

Technological transition and technological dependency: Latin America–China relations in a changing international order

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Abstract

Purpose – The purpose of this paper is to present a conceptual framework of the relationship between technological transitions and hegemonic transitions in the international system from a historical perspective and discuss its consequences for technologically dependent countries and regions.

Design/methodology/approach – This paper analyzes the relationship between technological transitions and hegemonic transitions in the international system from a historical perspective. It then constructs four possible transition scenarios for China's international order and the USA's central role in defining the international order. It closes with a discussion of how changes in ICT and global health public goods can impact China's position in the international order and opportunities for Latin America–China technology partnerships.

Findings – Historically, technological transitions and hegemonic transitions in the international system simultaneously occur, with the country winning the technological dispute emerging as the international system's hegemon. The USA and China are currently involved in technological races in several next-generation technologies. The outcome of these technological races will define each country's position in the international system in the coming decades and the transformations in the international order.

Research limitations/implications – This paper is limited to discussing the technologies/sectors: ICT, specifically 5G, and AI technologies, and medical technologies with the potential of global public health goods. Research on other technologies/sectors will provide a deeper understanding of the likely outcomes of the current technological transition and its implications for the balance of power in the international system.

Practical implications – This paper makes a case for Latin American countries to (1) engage in a pragmatic bargain with China and the USA to establish technological partnerships in emerging technologies and (2) to develop national technology strategies aimed at promoting autonomous technology development capabilities.

Social implications – This paper addresses the need for Latin America to take a strong stance for technological autonomy, stressing the differences in buying technology and making technology.

Originality/value – This paper presents an original framework of the relationship between technological transitions and hegemonic transitions in the international system. It discusses how technological leadership impacts the international order by establishing relations of technological dominance and technological dependency.

Keywords Technological transitions, Technological dependency, Technological autonomy

Paper type Research paper



Introduction

In recent years, China has obtained impressive achievements in catching up with world technological leaders. But the country is entering a very challenging phase in its catch-up process as it approaches the current technological frontier. Advanced technologies are the domain of the world technological leaders, and leaders fiercely defend their technological monopoly against contender countries that might compete for their technologies and markets. As the world approaches the watershed moment of a technological transition toward ubiquitous digitalization of products, services and social life in general, the dispute between incumbent and contender powers over technology tends to reach a climax. China's position as a pioneer and leader in 5G technology – the pervasive technology that will support core technologies of the next technological revolution – accentuates the dispute even further. How will this impact the international order, and how will it affect China–Latin America relations?

This paper examines the ongoing technological transition and its impacts on China–Latin America relations in light of changes in the international system's balance of power. China's leadership in those technologies has the potential to strengthen China–Latin America relations far beyond the current trade and investment trends. These relations will depend not only on the will of the countries of the region but also, and fundamentally, on China's position in the world as a technological provider vis-à-vis the USA and ultimately on the direction of changes in the international order. This scenario opens opportunities for Latin America's technology development if the region's countries can implement national strategies to overcome technological dependency. It also poses constraints for Latin American countries because the transition to a new technological paradigm can consolidate its technological dependency for several decades.

Technological transitions and international relations

There is abundant historical evidence of the connection between technological leadership and hegemony in the international system. From the first technological revolution in the 19th century to the present day, the political, economic and military hegemon also has pioneered the development of the central technologies in each successive technoeconomic paradigm; power transitions in the international system have also occurred hand-in-hand with technological transitions (Perez, 2009; Arrighi, [1994] 2010; Toledo, 2019).

The periodization of technoeconomic paradigms maps elegantly onto the periodization of hegemony cycles and power transitions in international relations. In her seminal work on technological revolutions, Carlota Perez, in dialogue with neo-Schumpeterian interpretations of the history and dynamics of technology, dates the first technological revolution circa 1770 having Great Britain as the core country, and the second technological revolution circa 1829, followed by the third technological revolution circa 1875. The period corresponds to Arrighi's definition of Great Britain's tour as hegemon, from the 1770s to the 1870s. Great Britain's fall from dominance as the international system's hegemon is contemporary to the third technological revolution. Both transitions – the power transition in the international system and the technological transition – happened during the same period.

The third technological revolution (circa 1875) and the fourth technological revolution (circa 1908) witness multiple technological races between the USA and Germany, the countries pioneering the innovations of the third technoeconomic paradigm. Great Britain, France and Japan follow closely behind. The USA eventually won the contest and became the hegemon, a position it would consolidate in the immediate aftermath of Second World War.

The USA's role as the hegemon in the international system would face a critical challenge in the 1970s, concurrently with the fifth technological revolution (the beginnings of the ICT technoeconomic paradigm). The USA faced fierce technological competition from Japan. Still, it eventually secured the fifth technoeconomic paradigm's leadership and reasserted hegemony in the international system and its position as a technological leader.

The relationship between technological leadership and hegemony in the international system is clear from the historical evidence presented above: power transitions in the international system coincide with technological transitions. From this general statement, we propose the following hypotheses: China's rise and the challenge to the USA's hegemony will ultimately be defined by the contest for leadership in the ongoing technological transition (that may or may not give rise to a new technoeconomic paradigm). If China wins the contest for technological leadership, it will likely occupy a central role in the international system, displacing the USA in its role of technological leader and hegemon in the international system in many, if not all domains.

What will the future of technology and international relations look like in the following decades? Will China be able to position itself as the technological leader? How will this impact the balance of power in the international system? Will the USA willfully accept China's leadership in technology and its more assertive and central role in international relations?

Most importantly, from our standpoint, is how this will impact Latin America's technological development. Will the region continue in its historical role as a peripheral, natural resources-exporter region, dependent on technologically advanced countries, shifting from a US-centered technological dependency to a China-centered technological dependency? Or will the technological transition *cum* power transition in the international system from the dominance of the USA to China (assuming China will come out as the winner of this contest) offer new possibilities for Latin America under a new type of technological partnership with China?

Overcoming technological dependency or getting stuck in it

Regarding Latin America's position in the world economy, the basic tenets of Latin American structuralism and dependency theory still hold. Latin American economies specialize in the export of natural resources, importing technology in tangible and intangible products. This fact makes the region dependent on advanced countries in the technology sector. Latin American economies are far from the current technological frontier. The technological frontier is advancing rapidly in the current technological transition, making it even harder for Latin American countries to close the gap with the more advanced economies.

Latin American countries will need to implement a technological development strategy that combines access to foreign, more advanced technologies and indigenous technological development to overcome technological dependency. If successful, it will achieve technological autonomy in several (but not all) core technologies of a technological paradigm. Technological autonomy is not technological autarchy: the goal of technological development should not be thought of as achieving dominance and leadership in every relevant technology but as a means of reaching a delicate balance between the use of foreign technologies and the creation of domestic technologies.

The make or buy dilemma that applies to a firm's technological strategy – a decision over either developing technology (make) or using technology developed by other firms (buy) – also applies to countries. A national technology strategy should define which technologies a country will access as a user and which technologies it will develop indigenously.

A country's decision to access foreign technology is conditional on the country that controls the technology giving access to it. Access to foreign technologies varies in a spectrum that goes from no-access (as in the case of nuclear and space technologies, e.g. access to the technologies for the development and production of advanced strategic deterrence weapons systems) to end-user access, with licensing, joint venture, royalties, technological alliances, etc., falling somewhere in between.

Advanced, state-of-the-art technologies – i.e. the technologies close to the current technological frontier – are subject to technological monopolies: It is virtually impossible for a foreign country to access them. Access to mature or obsolete technologies – i.e. technologies distant from the technological frontier – is more straightforward but does not guarantee that

the country accessing that technology will close the gap with the more technologically advanced countries.

As for the indigenous development of technology, there are also many possibilities. Success will depend, ultimately, on the existence of a fine-tuned techno-productive system in which institutions, human resources, and firms interact in ways conducive to developing national technological and innovation capabilities.

It is essential to let go of all of the illusions of a national technology strategy magically coordinating itself through price-formation market mechanisms. In history, there is not one case where a country has achieved long-term, sustained development without the strong coordination of the state. The state should provide goals, and means for achieving them, in an environment where individuals and firms have strong market and nonmarket incentives to raise productivity through technology-intensive means. State coordination and market competition are the necessary foundations of a national technology strategy.

To overcome technological dependency, it is necessary to (1) implement a national technology strategy and (2) establish technological cooperation with more technologically advanced countries. During the phase of “normal technology” (in the sense of Thomas Kuhn’s concept of normal science), the choice of technology partners is straightforward: The technological leaders are the default choice, though it is possible to adopt alternative strategies by cooperating with advanced followers of the technological leader (e.g. Brazil’s Nuclear Cooperation Agreement with the Federal Republic of Germany in the 1970s or the China-Brazil Earth-Resources Satellite in the 1980s). During a paradigm shift – a “technological revolution,” in Kuhn’s and Perez’s terms – the choice of technology partners is more complex, as there is (still) no clear technological leader in the frontier technologies currently being developed.

This is the challenge that Latin American countries now face regarding the choice of technological partners. Stakes are very high because ultimately, the success or failure of a technology development strategy will depend on who comes out as the leader in the current technological revolution and who falls behind as a follower. A sound strategy would combine forging technology alliances with the USA, the technological leader in the current technoeconomic paradigm, and with China, a rising technological power.

Latin America does not need to and should not have to choose to side with the USA *or* China; it should side with the USA *and* China. The region has longstanding trade and technology ties with both the USA and China and will continue to have in the foreseeable future. But Latin American countries will have to choose between individual technologies pioneered by China or by the USA, and this choice will have implications in the coming decades.

The adoption of core technologies of the emerging technoeconomic paradigm will have far-reaching implications in the following decades. Setting technological standards, establishing technological alliances, affecting trade and investment and, ultimately, defining how the region will integrate into the world economy and the international order will depend on it. What will the international order look like in the coming decades? Will it be an American-dominated international order based on American interests, values and technologies or will it be a Chinese international order with Chinese interests, values and technologies? We address this question in the following section before discussing the consequences of the transformations in the balance of power and the technoeconomic paradigm in two sectors: next-generation information and communications technologies and global health goods.

The forging of the American international liberal order

The so-called liberal international order established by the USA after Second World War achieved mixed results. From 1945 to the mid-1970s, it presided over the most substantial

reduction of the differences in income and productivity levels between core and peripheral countries. Many countries at the periphery of the system experienced the combined process of industrialization, urbanization and technological catch-up that would promote a significant, if incomplete and short-lived, socioeconomic convergence with the former. Post-WWII international order also set the stage for decolonization-cum-independence movements in Africa and Asia, and the new international order ended 500 years of colonialism and imperialism. The period was also one in which the global diffusion and supply of public health goods – above all the distribution of antibiotics and vaccines – combined with rising income per capita, promoted higher life expectancy and increased living standards for vast swaths of the world's population.

A significant part of those events took place under the institutions of the liberal international order: the United Nations system; the ideas and politics of self-determination; the Bretton Woods agreements and its institutions; the General Agreement on Tariffs and Trade; the rise of the multinational corporation; the US dollar; the Cold War and the gray area in between the US and Soviet blocs that left space for some degree of autonomy for the nonaligned nations. Two crossroads marked this institutional, economic, political and ideological order in the 1970s and again in 2008.

The crisis that struck the capitalist world system in the mid-1970s had three dimensions. It was a global economic crisis, reducing growth both in the system's core and its periphery. It was a geopolitical crisis, as in the oil crises of 1973 and 1979. And it was ideological, expressed in the global ascent of the formerly fringe radical ideology of neoliberalism. Many scholars and pundits interpreted that triple crisis as the beginning of the decline of US hegemony and the rise of an Asian power, Japan. By the end of the 1980s, the maturing of the fifth technological revolution (information and communications technology), the entrance of neoliberalism into mainstream political discourse and policy, Japan's plunge into stagnation, and the collapse of Eastern European socialism and later of the Soviet Union itself, gave pause to the interpretations of American decline. The USA reasserted itself not only as hegemon but as an uncontested one for that matter.

The 1980s and 1990s marked a comeback for US hegemony. American finance and tech corporations stormed the globe, allowing for a decade of sustained growth and near-full employment. Technological leadership was again in the USA's hands, and Japan slipped back into a position of technological follower, holding its leadership only in a handful of high-tech sectors.

American hegemony went without serious contestation for twenty years. Neoliberalism was promoted to ideological orthodoxy: there was, preached its apostles, no alternative. Oil prices soared, and the global energy supply was threatened by coordination between OPEC members? No problem, bomb them back to the stone age and go full throttle into oil-grabbing mode. As for the liberal international order, the USA was now in the position to impose it at its will, with no significant opposition whatsoever.

In the 40 years from the mid-1970s, US-China rapprochement to the 2012 Pivot to Asia rebalancing strategy under Barack Obama, China, strived to adhere to the liberal global order first imposed by the USA in 1945 and then re-established in the 1980s and 1990s. Many China analysts, foreign and Chinese alike, have pointed to how China has benefited from the liberal international order since 1978 at the outset of the Reform and Opening Up period. Not few have stressed how Chinese elites have sought acceptance in the liberal international order and their willingness to comply with it and adhere to global governance institutions, rules and practices.

The 2008 financial crisis, rather than halting China's economic growth, elevated her importance in the global economy. In the past 10 years, China has consolidated its position as a leading international trade and investment partner. China has become a player with whom the vast majority of countries need and want to engage in the most extensive ways possible.

The image of China as a nonrevisionist rising power that not only abides by but is dependent on the current liberal international order has gained wide acceptance in academia and the media. Paradoxically, it is not the rising nation, China, but the status quo nation, the USA, that is contesting and revising the liberal international order in reaction to China's development.

Under the Trump administration (2017—21), the USA moved away from its commitments to the liberal international order. The techno-trade war waged by that country against China is the more prominent example (Wei, 2019). How should we interpret this move? Is it similar to the reformation of the liberal international order the USA engaged in from the 1970s to the mid-1990s, from the end of the dollar-gold convertibility through the ending of the General Agreement on Tariffs and Trade and the establishment of the World Trade Organization? Or is the liberal international order set for some more fundamental transformations?

What should we expect as a result of China's ascent regarding the international order? Will the liberal international order be reaffirmed with minor adjustments? Will it undergo more significant changes, or will it come to an end? If so, will it be replaced by a different international order, possibly in the making, or will the world plunge into a period of systemic chaos in which no nation can impose a new international order?

The dying – or changing? – liberal international order: likely and (unlikely) scenarios for the future of global governance

In the last couple of years, the USA has unilaterally taken steps to move away from the international commitments to the liberal international order it imposed and reimposed to the world in the last 75 years (Mearsheimer, 2019). By doing so, the USA expects to cut off China from the global governance architecture that has enabled, or at least not prevented the country from rising as a major global power second only (for the time being) to the USA itself.

In its three-quarters century history, the liberal international order has taken many forms. The term describes a broad set of principles, institutions and rules, many of which have changed over time. In its most general sense, it defines the international order of US hegemony since 1945. Some institutions have survived. Others have perished. Others still have morphed into different social constructs, not rarely departing from earlier institutional forms, principles and rules.

Being both a construct and an instrument of US hegemony, the liberal international order has received extensive support from the USA and its allies. Historically, critiques directed toward the principles, rules and institutions of the liberal international order, no matter how vocal, have led to its reform, not to its upending. Many analysts interpreted the Trump administration's approach to the liberal international order as delivering clear signs, sometimes translated into actions, of departing radically from the US commitments and interests that took shape in that same order – the order itself having been created to impose US interests across the globe (Brattberg & Kimmage, 2020; Patrick, 2020). Has the liberal international order become dysfunctional to US hegemony? It is hard to say. On the other hand, the liberal international order has not stopped China's rise since the Reform and Opening Up era; quite the contrary. Although the liberal international order might not have been straightforwardly beneficial for China, there is no doubt that China has learned how to use it to favor her interests (Yan, 2018).

Has the liberal international order promoted China's rise and, thus, the USA's decline? This interpretation has gained supporters in the more hawkish foreign policy circles in America. Provocative as the idea might be, it ignores that the USA has benefited and still benefits from the liberal international order *and* China's rise as an economic powerhouse. Off the mark as it may be, the idea that the liberal international order no longer serves the USA's interests has influenced US foreign policy toward China.

What is China’s current standing regarding the liberal international order? Assuming that the liberal international order was beneficial to China’s rise, does this mean it will continue to benefit China in the near future? Will China be blocked out of the liberal international order institutions, out-ruled, and accused of not adhering to its principles? In this case, what should China do? Should China reaffirm the commitments to the liberal international order? Or should China put the liberal international order on stand-by and commit to the building of the principles, rules and institutions of a new, genuinely multilateral international order that veers away from the zero-sum game that has presided the liberal international order, moving toward a win-win framework in global governance?

To better grasp what is at stake, we propose four scenarios that describe China and the USA’s possible approaches to the current and future international order. We present them in a two by two table. The scenarios have two players whose actions are modeled as dichotomous variables: either “stays in the liberal international order” or “departs from the liberal international order.” We examine the four possible outcomes of the combined actions of China and the USA and their effects on the resulting international order (see Figure 1):

There are three scenarios in which outcomes result in maintaining a complete or transformed liberal international order. The fourth is a big question mark: We define it tentatively as a postliberal international order under systemic chaos. We do not risk defining its basic features, but we think it will likely plunge the international system into a period of conflict and noncooperative behavior between national states.

In the first scenario, China and the USA both renew their commitment to the liberal international order by “staying” in it, thus accommodating themselves to one another. From a historical perspective, this would mean going back to the status quo that prevailed from China’s accession to the World Trade Order (WTO) in 2001 up to the Trump administration. This outcome is neither easy to reach nor likely to happen since it depends on the USA de-escalating its current China policy.

In the second scenario, China withdraws its commitments to the liberal international order, and the USA reaffirms its earlier commitments to it. This outcome would see the USA reassuming its leadership of the liberal international order and China as a free-rider, adhering to the liberal international order in specific issues if and when benefiting its national interests. We can draw a historical parallel with the period from Reform and Opening-Up to China’s joining of the WTO. Compared to that period, though, China would have less leeway in international affairs. The USA and its allies would be more aggressive in trade and investment, environment and China’s internal affairs.

In the third scenario, China keeps its commitment to the liberal international order, and the USA withdraws from it. The liberal international order would very likely be reformed and updated to meet the current economic and political international context and China’s new role as the co-leader (most likely along with the European Union, India and possibly Japan) of this

		China	
		Stays	Departs
United States	Stays	<i>Liberal International Order, China, and the United States accommodate</i>	<i>Liberal International Order, China as a free-rider</i>
	Departs	<i>Liberal International Order with Chinese Characteristics</i>	<i>Post-Liberal International Order under systemic chaos</i>

Figure 1.
The future of the international order: four scenarios

renewed liberal international order. We define this outcome as a liberal international order with Chinese characteristics. Because China would need to count on the adherence of the vast majority of countries with which it has economic and political ties, there would be ample space for building a more inclusive, less hegemon-centered international order. China would have to make concessions to prospective adherent countries to guarantee this international order's legitimacy, making a win-win result more likely. In this hypothetical liberal international order with Chinese characteristics, China would be able to merge the many institutions and initiatives the country has been building in the last couple of decades with some of the existing liberal international order institutions.

The fourth scenario, in which China and the USA withdraw from their commitment to the liberal international order, is the most likely right now and also the most inauspicious. The resulting international (dis)order would have multiple coexisting principles, institutions, and rules and third countries would sooner or later be forced to choose sides. Uncertainty would be rampant. The lack of predictability would cause states to entrench in their national interests, now defined narrowly under an international system in which commitments cannot be upheld or enforced. It would be a free-for-all situation similar to what Giovanni Arrighi described as systemic chaos (Arrighi, [1994]2010). The world would plunge into a fierce, open competition between China and the USA, which most likely would be joined by other major powers as allies or competitors on their own – the European Union, Russia, India, Japan. From a historical perspective, the international system would have strong resemblances with the context leading up to the war of 1914: a shattered liberal economic order, the decline of the hegemon and the rise of both traditional and ascending national powers contending for preeminence in the international system. Eventually, a state (or a group of states) would come out as the winner of the contest for hegemony and impose its international order. This process, of course, would take a long time.

Although it is not clear the outcome of the current tensions between the USA and China, it is evident that whatever happens to the international system will require changes in the current international order (Layne, 2020). To what degree the international order will be reformed, no one can tell (Nye, 2020). In the next section of this paper, we discuss two knowledge-intensive areas in which China's leadership offers inroads to some pressing issues that will shape the international system in the coming decade: next-generation information and communications technologies, and global public health goods. The need for a new framework for global governance of these issues offers China the opportunity to influence the international order in ways more conducive to the country's goals. It will also speak to the interests of all those countries that have not been significant beneficiaries of the liberal international order, whose growing grievances reached unparalleled heights in the aftermath of the 2008 global financial crisis, as is the case of Latin American countries.

Next-generation information and communications technologies and global health goods

China holds a critical competitive advantage in two areas that will shape technology and impact international relations in the coming decade: information and communications technology and a provider of global public health goods. We treat China's current competitive advantages in information and communications technology, and as a provider of global public health goods, as an evolving, transitional position in which leadership is continuously put in check by competing firms and states. Politics is currently the driving force of international competition in those two areas, while economic and technological considerations have taken the back seat. In the next couple of years, we will have a clearer picture of emerging trends. Profound changes can occur much earlier, as domestic and international politics evolve at a highly unpredictable pace due to the coronavirus pandemic and the growing tensions in international politics.

We believe that China's economic and technological leadership in information and communications technology and as a provider of global public health goods will not suffice to reposition the country in the changing international order. China will have to adapt and transform the current global governance system – or build a new one – to allow other countries to benefit from China's advances in those areas. And China has a unique advantage that should be taken into account. Apart from a handful of countries closely aligned with the USA, the rest of the world wants and needs to share in China's advances in those areas.

Changing the international status quo will not be an easy task, though. The institutions and rules of governance of the liberal international order are being watered-down and neutralized. Simultaneously, the issues regulated by global governance institutions are being weaponized by the USA and its closest allies, bypassing those same institutions. Trade, intellectual property, global health and environmental issues will be increasingly used to project power and impose the US-led block's interests. In the coming years, global governance's geopolitical dimension will likely be further expanded and explicitly addressed by states, with liberal international order ideas and vocabulary giving way to an increasingly zero-sum game mentality.

Emerging information and communications technologies

Current advances in 5G networks and artificial intelligence technology will change the technological and productive landscape in profound ways (Majerowicz & Medeiros, 2018; Majerowicz, 2020). The advent of these technologies can inaugurate a radically new technological paradigm (Perez, 2009). There is reason to believe that 5G, artificial intelligence, and other technologies will have far-reaching effects on institutions, behavior, culture and values. More importantly, leadership in those technologies will be one of the main driving forces behind countries' repositioning in the international system Yan (2020).

That is the reason why the ongoing "trade war," more aptly described as a techno-trade war, is so important. Through its techno-trade war on China, the USA is trying to prevent China from approaching the current technological frontier. There is reason to believe that the world is close to a technological revolution. The ubiquitous digitalization of virtually every aspect of social life will sooner or later have wide-ranging, epochal effects on all societies and the international system. Leadership in the development and diffusion of these technologies will strongly influence the structure of the international system in the coming years.

The USA's technotrade war will leave China no other option but to accelerate its technological catch-up. If the technotrade war succeeds, China will find itself stuck in a middle technology trap. It will have provided powerful incentives for China's life-or-death take at the final technological development stage if it does not succeed.

The emerging technologies of 5G and artificial intelligence will demand global governance mechanisms to assure not only technical standards of interoperability, security and privacy. Still, they will also build a cooperative environment in which initiatives from different countries, public or private, can work together to reach ample diffusion and guarantee broad access to the results of specific advances in those and accompanying technologies, as well as in the benefits that come with them. China's Standards 2035 plan aims to establish the next generation of ICT standards, creating the institutional framework for those emerging technologies. It is doubtful that current institutions and rules of governance will provide a favorable environment for the technological advances and geopolitical disputes at the core of the technotrade war. A new framework is set to emerge soon.

Global public health goods: sanitary security and collaboration

The post-COVID-19 world will put global sanitary security at a very high priority, and China has already taken the lead in this critical issue. China's emerging role as a global leader in

sanitary security has brought renewed prestige to the country. The world now turns to it as a model and partner for dealing with the COVID-19 pandemic. Affected countries in all continents have benefited from China's sanitary expertise and industrial, scientific and technological inputs such as medical protocols, pharmaceutical products, medical supplies, equipment and, most importantly, vaccine development and production.

China is currently providing a global public health good in the form of sanitary security through vaccine supply (Hotez, 2014). Dealing with a highly contagious virus is not a new experience for China, though, neither is her leading role in response to a global epidemic. In 2002–2004, China had to face the SARS outbreak. In coordination with affected countries and the World Health Organization (WHO), China developed critical expertise on fighting a fast-spreading epidemic. Western specialists in global public health and international organizations recognize China's know-how in this regard.

China's role as a model for dealing with public health emergencies will soon expand since China is months ahead in the COVID-19 timeline. Just as China has shown the world how to fight off the disease, the country will also show how to deal with the postpandemic scenarios and how to enter the new normal – whatever that means – as China is a firstcomer to this new phase. China is now beginning to experiment and develop policies for the post-COVID-19 period the country is entering. This experience will be a source of knowledge for other nations regarding how to restart economies and societies.

The international press has rightly characterized the pandemic as a “global test of governance quality.” International cooperation is the keyword in handling the COVID-19 pandemic. Today's value chains are spread worldwide, and it is in every country's best interests to cultivate good diplomatic relations with their commercial partners. But the present institutions of governance in global health issues are under attack. As a central institution of the liberal international order, the World Health Organization will be impacted by changes to the global governance architecture. China can play a leading role in global governance in health issues (Campbell & Doshi, 2020). More than a mere provider of global public health goods (in the form of vaccines and medical know-how), it can also establish a new framework for the emerging and pressing issues in global health governance (Smith & Fallon, 2020).

A changing international order: what role for Latin America–China relations?

What is the future of the current international order? Although the odds of the liberal international order being restored are dimming, one should not rule out the possibility of a zombie apocalypse scenario in global governance in the next decade, our fourth scenario in the analysis above, in which both China and the USA withdraw from the liberal international order. In this scenario, institutions and rules of the liberal international order will not go away. They will still be roaming around like walking dead, no longer displaying the strength and vitality they once had when they were alive but not quite yet finished. States will seek solutions that bypass the presence of those zombie institutions and rules. But they will very likely self-limit their governance-building efforts and their willingness to depart once and for all from the liberal international order due to the constraining effects of the presence of the half-dead institutions and rules of the late international order. The result would be the lack of incentives for the creation of a new international order. In this scenario, the world will see too little, too late being done regarding global governance improvement.

And who can blame such lack of initiative? After all, states will have to consider possible gains from a not yet clearly defined international order: Will it be nonliberal? Will it be postliberal? Will there even be an international order for the following decades or are we bound to plunge into the systemic chaos that characterizes transitions in the international system?

As Perez (2010) has argued, technological revolutions offer an opportunity for catching up for latecomer countries. Will Latin American countries be able to benefit from the current

technological transition? For this to happen, countries in the region will have to implement national technology strategies that simultaneously develop indigenous technological capacities that access and interact with foreign technologies to achieve technological autonomy. The USA has made clear it has no intention of establishing technological partnerships with Latin America. And the USA is currently lagging behind China in terms of information and communications technology and as a provider of global health public goods, a situation that will not change soon.

What about China? Is it willing to establish technological partnerships that will enable Latin American countries to go beyond their traditional role as users of technology and participate in developing next-generation technologies? There is also no indication that this will happen.

The real challenge, though, lies not in the possible technological partners, but the lack of national technological development strategies all over the region – and here we refer not to government plans presented in glossy official reports, of which there is no lack of in the region and, for that matter, in the world. The countries in the region lack a robust strategy to overcome technological dependency and achieve technological autonomy. Engaging as users of next-generation technologies will keep Latin American countries in their centuries-old position as peripheral countries exporting natural resources and importing advanced technology incorporated in goods and services.

The current technological transition is one in which Latin America can, and should, bargain pragmatically with the countries competing for technological leadership and adopting its technologies and technological standards. The deal should put countries in the region in a more favorable position and establish true technological partnerships. Latin America's role as a user of foreign technologies – American and Chinese – has only a marginal contribution to technological development. Indigenous development of technology will be central for the countries in the region.

Establishing effective technological partnerships will not be easy, though. Latin American countries currently lack the absorptive capacities to engage with production and development even of older, earlier generation information and communications technologies. And it is not clear what role the productive systems of the region can play in the global value chains of ITC other than end-users. Developing the technological capacities that would allow Latin American countries to engage in technological partnerships with ITC technology leaders is currently a distant goal. And there is no guarantee that, if countries in the region choose to implement catching-up policies in ICT, leader countries will not kick away the ladder (Chang, 2004), barring the countries in the region of implementing the types of public policy that can support a catching-up strategy in advanced technology sectors.

There is also a more profound reason that raises doubts about Latin America's chance of engaging in effective technological partnerships in ICT with the technological leaders. The productive systems of the countries in the region being so distant from the technological frontier in ICT sets the time horizon for catching up in a distant future, no earlier than two decades from now. But 20 years is a long time when it comes to technology development, and it could well be that in that time, the world will have seen a new technological revolution and have transitioned to a new technological paradigm (Perez, 2009, 2010), rendering the efforts to catch-up in current ICT useless. This will maintain Latin American countries in a position of technological backwardness and technological dependency, as the productive systems of the region will be stuck in a technological paradigm that might have become obsolete.

These legitimate doubts invite countries to a cautious, step-by-step, you-go-first mentality regarding building new global governance institutions adapted to the changing international system. However, bold action is urgent.

In the last two decades, China and many developing and emerging countries have taken significant steps in building the institutions of a new, non-US-centered global governance

framework. To this day, those new institutions have coexisted with the older institutions of the liberal international order (Mahbubani, 2020). Coexistence can and should be peaceful. But these new institutions are now mature enough to take on broader responsibilities. And there are quite a few issues that offer a solid starting point for the renewal of global governance.

Building a new institutional framework for global governance in information and communications technology and global health is not only possible but urgent. The 2002–2004 SARS crisis inaugurated, and the COVID-19 pandemic consolidated a new era of “post-Westphalian” global public health, in which sanitary concerns transcend national borders (Horton, 2020). Pandemics, as we all know by now, erode nation-states’ omnipotence, calling for global cooperation and collaboration. What is in order is a roadmap to a comprehensive reshaping of the institutions and rules of global governance of the international system in a changing world that needs to cooperate and share the benefits of technological and institutional transformations. Latin America should strive to be an active participant in these transformations and benefit from the opportunities that open up during technological transitions.

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