e-commerce. According to data from the Amazon China Summit 2018, the global business to consumer (B2C) cross-border e-commerce market expanded from 233 billion US dollars in 2014 to 676 billion US dollars in 2018. Given its role in facilitating cross-border trade in services, digitalization should be a key item on the WTO's agenda. Negotiations on digital trade rules used to occupy an important position on the WTO's agenda, but have recently stalled. The conclusion of negotiations on global digital trade rules cannot bypass traditional multilateral platforms such as the WTO. Parties may start with negotiations on easier topics, such as the goods trade over Internet platforms, as well as technical assistance and capacity building for developing countries. Such negotiations should strike a delicate balance between policy goals on technology, commerce, security and sovereignty, and break the ice on digital trade negotiations under multilateral systems, with a view to boosting the confidence of various parties on multilateral negotiations.

6. Concluding Remarks


The new industrial revolution, underpinned by artificial intelligence, the internet of things and digitalization is shifting from the initiation stage of explorations in science and technology to the expansion stage characterized by commercial applications. The tremendous economic value unleashed from the new industrial revolution is ushering in profound transformations in global industrial structures and development patterns, and injecting powerful momentum into the world economy. Lured by the opportunities from the new industrial revolution, major industrialized countries have enacted industrial policies to speed up the development of new technologies and industries. International policy competition is conducive to diverse technology explorations and market experiments, and represents an important and positive force in fueling the new industrial revolution.

However, international competition should not disrupt multilateralism and inclusive development. Unlike the previous industrial revolutions that originated from a handful of countries, the technological and industrial complexity of the current industrial revolution requires more countries to directly participate in the innovation of fundamental science, frontier technology, and diverse commercial applications. Countries that can create more open industrial and innovation ecosystems stand to prevail in the new industrial revolution, in which countries share common interests and destinies.³ Only by coordinating their competition and social policies under a multilateral framework, and by addressing social and economic problems such as monopolies, will countries jointly combat the monopolies that may arise from new technology and other challenges such as economic growth without job creation, and social ethics, cope with the challenges from the new industrial revolution, and guide the new industrial revolution towards the direction of combating global problems and promoting inclusive world development.

The new industrial revolution and economic globalization are two irreversible trends that reinforce each other. In the wave of globalization driven by the new industrial revolution, multilateralism remains the dominant economic paradigm through which the world shares in the dividends of the new industrial revolution. Multilateralism is the fundamental solution to the challenges from the new industrial revolution, and the dominant logic of global governance reshaping. It should be the basic stance upheld by all responsible countries. Multilateralism, based on cooperation, mutual benefit and consultation, remains the dominant direction in the changereshaping of global governance. Of course, the principle of

³ Xi Jinping: Turn Our Vision into a Reality, speech at the Plenary Session of the BRICS Johannesburg Summit, July 26, 2018.

multilateralism does not mean that existing multilateral organizations and mechanisms are perfect. The current priority is to introduce reforms of the WTO in line with the principles of fair competition, and innovative and inclusive world economic development, to strengthen the dominant role of multilateral trade regimes in world trade liberalization, and to facilitate and encourage the WTO to play a bigger role in world economic governance.

China is both a beneficiary and a proponent of economic globalization. By deepening reforms and opening wider to the rest of the world, China is pursuing high-quality development and building a modern economic system. While embracing the era of the new industrial revolution, China will steadfastly support multilateralism and free trade, and resolutely oppose the unilateralism and protectionism that go against the mainstream trend of world development. Since becoming a member of the WTO, China has actively fulfilled its WTO commitments by opening up its markets for mutual benefit, and has thus contributed to world economic growth and stability. Facing both a new industrial revolution and a complex and volatile international situation, China will not hesitate to open up wider to the rest of the world, push forward necessary WTO reforms under the principle of multilateralism, and foster partnerships amid the new industrial revolution. China stands ready to explore new technologies, business models and paradigms with other countries, explore new growth momentum and development pathways, and promote open and inclusive world development. 

References:

- [1] Bresnahan T. 2010. "General Purpose Technologies", in *Handbook of the Economics of Innovation* edited by Bronwyn, H. H., and R. Nathan. Oxford: Elsevier.
- [2] Fortune Steven, and Martin Zirngibl. 2009. "Enabling Science and Technology." *Bell Labs Technical Journal*, 14 (3): 1-5.
- [3] Lazonick William. 2011. *Sustainable Prosperity in the New Economy*. Shanghai: China Far East Press.
- [4] Lee Keun. 2016. *Schumpeterian Analysis of Economic Catch-up: Knowledge, Path-Creation, and the Middle-Income Trap*. Beijing: Tsinghua University Press.
- [5] Marx Karl. 2004. *Le Capital* (volume 1). Beijing: People's Publishing House.
- [6] Perez Carlota, and Luc Soete. 1988. "Catching Up in Technology: Entry Barriers and Windows of Opportunity", in *Technical Change and Economic Theory* edited by D.Giovanni et al. London: Francis Pinter.
- [7] Perez Carlota. 2007. *Technological Revolutions and Financial Capital: The Dynamics of Bubbles and Golden Ages*. Beijing: Renmin University of China Press.
- [8] Perez Carlota. 2010. "Technological Revolutions and Techno-economic Paradigms." *Cambridge Journal of Economics*, 34 (1): 185-202.
- [9] Rosenberg Nathan. 2004. *Exploring the Black Box: Technology, Economics, and History*. Beijing: the Commercial Press.
- [10] Xie Fuzhan. 2018. "China's Economic Development and the Innovation of Developmental Economics." *China Social Sciences*, No.11.