



Technological Innovations and Future Shifts in International Politics

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How are large technological changes and important shifts in international politics interconnected? It is shown in the article that primary technological innovations, which take place in each Kondratieff cycle, change the balance of power between the leading states and cause shifts in international politics. In the beginning of the twenty-first century, the genesis and initial development of the cluster of new technologies takes place in periods of crisis and depression. Therefore, the authors forecast that the period 2013–2020 will be marked by the advancement of important technological innovations and massive geopolitical shifts in many regions of the world.

General Connection between Technological and Political Development

Technological development and shifts in international politics are usually analyzed separately, since the development of technologies is traditionally the prerogative subject of natural and technical sciences, while changes in international politics are analyzed in the framework of political science and international studies. Meanwhile, according to the world-system approach offered by Fernand Braudel and Immanuel Wallerstein, and approaches based on analysis of Kondratieff long waves, there is a close connection between technological shifts, changes in the world economy, and shifts in international politics. As Modelski and Thompson (1996) have shown, shifts in technological development lead to shifts in world political leadership.

What is the essence of the connection between important technological innovations and shifts in international politics? Before answering this question, we should briefly analyze the development dynamics of new technologies. There are different concepts and perceptions of dynamics and trends in technological development. In our opinion, one of the most realistic and effective approaches is the one which assumes that deep economic crises and depression stimulate basic technological innovations and the emergence of new technologies (Mensch 1979; Freeman

1987; Perez 2002). During a subsequent economic upswing, innovations that have emerged diffuse and form a basis for the development of new branches of industry and types of services (Hirooka 2006). At the same time, periods of the longest and most severe crises and depressions correspond with downswings (B-phases) of Kondratieff waves (Kondratieff 1935; Schumpeter 1939; van Duijn 1983). Therefore, many important technological innovations appear during downswings of Kondratieff waves (Kleinknecht 1987; Hirooka 2006; Mensch 2006:80–90), and new branches of industry based on these innovations experience rapid development during the upswings (A-phases) of K-waves (see Table 1).

Thus, important technological shifts consist of several stages: at the first stage, basic innovations emerge, and at the second stage, new branches of industry are shaped in the most developed countries and then expanded throughout the world. Despite the doubt expressed by many economists and political scientists concerning the existence of Kondratieff long waves, the alternation of periods of deep crises, depressions, and periods of booming economic growth testifies to their existence. Such alternation, that is, the presence of the K-waves, is likely to have existed also in the pre-industrial period, before the first cycle defined by Kondratieff (Modelski and Thompson 1996). However, in this work, we consider Kondratieff waves since the beginning of the industrial age, that is, from the end of eighteenth century, when crises and depressions became particularly notable. Now, in the beginning of the twenty-first century, we are likely to be experiencing another of these periods of crises and depressions (Stiglitz 2010).

At the same time, one of the main and most difficult problems is not so much the existence of Kondratieff waves itself, as their exact dating. Correctness of historical analysis and precision of forecasting international economic and political development depend to a large extent on this dating. Table 1 gives a dating of the first two K-waves and the first half of the third K-waves defined by Nikolai Kondratieff himself (1935). This dating was based on statistical analysis. The dating of the second half of the third K-wave and the fourth K-wave can be found in the works of many authors (for example, Mandel 1980; van Duijn 1983; Wallerstein 1984). The dating of the fifth

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TABLE 1. The Main Industries in Different Kondratieff Waves

<i>Kondratieff wave</i>	<i>The period of the K-wave (upswing and downswing)</i>	<i>The main industries</i>
1 st	From the end of the 1780s to the beginning of the 1850s	Cotton industry, industries based on steam engine
2 nd	From the beginning of the 1850s to the end of the 1890s	Railway construction, steel production, steam ship construction
3 rd	From the end of the 1890s to the middle of the 1940s	Electrical and heavy engineering, inorganic chemistry
4 th	From the middle of the 1940s to the beginning of the 1980s	Automobile industry, aircraft building, atomic energy, organic chemistry
5 th	From the beginning of the 1980s to the beginning of the 2020s	Microelectronics, personal computers, Internet
6 th	From the beginning of the 2020s to the 2050s	Biotechnology, advanced information technologies, new sources of energy

K-wave given in Table 1 is based on the empirical observation of a small shortening of K-waves at the expense of a general acceleration of the world-system development, as well as on realized forecasts following from such dating. As far back as 1996, we forecasted a change in post-crisis world development dynamics in the early 2000s (in reality, the crisis took place in 2000–2001) and the entry of the world system into a period of crises, depressions, and political shocks after the year 2005 (Pantin 1996:131–133). Certainly, other variants of K-wave dating are also possible. However, any conclusions and forecasts following from them should correspond with the real dynamics of political and economic development.

But why are new technologies, industries, and social institutions unable to establish themselves immediately, without economic crises and recessions, without cycles and waves? The answer is obvious—because old technologies, industries, and institutions prevent the establishment of the new ones, and only crises make it possible to replace the old ones with more effective structures.

The interconnection between large-scale technological changes and shifts in international politics is shown in Table 2, where Kondratieff waves and corresponding large shifts in international politics are given. Here, we should pay attention to the fact that important changes in world politics began in the previous Kondratieff wave; they end and become irreversible only in the next wave. For instance, the fall of the old feudal order with its absolutist regimes in Europe was initiated during the first Kondratieff wave by the French revolution in the late eighteenth century and by the Napoleonic wars, but was temporarily slowed down after the collapse of the Napoleonic empire. The Holy Alliance of Russia, Prussia, and Austria emerged, which preserved the old semifeudal

order in Europe up to the late 1840s. Change of the former world order became complete during the second Kondratieff wave, soon after the defeat of Russia in the Crimean war, the Civil war between the North and the South in the United States, and the association of Germany and Italy. Something similar happened during the third and fourth Kondratieff waves. First, the former world order based on the British leadership and European states' colonial systems was shaken, but was generally reestablished.

President Woodrow Wilson's efforts aimed at establishing a new world order right after the end of the World War I did not succeed. Only after World War II did the former colonial systems collapse and a new world order emerge, based on a new, freer movement of people, ideas, capitals, goods, and information.

On the basis of a more detailed analysis of the technological shifts and historical events stated above, it might be supposed that large shifts in international politics include two stages. The first stage is characterized by crisis and the loosening of the former world order, driven primarily by rapid development of new technologies. Due to the insufficient development of the new technologies, the former world order partly evens the score and revives. It is testified to by the defeat of the Napoleonic empire and the creation of a Holy Alliance, called to preserve the status quo in Europe and in the world during the period of the first Kondratieff wave; by the preservation of British economic and political leadership despite the rapid development of Germany and the United States during the second Kondratieff wave; by the preservation of the former colonial empires of the European states in the period of the third Kondratieff wave, and so forth. Only during the second stage, that is, during the next

TABLE 2. Kondratieff Waves and Changes in International Politics

<i>Kondratieff wave</i>	<i>The period of the K-wave (upswing and downswing)</i>	<i>The main changes in international politics</i>
1 st	From the end of the 1780s to the beginning of the 1850s	Formation of the United States, Napoleonic wars, Holy Alliance between Russia, Prussia and Austria
2 nd	From the beginning of the 1850s to the end of the 1890s	Crimean war, formation of German empire, Civil war in the United States
3 rd	From the end of the 1890s to the middle of the 1940s	The First and the Second World Wars
4 th	From the middle of the 1940s to the beginning of the 1980s	"Cold war" between Western countries and the USSR
5 th	From the beginning of the 1980s to the beginning of the 2020s	Collapse of the USSR, operations of NATO in Yugoslavia, Afghanistan, Iraq, and Libya
6 th	From the beginning of the 2020s to the 2050s	???

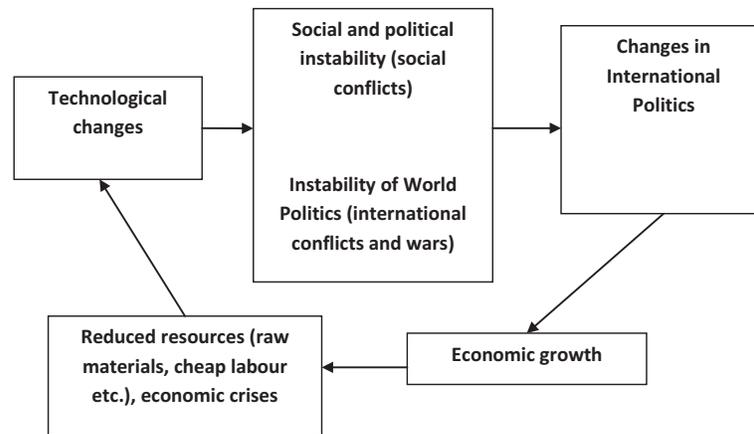


FIG 1. The Interaction between Technological and Political Changes

Kondratieff wave, the shaken former world order gives way to a new one as new technologies and social institutions spread and change the whole world.

It appears that the general reason for the interconnection between large technological changes and shifts in international politics is that basic technological innovations and rapid development of new branches of industry tip the former balance of power in world politics and the world economy. The states which were the first to introduce the most important innovations pull ahead in economic, political, and military dimensions by forming new coalitions. Consequently, former coalitions in international politics give way to new ones. The most striking instances are Germany in the late nineteenth and early twentieth century (third Kondratieff wave) and the United States in the second half of the twentieth century (fourth Kondratieff wave). In the first case Germany, in place of the former union with Austria-Hungary and Russia, formed the Tripartite Alliance directed against Russia and France. In the second case, the United States, in place of the alliance with the USSR against Germany and Japan during World War II, established the North-Atlantic Treaty Organisation which included the Federal Republic of Germany, and was aimed against the USSR, and also formed a political and military union with Japan.

The general interconnection between technological shifts and changes in the international politics is illustrated in Figure 1. It follows from Figure 1 that serious changes in international politics are caused by large technological shifts, but are not immediate. First of all, technological shifts give rise to social and domestic political instability in many countries, including developed ones. After that, instability in international politics intensifies, leading as a result to important geopolitical shifts and changes in the balance of power in the international arena. Along with technological and other changes, these geopolitical shifts form conditions for a fast economic growth by opening new markets and resources. However, some time after it turns out that such available resources as raw materials, a relatively cheap and qualified labor force, as well as former technologies can no longer meet the increased demands of economics. This results in a saturation of the market, a fall in demand for former production, and a slowdown in the former high rate of production growth. Economic crises occur, which stimulate new technological shifts, and the general cycle

repeats—this time on a new, higher level and in new conditions.

Modern Technological Development and Forthcoming Crises

The question of what technologies will dominate during the next decades is of high importance, since the answer to it determines the development strategies of the leading corporations and entire states. At the same time, this answer is debatable nowadays and looks different from various viewpoints. In our opinion, one of the most authoritative viewpoints is presented in the works of a Japanese researcher Masaaki Hirooka (2006), who analyzed in detail the development trajectories of various technologies. According to Hirooka, it will be computer technologies, multimedia, biotechnologies, genetic engineering, and ecologically clean power engineering that will form the basis of the new technological cluster. In the opinion of a Russian physicist and winner of the Nobel Prize in physics, Zhores Alferov, the transition to ecologically clean power engineering can be significantly influenced by solar cells which transform the solar energy directly into electric energy. We also consider the production of new materials, nanotechnologies, and, probably, superconductors to be important for the future technological development. Nanotechnologies are likely to be used together with biotechnologies and the production of new materials (for example, in the production of new plastics with complex, ordered molecular structure), rather than separately.

Moreover, the development and application of new technologies can have negative consequences as well. It often leads to anthropogenic disasters such as the one involving the “British Petroleum” deep water drilling oil platform in the Gulf of Mexico in 2010 or the one with the Fukushima nuclear power plant in Japan in 2011. Both accidents were connected with the application of relatively new and insecure energy technologies, which again underlines the necessity of a transition to more ecologically clean and safe energy sources. However, this problem has not been solved yet either on a national level or on a global one. The rapid development of China and India, moreover, can lead to the relatively fast exhaustion of easily accessible world oil and gas resources. As a result, this sharpening of competition for

energy resources can cause international political and military conflicts due to contested oil and gas deposits. Furthermore, the development of such new technologies as biotechnology and genetic engineering can conceivably lead to unexpected mutations of microorganisms, plants, and animals and to the emergence of artificially created viruses and clones, some of which may be dangerous or harmful for humans.

Nevertheless, the economic recessions and crises that have already started to stimulate technological innovations will bring about important technological and social shifts, and then shifts in international politics in the near future. However, based on preceding historical periods, one or even two crises are usually not enough to introduce basic innovations and develop new branches of industry. A period of economic, social, and political shocks is required for new technologies and branches, as well as new social institutions, to pave the way and press the branches and institutions which dominated before. The best examples here are the periods of the 1930s–1940s and the 1970s–early 1980s. In the first case (during the 1930s–1940s), such factors as the world crisis of 1929–1932, another economic crisis (1937–1938), and, finally, World War II were required for the new technologies and branches to gain a foothold and for rapid economic growth to commence worldwide. Meanwhile, the economic and political situation in the world would not have been so stable without the creation of such new international economic institutions as the World Bank, the IMF, GATT, and such political institutions as the UN and its Security Council, the Partial Test Ban Treaty, the Nuclear Weapons Non-Proliferation Treaty, and so on. In the second case (the period of the 1970s–early 1980s), such necessary factors were the crisis of 1969–1971, accompanied by the devaluation of the dollar and the actual abolition of the gold-dollar standard, the “energy” crisis (1974–1975) caused by the rise of oil prices, and, finally, the economic crisis of 1980–1982. It was only after 1983 when in the West and first of all in the United States, a steady economic growth began that was based on the introduction of microelectronics, personal computers, mobile telephone communication, and Internet. New branches of industry emerged, which pressed the dominating power. On the basis of this economic boost, such international organizations as the European Union, the International Monetary Fund, the World Bank, the World Trade Organisation, and others received a second breath. However, by the beginning of the 2000s, the impetus gained by the world economy and international politics from the introduction of new technologies and the institutional shifts of the 1960s–1980s was becoming exhausted. In turn, the exhaustion was indicated by a slowdown of economic growth in developed countries, the aggravation of social tension in developed and developing countries, and more frequent international political conflicts.

Therefore, it is likely that the global financial and economic crisis of 2008–2009 represents only the beginning of the next phase of serious shocks in international economics and politics. According to our estimates, this phase is likely to last till 2018–2020. The strongest consequences of the global crisis have taken hold in Europe in the form of the so called “debt crisis,” but are not restricted to it. The rise of food prices caused by the crisis has severely hit many developing countries, and in the Middle East, accompanied by other factors, it has stimulated a whole series of revolutions and civil wars.

Taking into account the economic cycles and the fact that the world economy and financial system are in an unstable condition, the next economic crises are very likely to break out in the periods of 2013–2015 and 2018–2020 (Dynkin and Pantin 2010:29–31). These crises almost surely will involve serious social and political shocks in many countries, as well as dangerous international conflicts. However, both current and future shocks, despite their burden for many millions of people, in the long term, will contribute to important technological, social, and political shifts. At the same time, in periods of crises and social–political shocks, it is highly important to manage them and calculate the possible implications of decisions in advance in order to minimize the wreckage and conflicts. No single state is able to do this alone, not even the strongest state in the world. New, wider coalitions of states and the cooperation of many countries are required to manage the processes that take place in the period of great shocks. Otherwise, if the crises and shocks take a spontaneous form, they may lead to huge casualties and even to a global disaster.

One should also take into account that in the modern age, the interaction of economic and political crises is reinforced by the influence of a prolonged global ecological crisis and its consequences. Global climate change, soil erosion, desertification, and the lack of drinking water, which is already felt in many regions of the world, will lead to more frequent natural disasters, great economic losses, and human casualties. Unfortunately, nowadays, the investments in new technologies, capable of reducing the destructive consequences of global ecological changes, do not correspond to the scale of the threat at all. Many states and their unions continue to increase their already substantial war potentials, while they remain helpless in the face of natural cataclysms. Modern international politics is to a lesser extent aimed at states’ joint resistance to natural and anthropogenic disasters, as well as to the consequences of the global ecological crisis. Nevertheless, sooner or later international politics should acquire a serious ecological dimension. The new cycle of technological development may also contribute to this important shift in international politics (Moody and Nogrady 2010).

Future Shifts in International Politics

As it follows from the analysis of the tendencies considered above, it is highly probable that large shifts in international politics and international relations will take place in coming decades. These shifts will in many respects be connected with the further development and massive introduction of new technologies, since the development of these new technologies will inevitably change the balance of economic, political, and military power between the leading powers, as well as between the key regional, economic, and political unions.

Important geopolitical shifts are most likely to take place in the Middle East, North and Sub-Saharan Africa, Central Asia, and South and South-East Asia. These regions are already marked by a heightened social and political tension caused by rapid population growth, high youth unemployment, and the aggravation of many social and ecological problems. Political revolutions and civil wars have already touched most countries in the Middle East and North and Sub-Saharan Africa. However, the geopolitical shifts in the Middle East and in Africa are far

from their end, since the main social problems there not only remain unsolved, but have also become aggravated as a result of the political conflicts. Moreover, the already accomplished or possible assumption of power by radical Islamites in some states gives new energy to the revival of plans to create “the Global Caliphate” and destabilizes the political situation in the entire world. Ironically, the spread and development of new information technologies (for example, Facebook, and other social networks) as well as of new types of modern arms often plays into the hand of terrorists, who actively use these technologies for their own purposes. Events that happened in the Middle East after the 2011 “Arab spring” show that one by one, countries of this region are falling into chaos, and the numbers, along with the quality of arms, of militants, including radical Islamites, are rising constantly. The social and economic problems of the Middle East and North African states after revolutions or civil wars are only intensifying, which leads to the formation of a huge region of instability that threatens other regions. Redivision of the political map of the “Greater Middle East” has already started, yet no one can predict its consequences. At the same time, the international community is still incapable of working out concerted and effective measures aimed at counteraction against the spread of international terrorism, which is acting under the banner of the radical Islam.

Central Asian countries have experienced an increase in social and political tensions connected with a rise in youth unemployment, unsolved social problems, and large-scale corruption. For the time being, the situation is in many respects stabilized by Russia, which receives a considerable number of migrant workers from Kyrgyzstan, Uzbekistan, and Tajikistan. However, this stabilizing Russian influence on the Central Asian countries is not boundless. The withdrawal of the United States and other NATO countries’ contingents from Afghanistan planned for 2014 may lead to the seizure of power in this country by the Taliban, which will seriously destabilize the situation in the whole of Central Asia, since Afghanistan is mostly populated by the same ethnic groups as Tajikistan and Uzbekistan, and the borders between these countries can be violated. In such case, Central Asia may become the next seat of international terrorism and a base for militants striving to establish “the Global Caliphate.”

East Asia is another potentially highly explosive region. In this region, which is the locomotive of the world economic development and is strategically important for international politics and global economy, the interests of the United States, China, and Japan are crossed. However, it is the fast economic growth of the countries of this region, changing the correlation of political forces, which has lately been the reason for the continuing aggravation of relations between China and Japan and North and South Korea. There is no doubt that the territorial dispute between China and Japan will not lead to a military conflict, since both countries are closely interconnected in technological and economic spheres. However, their political differences are too sharp, and none of the parties will make any concessions to the other, which means that in East Asia, a basis is being laid for a prolonged conflict between the two leading states of the region, unsolvable by diplomatic means. Moreover, China aspires to annex Taiwan, which directly infringes on US interests in East Asia. For the time being, China is engaged in a peaceful economic expan-

sion with Taiwan, but at some point, it could turn into a military-political one.

The political conflict between North and South Korea can turn into a military one at any time. North Korea has already tested an intercontinental ballistic missile and is preparing for periodic nuclear tests. On its side, the North Korean regime is willing to secure itself by means of nuclear weapons, which causes rising anxiety in South Korea and in Japan. This “battle of nerves” can at any point lead to large-scale military clashes.

Many geopolitical shifts discussed here are in some way connected with the dramatic growth of China’s and India’s strength. Therefore, the coming shifts in international politics will be in many respects connected exactly with China and India, where rapid economic growth continues despite all crises. The geopolitical activation of China can already be seen by the unaided eye. Despite wise advice given by Deng Xiaoping to the future Chinese leaders “to keep a low profile,” this country, reluctantly, will have to take a growing part in the solution of different international problems. In particular, China’s position as one of the five UN Security Council permanent members is important for the solution of many disputable issues, such as whether to adopt certain UN resolutions regarding Libya, Syria, Iran, and other states. China, in accordance with its traditions of “silent” diplomacy, has already achieved considerable geopolitical success, not always seen by the general public. China, for instance, has succeeded in establishing close economic and political cooperation with Pakistani leaders, which plays a very important role in South Asia as a counterbalance to India. Apart from that, China has taken important geopolitical and economic positions in East Asia, Latin America, and Africa. From now on, one may expect the further strengthening of Chinese influence on international politics and a sharpening of competition between China and the United States for resources and influence in many regions of the world.

In the meantime, the chance of a direct political or a military conflict between the United States and China in the next few years is extremely low. It is explained not only by the incommensurably greater military power of the United States in comparison with China, but also by close technological, financial, and economic interaction between these countries. China is highly interested in American technologies, while American transnational companies are interested in a cheap Chinese labor force and the huge Chinese market. Therefore, much more likely is a scenario of “peaceful clashes” between the United States and China, predicated on differences and even conflict of political and economic interests in various regions of the world without any obvious military confrontation (Dynkin and Pantin 2012). Such a strategy is in line with the traditions of Chinese foreign policy. It also acknowledges current US political and military superiority over China. However, it does not exclude a whole number of regional political conflicts between China and US allies, for example with Japan, Taiwan, or South Korea.

Another geopolitical situation is typical for India, which is a regional power in South Asia. The Indian economy is growing fast; only China has a higher growth rate. At the same time, despite visible economic growth, India falls behind China in many respects and is no real aspirant for global leadership. Moreover, there is plenty of social, interreligious, and political conflict inside India itself, along with separatism and terrorism, while the quality of life of most Indians remains very low. The presence

of terrorism in India, as well as the political and military conflict between India and Pakistan, does not contribute to the stabilization of the geopolitical situation in South Asia as well. Furthermore, there are serious antagonisms between India and China: both of them are rivals in the battle for political and economic leadership in the Third World. It generates the possibility of a disruption of the existing balance of powers in the South and East Asia, which will cause serious changes in the correlation of forces between China, India, Japan, and the United States.

Consequently, the large-scale shifts in international politics since the beginning of the 2000s are being realized rather intensively and are likely to accelerate in the nearest future. However, it is important to underline that the results of these shifts may turn out to be rather different from how they are seen today by leaders of the leading powers and forecasted by many experts capable of influencing the key strategic decisions. One should take into account that the previous global shifts in international politics discussed above (for example, in the periods of the first and second Kondratieff waves, as well as in the periods of the third and fourth Kondratieff waves) have led to events totally different from how they were imagined by the political elites of France under Napoleon I, of Germany during the World Wars I and II, of Britain on the eve of the World War II or of the USSR in the 1970s–1980s. It is no coincidence, since politicians, statesmen, and experts close to them usually see only a part of the entire picture, which is rather complicated. They often rely on known experience and are guided by short-term goals and interests rather than by long-term ones. As a result, political developments quite often generate unexpected surprises. The same may take place in the near future.

Therefore, it is possible to forecast only the fact of coming large shifts in international politics and key regions, which will be impacted by these shifts, rather than the eventual results of the ongoing global changes. In reality, the situation will be even more complex, since in the modern globalization era, the changes in foreign policy are closely interconnected with domestic political changes, including the largest and most developed countries. For instance, domestic political changes in the United States, China, or Islamic countries can seriously affect the international political situation. However, if we draw an analogy with the previous periods, it can be believed that in the long term, technological shifts will lead to deep social, economic, and political changes, including changes in the middle class and ruling elites of various countries. Moreover, a mass immigration from the less developed countries and regions to more developed ones will lead to changes in the ethnic composition and social structure of the population of these countries. In its turn, it will cause important shifts both in domestic politics of most states and in international politics.

In such a rapidly changing, turbulent, and unstable world, it is necessary to establish a more stable and secure

partnership between the United States, Russia, and other states in various spheres of international relations and in different regions. The existing Russian–American contradictions should recede into the background in the face of new global challenges and threats. It is important to completely abolish the logic of the “cold war,” when one side’s defeat automatically meant victory of the other. In the modern situation, economic or political failures of the United States may turn out to be large failures for Russia, while the crisis and weakening of Russia are likely to result in the strengthening of international terrorism, uncontrolled proliferation of weapons of mass destruction throughout the world, and, in general, destabilization. The United States and Russia, like many other states, are in the same boat: rocking this boat can have disastrous consequences for everyone. The new world order, the emergence of which we are witnessing now, is likely to be polycentric and very dynamic, corresponding to the rapidity and dynamism of technological, social, and political changes.

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