

**STRATEGY FOR RUSSIAN GROWTH IN THE
CONTEXT OF THE GLOBAL ECONOMIC CRISIS**

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SYNOPSIS

In his new book, the distinguished Russian economist and politician, Member of the Russian Academy of Sciences (RAS) S.Y. Glazev distils extensive theoretical and empirical material to analyze the causes of the global economic crisis, gives predictions for its continued development, and provides sound proposals for the modernization and faster growth of the Russian economy based on a new, technological mode as the key element of the country's anti-crisis policy. The book outlines a comprehensive action plan designed to allow Russia to recover from the crisis and chart a course for rapid and sustainable economic growth.

FOREWORD

The crisis now engulfing the world's advanced nations came as no surprise to area specialists. Long before its advent, the works of L. LaRouche and Tenenbaum in the United States, S. Peres in Latin America, and D. Mityaev, M. Khazin, M. Ershov, A. Kobayakov, and the author of these lines in Russia were forecasting the impending collapse of the dollar-based financial pyramid and the bursting of the massive financial bubbles that had been driven by all manner of ersatz securities. Specialists in the area of long-term technical-and-economic development provided ample warning of the brewing structural crisis in the global economy and of the need for the intensive development of innovational activity to ensure the timely creation of new opportunities for economic growth. Globelics, the worldwide network of scholars studying the issue of economic development, held international conferences – including in Russia and on the eve of the crisis – for the purposes of drawing the attention of the managerial elite and expert community to the need for the swift implementation of technical-and-economic development policies in order to mitigate and quickly overcome the consequences of the global economic crisis, which threatened to be conditioned by the objective laws of long-term technological shifts.

Unfortunately, these warnings went unheeded by the governing circles of developed countries, including Russia. Prevailing in the business community was the rosy expectation of a continuing financial boom, driven by new, increasingly complex and virtual financial instruments. The Federal Reserve System (FRS), which performs the function of the central bank in the United States, fed these expectations with its pumping of cheap credits that streamed across the entire globe, thereby stimulating the further ballooning of financial bubbles driven by short-term speculation with securities and their ever-multiplying derivatives. With the exception of China and India, which prudently continued to develop their respective strategic-planning institutions and retain domestic monetary control, the leadership of the world's advanced nations recklessly trusted the disciples of neo-liberal ideology, relying on the “unseen hand” of the market, the primitive

recommendations of the International Monetary Fund (IMF), and irresponsible rating agencies.

The collapse of the global financial pyramids caught the political and economic leaders of most world countries off guard. On the eve of the crisis, Russia's political and business elite was dominated by a naïve belief in the rock-solid stability of the Russian financial system and its attractiveness to international capital. Constructed according to the IMF template, the system certainly was attractive – not for long-term investment purposes, mind you, but for speculative activity aimed at reaping excess profits off destabilization of the country's fiscal and monetary system. Suffice it to say that speculators raked-in astronomical profits on the financial pyramids of the 1990s, the peak of which involved the piling-on of short-term government bonds and subsequent bankrupting of the state in August 1998. Having spirited hundreds of millions of dollars out of the country and toppled its financial system, the speculators returned once again – this time, buying-up “cheap” assets that had sustained a thirty-fold depreciation¹. Russian authorities mistakenly interpreted this latest flooding of the Russian securities market as an economic boom. Government economists took particular pride in the robust growth in stock-market capitalization, which, upon further inspection, turned out to be nothing more than just another financial bubble. It burst immediately after the flight of foreign speculative capital, once again thrusting the Russian financial system into deep crisis.

The lessons of the 1998 default were poorly learned by the country's financial authorities. Soon after macroeconomic stabilization, which had been achieved via the four-fold devaluation of the ruble and painful slashing of national assets and household incomes, they dismantled monetary control, once again opening the floodgates for the outflow of capital from the country. At the same time, following the advice offered by Washington-based financial institutions, they effectively got the country's financial system “hooked” on foreign credits, firmly linking domestic monetary emissions to growth in foreign-currency reserves. As a

¹ Materials from the Commission of the RF Federation Council

result, Russia's economy was left extremely vulnerable – a situation that international and domestic speculators didn't fail to exploit, funneling a couple hundred million dollars out of the country in the first few months of the crisis alone.

This time, Russia was not alone in falling victim to financial aggression by dismantling its economic-security system according to advice proffered by the IMF and the other proponents of free international-capital movements, driven principally by the emission of dollars undertaken by the American banking system. Disregard for the recommendations offered by area scholars and blind faith in the dogma of market fundamentalism prevented the G8 leadership from developing effective anti-crisis measures. That said, left suffering the most were those countries where a high degree of economic openness had been exacerbated by the political rejection of monetary control and financial-market regulation. In fact, of all the G8 countries, Japan, Germany and Russia experienced the worst productivity contraction. In Russia, the steepest drop in GDP was accompanied by the highest inflation rate (Table 1).

Table 1. Macroeconomic-indicator dynamics of the world's advanced nations during the crisis

| | 2007 | 2008 | 2009 | | 2009 | |
|---|------|------|-------|-------|-------|--------|
| | | | I | II | July | August |
| <i>GDP dynamics, year-on-year % change</i> | | | | | | |
| USA | 2.0 | 1.1 | -3.3 | -3.9 | -3.7 | - |
| EU-27 | 2.9 | 0.9 | -4.8 | -4.8 | - | - |
| Great Britain | 3.0 | 0.7 | -4.9 | -5.5 | - | - |
| Germany | 2.6 | 1.0 | -6.7 | -5.8 | - | - |
| France | 2.1 | 0.7 | -3.4 | -2.6 | - | - |
| Japan | 2.4 | -0.7 | -8.3 | -6.5 | - | - |
| Brazil | 5.7 | 3.8 | -1.6 | -1.2 | - | - |
| Russia | 8.1 | 5.6 | -9.8 | -10.9 | -9.3 | -10.5 |
| India | 9.3 | 7.5 | 4.1 | 6.0 | - | - |
| China | 13.0 | 9.0 | 6.1 | 7.9 | - | - |
| <i>Industrial-production dynamics, year-on-year % change</i> | | | | | | |
| USA | 1.7 | -2.2 | -11.6 | -13.0 | -12.4 | -10.7 |
| EU-27 | 3.3 | -1.4 | -16.8 | -16.7 | -15.1 | n/a |
| Great Britain | 0.4 | -2.7 | -12.2 | -11.6 | -8.8 | n/a |
| Germany | 6.2 | 0.0 | -20.3 | -20.5 | -18.0 | n/a |
| France | 1.4 | -2.6 | -16.0 | -15.1 | -13.1 | n/a |
| Japan | 2.9 | -3.1 | -34.6 | -27.8 | -22.9 | n/a |
| Brazil | 5.8 | 2.8 | -13.7 | -12.3 | -9.9 | n/a |
| Russia | 6.3 | 2.3 | -13.1 | -14.6 | -12.6 | -11.3 |
| India | 9.9 | 4.4 | -0.2 | 3.9 | 6.8 | n/a |
| China | 15.9 | 11.5 | 5.1 | 9.0 | 10.8 | 12.3 |
| <i>Consumer price index, year-on-year % change</i> | | | | | | |
| USA | 2.9 | 3.8 | -0.2 | -1.0 | -1.9 | -1.5 |
| EU-27 | 2.4 | 3.7 | 1.6 | 0.9 | 0.2 | 0.6 |
| Great Britain | 2.3 | 3.6 | 3.0 | 2.1 | 1.7 | 1.5 |
| Germany | 2.3 | 2.6 | 0.8 | 0.2 | -0.7 | -0.1 |
| France | 1.5 | 2.8 | 0.7 | -0.2 | -0.8 | -0.2 |
| Japan | 0.1 | 1.4 | -0.1 | -1.0 | -2.2 | n/a |
| Brazil | 3.6 | 5.7 | 5.8 | 5.2 | 4.5 | 4.4 |
| Russia | 9.0 | 14.1 | 14.0 | 12.5 | 12.1 | 11.7 |
| India | 6.3 | 8.3 | 9.4 | 8.9 | 11.9 | n/a |
| China | 4.8 | 6.3 | -0.6 | -1.5 | -1.8 | -1.2 |

| Stock indices (end of period), points | | | | | | |
|--|--------|--------|--------|--------|--------|--------|
| USA (S&P 500) | 1,468 | 903 | 798 | 919 | 987 | 1,021 |
| EU-27 (Eurostoxx 50) | 4,804 | 2,590 | 2,054 | 2,516 | 2,638 | 2,775 |
| Great Britain (FTSE100) | 6,457 | 4,434 | 3,926 | 4,249 | 4,608 | 4,909 |
| Germany (DAX) | 8,067 | 4,810 | 4,085 | 4,809 | 5,332 | 5,458 |
| France (CAC 40) | 5,614 | 3,218 | 2,807 | 3,140 | 3,426 | 3,654 |
| Japan (Nikkei 225) | 15,308 | 8,860 | 8,110 | 9,958 | 10,357 | 10,493 |
| Brazil (Bovespa) | 63,886 | 37,550 | 40,926 | 51,465 | 54,766 | 56,489 |
| Russia (RTS) | 2,291 | 632 | 690 | 987 | 1,017 | 1,067 |
| India (BSE-500) | 8,592 | 3,597 | 3,524 | 5,492 | 5,940 | 6,045 |
| China (Shanghai Composite) | 5,262 | 1,821 | 2,373 | 2,959 | 3,412 | 2,668 |

Source: Global Crisis Monitoring, Issue No. 9 (24.09.2009): periodical published by the Institute of Energy and Finance under the direction of L.M. Grigoriev.

Against this backdrop, the continuing economic growth of China and India constitutes a prime example of the importance of conducting an independent fiscal-monetary, industrial and structural policy that encompasses both monetary control and a powerful arsenal of methods for the government regulation of the credit and financial sectors. Strikingly, of all CIS member nations, the best indicators have been posted by Belarus, which managed to avoid production losses by pursuing a pro-active industrial and trade policy, preserving monetary control, and implementing measures to attract investments for the modernization and development of promising enterprises.

Of all of the world's advanced nations, Russia experienced the steepest stock-market, production and investment declines. Despite the fact that, relative to GDP, the Russian government spent the most money on anti-crisis measures, the country nevertheless suffered a sharp (over 15%) drop in industrial-growth investments, while hundreds of thousands of private citizens who had trusted the government and taken out mortgages and consumer loans went broke. By Q2 2009, industrial production had fallen by more than 15%, and in the machine-building sector it plummeted by almost 50%. The 40% devaluation of the ruble resulted in a

loss of confidence in the Russian currency and capital flight amounting to over USD 30 bln.

Due to the lack of fiscal-monetary control and deregulation of the financial market, most of the funds earmarked by the government for anti-crisis measures were used by the banks in currency speculation against the ruble with the aim of deriving hyper-profits off its devaluation. The Bank of Russia lost USD 200 bln in foreign-currency reserves in the first few months of the crisis alone. The flip side of the ruble's slide and drop in foreign-currency reserves involved the enrichment – to the tune of more than RUB 500 bln – of a small group of influential bankers who had received unsecured, low-interest loans from the government which they then unleashed in a speculative attack against the national currency. That said, the banks were in no hurry to channel the credit resources they had obtained from the government towards the real sector, raking in excess profits off the weakened ruble and excessive interest rates instead. Some of them even resorted to the clichéd “corporate raiding” of the most tempting debtor assets.

It should be noted that other G8 countries have experienced similar processes of the redistribution of property towards the financial oligarchy. But if the structuring of various loan-schemes to benefit insiders is predictable in the US, where the money printing-press (FRS) is controlled by private banks, the pocketing by private individuals of credit resources issued by the central bank in Russia – with its traditionally top-down political command system – appears illogical at best.

A prime example of the direct link between crisis severity and economic-deregulation level is the situation unfolding in the CIS. Russian declines were overshadowed by those posted by Ukraine, whose economic policy over recent years has resembled a lethal cocktail of liberalism, monetarism and populism. Conversely, the shallowest industrial drop (Table 2) occurred in Belarus, which has retained domestic monetary control while implementing tight credit-and-financial regulation and effective development policies.

Table 2. Key socio-economic indicators of CIS member nations in January-September 2009

| | GDP (at constant prices) | Industrial production (at constant prices) | Fixed-capital investments (at constant prices) |
|--------------------------------------|-------------------------------------|---|---|
| Azerbaijan | 106.1 | 105.0 | 82.9 |
| Armenia | 81.7 | 88.6 | 56.2 |
| Belarus | 99.7 | 95.5 | 114.5 |
| Kazakhstan | 96.8 | 99.0 | 102.2 |
| Kyrgyzstan | 102.9 | 88.5 | 127.0 |
| Moldova | 92.2 | 75.7 | 61.6 |
| Russia | 88.2 | 86.5 | 81.1 |
| Tajikistan | 102.7 | 90.0 | 80.5 |
| Turkmenistan | ... | ... | ... |
| Uzbekistan | 108.0 | 109.1 | 128.3 |
| Ukraine | 82.2 | 71.6 | 56.7 |
| CIS member-nation average | 91.0 | 86.0 | 82.0 |

Source: Socio-economic status of CIS member nations in January-September 2009. Keynote speech – CIS Multinational Statistics Committee, October 2009.

The subsequent unfolding of the crisis in Russia, as in other advanced nations, would involve the confluence of two processes – the destruction of old economic structures and the creation of new ones. That said, today’s financial, economic and political institutions will either need to undergo restructuring according to the requirements imposed by the growth in new technical-production systems or cease to exist. History shows that overcoming structural crises of this kind and positioning the global economy for a new, long wave of economic growth entails changes to the technical structure of the economy, as well as its institutional system, and the structural composition of leading firms, countries and regions.

The two previous structural crises were accompanied by far-reaching political and economic shake-ups. The Great Depression of the 1930s boiled over into the catastrophe of the Second World War, whose economic result entailed the intensive modernization of the economies of the world’s advanced nations on a qualitatively-new technological basis. The political result involved the collapse of the international colonial system and the formation of two global economic camps (capitalist and socialist), “protected” by two opposing military-political blocks.

The depression of the mid-1970s and early 1980s gave birth to the “star

wars” doctrine and led to the collapse of the global system of socialism, which had been unable to adjust its economy to the new technological mode swiftly enough and therefore fallen behind the advanced capitalist countries, which had just “caught” a long wave of economic growth. Rising on this same wave were newly-industrialized countries that had managed to quickly launch new, technologically-based core industries and create the conditions for rapid growth on a global scale. The political result was liberal globalization, dominated by the United States as the issuer of the world’s reserve currency.

Emergence from the current depression will likewise be accompanied by far-reaching geopolitical and economic changes. Some researchers are raising the specter of a systemic crisis in modern capitalism. The possibility of the collapse of the core of the global capitalist system and its servicing financial institutions cannot be excluded. Against the backdrop of deep recession in the world’s advanced nations, new global-economic centers – China and, to a somewhat lesser extent, India – are experiencing a new long wave of economic growth. The global financial system is becoming multi-currency, while globalization is being replaced by “glocalization” – the formation of major regional economic unions, with the lead role in the global economy assumed by the Asia-Pacific Region.

Under the positive scenario for emergence from the crisis, globalization will become more manageable and balanced from the standpoint of advanced-nation interests. International regulatory institutions will likely grow in significance, with the possible emergence of supra-national regulatory institutions for the markets and global currency. The strategy of sustainable development will supplant the Washington consensus doctrine as the primary globalization ideology. The war on terror, global warming, world hunger, illiteracy, disease and other threats to humanity will be used to rally the world’s advanced nations together.

The crisis will have a different impact on different countries, depending on a combination of the objective state of their science-and-technology potential and the relative effectiveness of their economic policies. It may be catastrophic for some countries and regions and manageable for others. It should be recognized that the countries and institutions that make up the core of the global financial system will attempt to exploit their dominant position by appropriating the resources of peripheral countries through establishing control over their assets. This goal will be achieved by exchanging reserve-currency emissions for the property of receiving countries.

For any country, the essential condition for a successful transition out of the crisis involves the existence of a domestic strategy geared towards the retention of its own economic potential and rapid creation of the conditions necessary for the growth of new industries. This type of strategy involves protecting the country's strategic assets and domestic market from foreign speculative-capital invasions and conducting a pro-active science-and-technology and structural policy designed to foster the development of competitive enterprises in promising areas of economic growth. This requires an effective system of strategic planning and a powerful national financial-investment system, based on domestic sources of credit and protected from the destabilizing influence of the global financial market.

This book attempts to ground a holistic vision for the process of the modern development of the global and Russian economy in the convergence of its technological, macroeconomic and management aspects. Proceeding from the modern theory of long-term technical-and-economic development as a process entailing the systematic change of technological modes, the underlying causes of the current global financial crisis are revealed to be linked to the substitution of dominant technological modes. Clearly illustrated is the fact that overcoming the crisis will necessarily entail a long wave of economic growth whose material-technical foundation will be based on the next-generation technological mode, the key element of which constitutes a combination of nano, bio and information technologies. Their spread is revolutionizing traditional directions of economic growth while giving rise to new ones, heightening the economic efficiency of

industrial production, expanding consumption opportunities, and creating new areas of economic activity in the process.

On the basis of a comprehensive, multi-disciplinary analysis of the crisis, including that of its economic, financial, institutional and technological aspects, the book investigates certain underlying causes and outlooks for the continued unfolding of the global crisis. The likely scenarios for changes to the global economy, depending on the decisions adopted with respect to anti-crisis policy, are formulated. The current state and development outlook for Russia in the given environment are analyzed. Finally, the focal points of anti-crisis policy and a list of measures for its implementation under the respective anti-crisis strategy are proposed.

The book investigates the key areas for development of the new technological mode, whose rise promises to thrust the economy onto the next long wave of economic growth: biotechnologies, based on achievements in the fields of molecular biology and genetic engineering, nanotechnology, artificial-intelligence systems, worldwide information networks, and integrated high-speed transportation systems, etc. Its emergence and further expansion will determine the trajectory of global economic development over the next two-three decades. As the process whereby previous incarnations are replaced by this new technological mode concludes, the global economy will experience a long-wave upswing at a new level of economic efficiency within a new technological structure.

Under any of the possible scenarios for the unfolding of the economic crisis, the Russian economy will only be able to recover on the basis of a new technological mode within an independent credit-and-finance system resting on domestic sources of monetary supply. The core idea for formation of an effective anti-crisis strategy involves the rapid development of primary industries within the new technological mode of Russia's economy and its swift transition to a long wave of economic growth. Achievement of this goal necessarily involves the concentration of resources for the development of the engineering-and-manufacturing complexes underlying the new technological mode, which presupposes implementation of a targeted monetary policy. Development of the

macroeconomic regulatory framework necessary for this system, including mechanisms of credit, tax-and-budgetary, and monetary policy geared towards the creation of a new, technological-mode core, should serve as the linchpin of anti-crisis strategy. The necessary condition for its success involves the achievement of a synergistic effect, which presupposes the systematic formation of integrated next-generation industrial clusters and the alignment of macroeconomic policy with the priorities of long-term technical-economic growth.

This book expounds upon the findings of research conducted with the generous support of the Russian Humanitarian-Science Foundation (RHSF) and RF Ministry of Science (grant by the leading School of Research on the topic “Design of the Strategy for Russia’s Economic Development in the Context of Global Economic Shifts”, R&D within the scope of the Federal Special-Purpose Program “R&D in Priority Development Areas of Russia’s Science-and-Technology Complex for 2007–2012”, and research on “Russia in Conditions of Global Crisis” conducted within the framework of the RHSF Analytical Departmental Program “Support for Fundamental Humanities Research” in 2009).

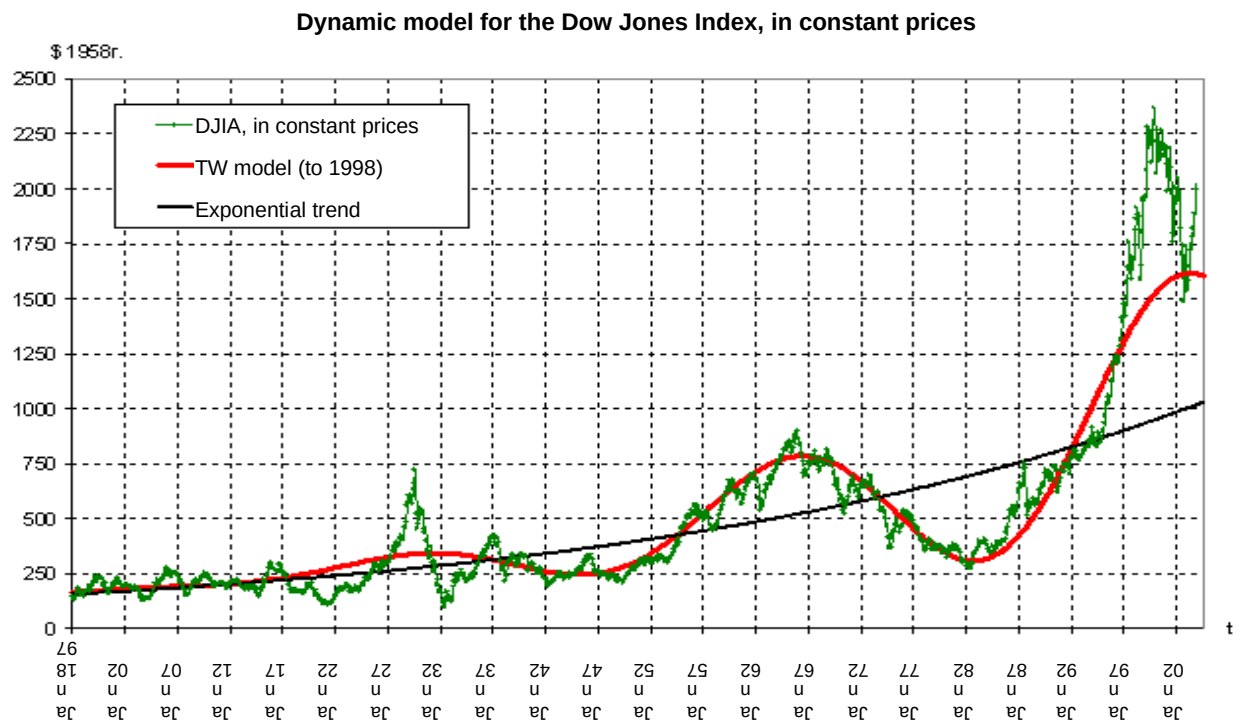
The author wishes to thank his colleagues, in joint work and discussions with whom many of the ideas presented in this book were generated and further developed: S. Batchikov, A. Grübler, V. Dementiev, G. Dosi, M. Ershov, A. Kobayakov, D. Mityaev, Y. Petrov, and V. Kharitonov. The author is particularly grateful to his friend and faithful teacher, D.S. Lvov, who left us prematurely in 2007.

CHAPTER 1. CAUSES OF THE GLOBAL ECONOMIC CRISIS

As predicted by scholars working on the theory of long-term economic development, the global financial crisis snowballed into a major worldwide recession, followed by a prolonged depression. The relative inefficiency of the anti-crisis policy pursued by countries at the center of the global financial system is associated with the underestimation of the structural element of the global crisis, defined as a shift in technological modes and their respective long (Kondratiev) waves of economic growth.

Historical experience and the theory of economic development indicate that these types of crises occur at an interval of 40–50 years and are accompanied by the formation and bursting of massive financial bubbles, preceded by price hikes for energy commodities and followed by a flurry of innovation that paves the way for the next technological mode (Diagram 1).

Diagram 1.



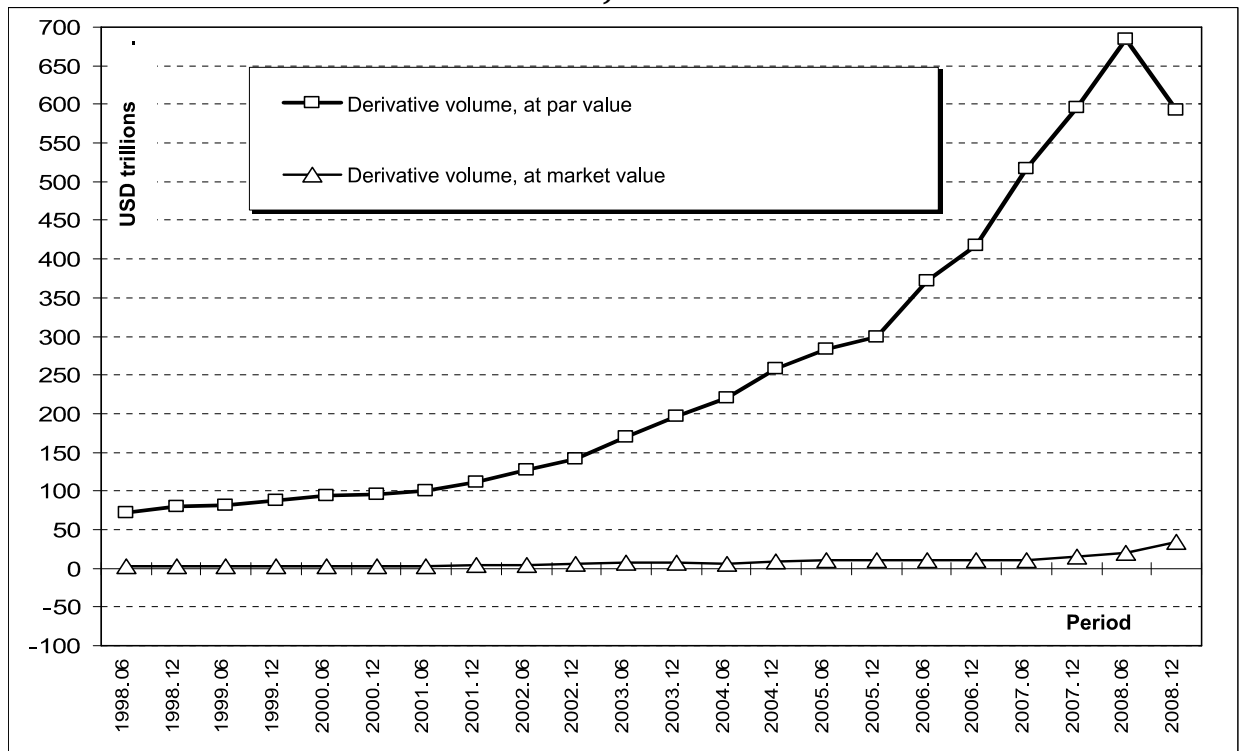
Source: P.F. Andrukovich; Long- and Medium-Term Dynamic of the Dow Jones Index
// Problems of Forecasting, No. 2, 2005.

The distinctive feature of the current crisis involves the unprecedented scope of its attendant financial fluctuations, driven by the global bond pyramids built by the issuing centers of global currencies. The starting implosion of these pyramids (first and foremost, US treasury bonds and the off-balance-sheet derivatives of American financial institutions) was associated with limited opportunities for economic growth based on the current technological mode. Insofar as the structural and financial crises occurred simultaneously, wrestling with the latter while ignoring the former is doomed to fail, since in and of itself, the financial aspect opens up no new opportunities for economic growth. The primary causes of the economic crisis are presented below.

1.1. Derivative avalanche

The most striking cause of the global crisis, lying at the surface of relevant economic phenomena, involves the geometric expansion of the shadowy world of financial-derivative operations – neither reflected on the balance-sheets of financial institutions nor regulated by the government (Diagram 2) – that resulted in the systematic underestimation of financial risks, formation of massive “financial bubbles”, and their subsequent bursting (Diagram 3). Diagram 2 illustrates derivative volume dynamics at par and market value. In terms of analysis, suffice it to say that the former exceeds the aggregate monetary-supply volume of all world countries combined by more than a factor of one. Diagram 3 reflects the extent of the contraction of the market capitalization of the leading American companies in various economic sectors following the bursting of the respective financial bubble.

Diagram 2. OTC credit default swap (CDS) derivative volume at par and market value, in USD trillions



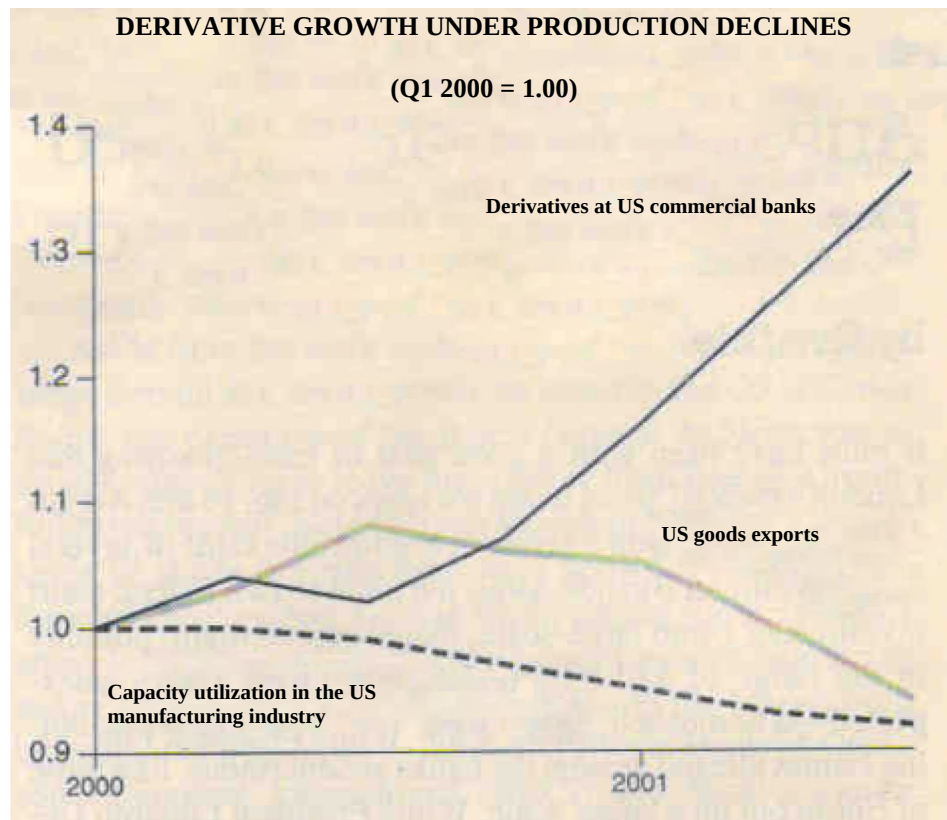
Source: Y.A. Petrov; Global Crisis and the Economic Crisis in Russia: Causes, Consequences, and Proposals for the Adjustment of Socio-Economic Policy // Russian Economic Internet-Magazine, 2009.

Diagram 3.

Source: M. Ershov; Queen Goes for Broke, Expert, No. 16, 27 April – 10 May 2009.

In his numerous articles, L. LaRouche wrote of the dangers of financial-derivative pyramids long before the explosion of the crisis. For more than a decade, he attempted to direct the attention of the business elite in the US and other countries towards the growing gap between financial-market-capitalization and GDP volumes. The so-called “LaRouche’s Triple Curve”, which illustrates this situation, has been explored by the economist on several occasions in the EIR Magazine he publishes (Diagram 4).

Diagram 4.



Source: R. Freeman, J. Hoefle. 2001: The U.S. Economy's Bad Year Points to Worse Ahead. EIR, February, 1, 2002, Vol. 29, #4.

Unfortunately, the warnings offered by this well-known American economist and politician were ignored, with the scholar ultimately finding himself the subject of ridiculous tax-evasion charges. The apologists for the American financial oligarchy did everything in their power to discredit him and effectively “bury” his works. Instead of restoring a balance in the financial and real sectors of the economy, the American financial authorities moved to stimulate further expansion of the derivative market. A key role in this process was played by high-profile economists adhering to the doctrine of market fundamentalism, who continue to set Washington’s economic policy to this day.

Thus, for example, Lawrence Summers, the former Secretary of the US Treasury appointed by President Obama to head the National Economic Council, played a decisive role in pushing through the repeal of the Glass-Steagall Act of 1933, which had shielded the banking system from speculative abuses and the formation of financial bubbles. In 1999, Lawrence Summers and Senator Phil Gramm introduced the Financial Services Modernization Act, pursuant to which commercial banks,

brokerage firms, hedge funds, institutional investors, pension funds and insurance companies were able to freely invest in other businesses and thoroughly integrate their financial operations. In 2000, this same Mr. Summers backed the Commodity Futures Modernization Act, which sanctioned financial-derivative instruments – the same derivatives whose “over-the-counter” (OTC) trading, off the balance-sheet of financial institutions and beyond the reach of government regulation, led to speculative growth in commodity prices, including those for oil and foodstuffs, as well as ballooning of the financial bubbles whose bursting resulted in the global financial crisis. The Act also gave birth to credit default swaps (CDS), which laid the groundwork for the recent derivative pyramids.

Swayed by the charms of robust financial-bubble growth were more than just businessmen and politicians, seduced by the “get rich quick” idea of endless virtual debt-instrument emissions secured with nothing but the reckless expectations of speculators. A good portion of the academic community also lost its head. In 1997, at any rate, the Nobel Prize in Economics was awarded to R. Merton and M. Skousen precisely for their development of a theoretical basis for derivative value. Thus, the Nobel Committee gave this pseudoscientific apology for the interests of financial speculators the cloak of respectability it needed.

1.2. Implosion of the USD financial pyramid

The lure of perpetual emissions of ever-newer and increasingly-devoid-of-real-security derivative securities was driven by speculator's faith in the bottomless capacity of the financial market, based on the tight linkage between the major derivatives-issuers and the issuer of US dollars – the US FRS. The latter had always supported its shareholders with limitless refinancing, which gave them the sense of a guarantee backed by the creditor of last resort, inter alia, with respect to the securing of debts under wildly-issued and unregulated instruments. Insofar as they weren't reflected on the banks' balance-sheets, their aggregate volume was hidden from financial regulators and was only exposed with the advent of the financial crisis, when investment banks, suddenly confronted with crashing asset values, raced to the FRS for new credits. As illustrated in the study by N. Starikov¹, the latter was quite selective in its approach, issuing limitless loans to “its” banks while ignoring the pleas of the others. It is for this reason that a number of distinguished experts and politicians have accused the FRS controlling oligarchy of artificially triggering the crisis by intentionally increasing and then abruptly contracting credit emissions for the purposes of effecting a massive redistribution of national and global wealth in its favor.

Lurking at the heart of the very ability to conduct runaway global-currency emissions is the fundamental cause of the global financial crisis. In 1971, US financial authorities reneged on their international obligation to exchange dollars for gold, forcing the entire non-socialist world to use its currency as the global currency. That said, actual emissions were carried out not by the government but by a joint-stock company of influential banks, which forced the American government into their private monopoly over dollar emissions, as enshrined in the Federal Reserve System (FRS) Act.

After 1971, when US authorities rejected continuation of their guaranteed exchange of dollars for gold, the might of the FRS reached global proportions. In analyzing the behavior of the FRS from the standpoint of today's crisis – i.e. its

¹ N. Starikov; *The Crisis: How It's Done*; 2009; Piter Publishing House

support of certain financial institutions and effective bankrupting of others – Starikov draws a conclusion as to the man-made nature of the current crisis, accusing the FRS of its purposeful organization via the sharp raising of refinancing rates following a lengthy period of cheap money.

The linkage between the current financial crisis and FRS policy has been addressed by other researchers, who have proven that the chief culprits in today's global crisis were the US regulatory authorities, which not only "closed their eyes" to the ballooning of bubbles on the derivative and real estate markets, but which over the course of several years also continued to pump the economy with liquidity in order to forestall the crisis that threatened to erupt back in 2000, following a localized crisis in certain segments of the financial market. Diagram 5 illustrates the dynamic of the FRS discount rate against US GDP volume changes, in 2005 prices, and growth rates².

² Y.A. Petrov; Global Crisis and the Economic Crisis in Russia: Causes, Consequences, and Proposals for the Adjustment of Socio-Economic Policy // Russian Economic Internet-Magazine, 2009

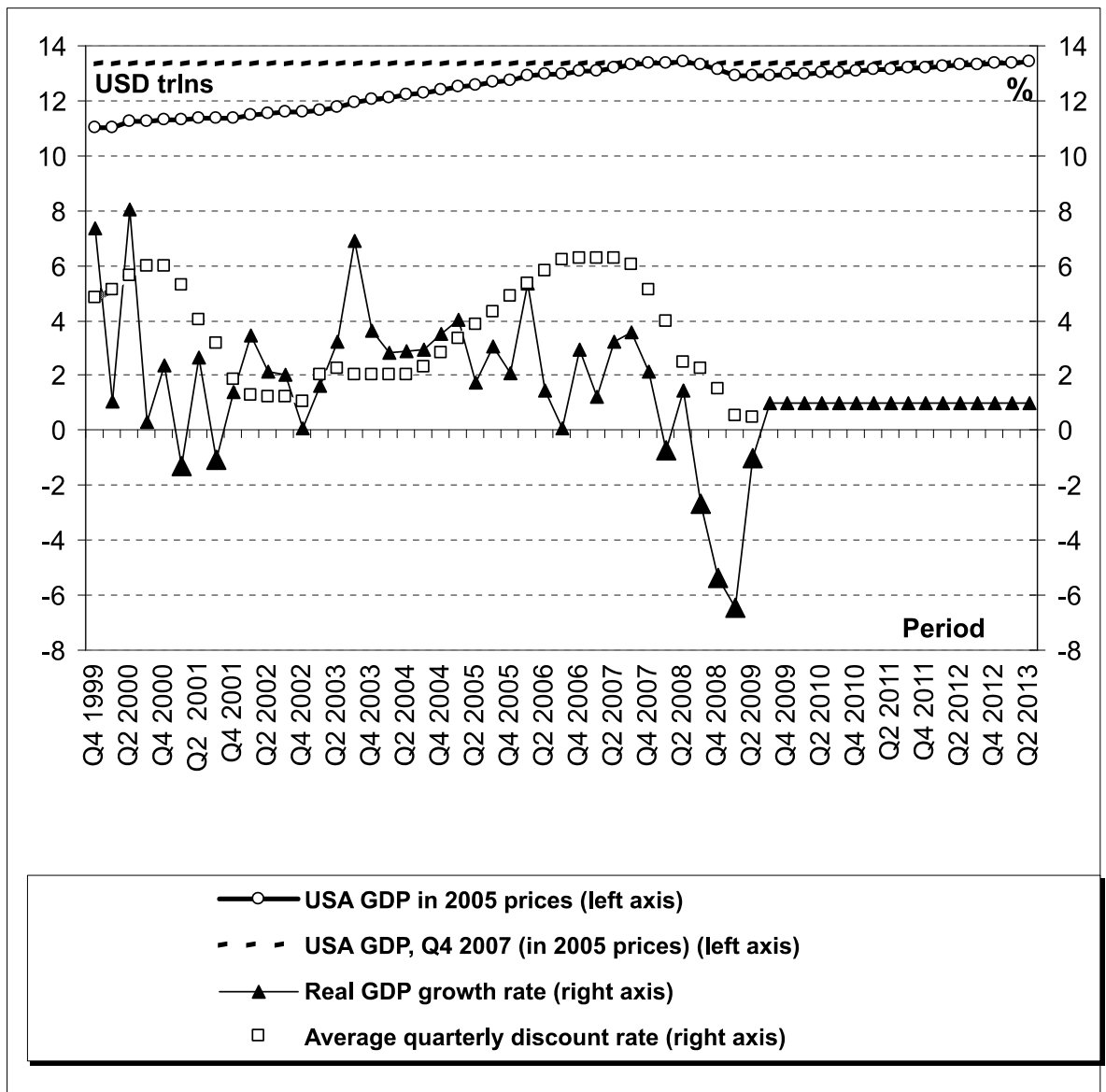


Diagram 5. Actual US GDP volume and quarterly growth rate (expressed annually³; corrected for seasonality); average quarterly discount rate

Source: Y.A. Petrov; Global Crisis and the Economic Crisis in Russia: Causes, Consequences, and Proposals for the Adjustment of Socio-Economic Policy // Russian Economic Internet-Magazine, 2009.

The diagram clearly demonstrates that the discount rate began dropping at the beginning of this century, with the drop doubling in the first eight months of 2001 alone. Thanks to the monetary infusion of the economy undertaken by the FRS via its lowering of interest rates and ramped-up lending, the economic recession that had begun looming at the time was “put off for later”. This “later” was triggered, in the opinion of Y.A. Petrov⁴, by the “mistake” of the FRS when it

³ Meaning that actual quarterly GDP growth rates have been increased biquadratically

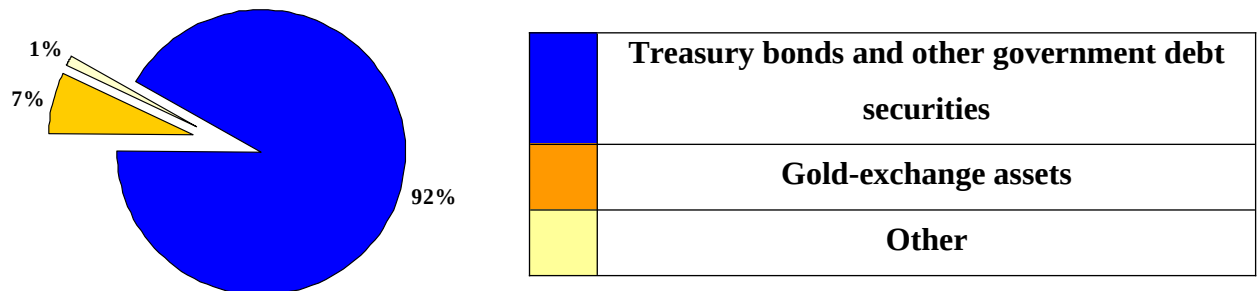
⁴ Y.A. Petrov; Global Crisis and the Economic Crisis in Russia: Causes, Consequences, and Proposals for the Adjustment of Socio-Economic Policy // Russian Economic Internet-Magazine, 2009

raised the discount rate from 2% in mid-2004 to 6.25% in June 2006. In fact, Starikov believes that this move was no mistake at all, but rather a measure planned in advance by senior FRS officials in order to organize the financial crisis.

However, no magical powers should be ascribed to the FRS with respect to its ability to create and overcome crises. While the artificial contraction of monetary emissions may be sufficient to provoke a crisis, the subsequent monetary infusion is, in and of itself, insufficient to shift the economy from depression to sustainable growth. Attempting to halt the crisis via the endless expansion of credits only serves to create a new institutional trap of “delayed recession”. As soon as the government winds-up its emergency government-support programs, the next recessionary wave hits. This state of depression will continue until such time as the economy assumes a new trajectory of technological development and the mechanisms for its broader application are formulated.

In essence, the mechanism for the issuance of US debt securities is but a variant of the same financial pyramid. When drafting the nation’s budget, US monetary authorities determine the volume of money required to cover the deficit and previously-assumed debt obligations. Government bonds are then issued in this amount, with the same volume of money simultaneously emitted for their market acquisition. Secured against these debt obligations, commercial banks receive the money emitted by the FRS at a minimal rate.

The key element of this money-printing mechanism is the procedure whereby commercial banks are refinanced against government securities, which forms the main dollar-emission channel. Thus, the FRS emits money for the purposes of financing US government debt. The overwhelming bulk of the US dollar supply is released into circulation according to this procedure. Today, no more than 4% of this total supply is secured by gold-exchange assets. More than 90% of the dollars currently in circulation was emitted to service US Treasury Bonds and is effectively unsecured (Diagram 6).

Diagram 6.**Formation of the monetary base by the US Central Bank, March 2008**

Source: M. Ershov; Financial Mechanisms of Economic Growth. Presentation at the State University of Management (SUM), Institute of New Economics.

1.3. Exhaustion of the capacity for economic growth on the previous technological foundation

It is possible that the emission of dollars, US debt securities and derivatives by the tightly-linked architects of this financial pyramid could have gone on much longer, were it not for the inherently limited capacity of the global financial market, demand on which depends on the ability of end-borrowers to repay their loans. Up to certain limits, the insolvency of individual borrowers is neutralized via refinancing and the writing-off of bad debts. Yet, the economic crisis manifested itself as a slump in final demand and sharp drop in the earnings of most sectors of the real economy, which led to the insolvency of many large enterprises. This is where the underlying cause of the global economic crisis was revealed to be structural, conditioned by the substitution of dominant technological modes. Beginning with the works of N.D. Kondratiev¹, numerous studies of the processes associated with long-term economic development have served to establish the following patterns of long-range economic growth:

¹ S.Y. Glazev; Opportunities and Restrictions on Technical-Economic Development in Russia in the Context of Structural Changes to the Global Economy; M.: SUM, 2008

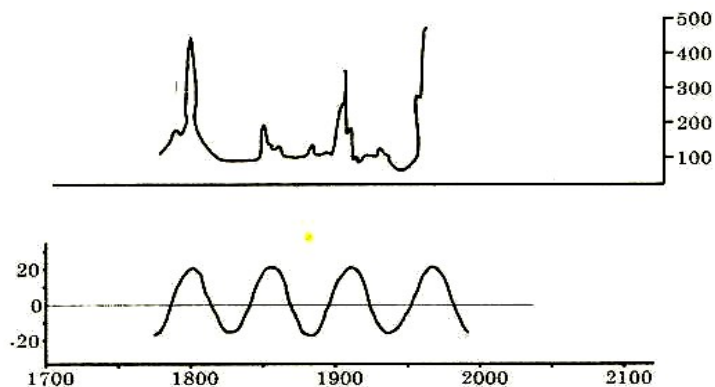
- distortions in the alternation of business-cycle long waves;
- conditionality of intermittently-occurring structural crises in the global economy on deep technical shifts that dramatically alter the structure, composition and interplay of economic-growth factors;
- disequilibrium in the processes of technical-and-economic development, each of whose lifecycle has an internal logic and inherent limits;
- non-linear trajectory of the development, dissemination and substitution of technologies;
- uncertainty and variation of technological trajectories at the beginning of the lifecycle of the respective areas of technical-and-economic development, followed by reductions in competition and the formation of global monopolies;
- gaps between the lifecycle phases of technological evolution, the ability to overcome which depends on the state of innovational and institutional systems.

The fourth chapter of this book contains a description of the mechanism for widescale technological shifts in the modern economy. The key element of this mechanism involves the periodic process of technological-mode substitution, accompanied by a shift in business-cycle long waves (Kondratiev waves).

The global crisis observed today fits into the general picture of a shift in business-cycle long waves and substitution of the technological modes at their foundation.

The sharp climb and even sharper drop in stock indices and energy prices is the hallmark of a structural crisis ushering in the substitution of technological modes. As illustrated in Diagram 7, this process has periodically occurred five times already in the history of modern economic growth.

Diagram 7. Divergence from energy-consumption trend (bottom)
and price index (top)



Source: IIASA

The surge in prices for prevailing energy commodities constitutes the critical element of the mechanism by which technological modes are substituted. It leads to the sharp appreciation of production and consumption costs under existing enterprises, and therefore to a drop in demand for related products. The resulting loss of profitability in the production sphere leads to a drop in investments in industrial expansion and the concentration of capital in the financial sector. This leads to the ballooning and subsequent bursting of financial bubbles. A financial crisis accompanied by capital depreciation forces capital to search for new areas of investment, whose center of gravity becomes the innovation of the next technological cycle. This “innovation boom” paves the way for its formation – the upswing in innovational activity attracts free capital to the next long wave of economic growth based on expansion of the respective technological mode.

Clearly, the sharp rise in oil prices observed over the past decade, along with the simultaneous growth in financial speculation and onset of financial bubbles under industrial stagnation in the world's advanced economies, paints the typical picture of the maturation of a structural crisis at the end stage of the lifecycle of a prevailing technological mode that has run its course. The rapid rise in oil, gas and electricity prices occurring over the past seven years has led to a price structure change that destroyed existing industrial processes and consumption stereotypes.

That said, in complete conformity with the theory, financial capital began to play the lead role in formation of the trajectory of further economic development. Conversely, industrial capital, concentrated in the traditional sectors, depreciated and lost its reproduction ability.

It is no coincidence that supercharged growth in financial speculation created the impression of the dominance of financial capital over industrial capital. This is a manifestation of the liberation of capital from the industrial components of the outdated technological mode, whose further expansion is no longer supported by the market. The information revolution in the financial arena and the elimination of a number of legal restrictions on speculative operations stimulated this process by creating opportunities for the endless expansion of such operations in the form of the virtual trading of future rights and obligations, beginning with oil contracts. The latter played a decisive role in both the formation of financial bubbles whose dimension was unprecedented, as well as in the synchronization of their ballooning with the rising oil prices. This synchronization was revealed in the subsequent simultaneous bursting of the global financial bubble and collapse of oil prices, which together triggered the repercussions that set off the global financial crisis.

The simultaneous implosion of the financial pyramid comprised of the debt obligations of the issuer of the world currency, bursting of the global financial bubble, and resulting onset of the financial-and-banking crisis have created dangerous consequences that threaten to topple the international monetary-and-financial system.

Given the complexity of the current global crisis, which certain scholars and politicians have already called systemic, recovery from it presupposes the creation of a new technological mode. Its expansion will lay the material foundation for the next long wave of economic growth, encourage the technological revitalization of the industrial capital remaining after depreciation, and breathe new life into stagnant enterprises via their modernization and expansion of development opportunities.

1.4. Ideology of liberal globalization

Along with the objective causes of the economic crisis, which were conditioned by the patterns of economic development and the operating mechanisms of financial institutions, ideological and political factors played an important role in its inception. The former relates to the disconnect between the neoliberal ideology prevailing among the controlling elites of the world's advanced nations and Russia and the actual processes of socio-economic development, which led to the dismantling of the strategic-planning system and disregard for objective economic research that had begun forecasting the crisis in the global and Russian economy several years ago. The latter encompasses liberal globalization, which was accompanied by the deconstruction of government currency-control institutions and which opened up limitless opportunities for American lenders to construct global financial pyramids and acquire the national wealth of other countries.

The disconnect between neoliberal ideology and the actual processes of socio-economic development, and the threats posed by liberal globalization, have been addressed in so many voluminous works that there is barely any point in proving such obvious points in this book. Yet, insofar as the apologists for market fundamentalism continue to force the Russian leadership into passively following the US FRS-manipulated “free” hand of the market, it would nonetheless be appropriate to address both the theoretical basis and practical results of the policy pursued by Russia from its transition to a market economy to the collapse of the state's financial system in 1998.

The choice of strategy for market transition, made in 1991, was imposed upon Russia in the form of “shock therapy” – a program that constituted the radical version of an extreme-liberal approach to economic-policy issues, based on the ideology of market fundamentalism. This choice was made despite the opinion of the country's academic community, the objections of the Russian parliament, and its rejection by the state apparatus. The ostensible need for the pursuit of this strategy motivated the new Russian government to commit crimes against the state

and society that lead to an economic and demographic catastrophe in Russia, including the effective confiscation of household savings frozen at Sberbank during the hyperinflation period of 1992, the unconstitutional state coup and firing upon the Congress of People's Deputies in 1993, the plundering of state property under the guise of privatization by the oligarchy that had usurped power in 1994–1997, the rigging of presidential elections in 1996, the bankrupting of the state in 1998, and so on.

All of this forces a closer inspection of the analysis of the ideology underpinning the transitions that were performed. The “shock therapy” strategy systematically implemented in Russia and the majority of post-Soviet republics was but a variation of the doctrine of the so-called Washington Consensus developed by the International Monetary Fund (IMF) for underdeveloped third-world countries. It stands out for its extreme simplification of economic policy, which it reduces to three basic axioms: liberalization, privatization and stabilization via the strictly-formal planning of the monetary base. This concept presupposes maximum limitations on the role of government as an active agent of economic influence and restricting its control functions over the dynamic of monetary-supply indicators. While the latter are usually issued “out of thin air” and systematically lowered for the purposes of battling inflation, everything is sacrificed to ensure their implementation: social spending is slashed, R&D financing is suspended, government investment programs are wound-up, state procurements go unfunded, and wages are paid late, etc.

From the outset, the guiding principles of the Washington Consensus were developed in order to establish control over the formulation of economic policy in underdeveloped countries for the purposes of preventing the squandering of the loans extended to them from overseas and ensuring guarantees for the free operation of international capital within their territories. This explains the shocking primitiveness of the concept, which reduces all matters of macroeconomic policy to minimizing state control over the economy by limiting it to issues of supporting law and order and protecting property rights, liberalizing prices and domestic and

foreign trade, and eliminating government influence over production and investment processes by tying the emission of national currency to the acquisition of dollars.

The point of the Washington Consensus policy was not to promote national prosperity or economic growth. Rather, it was designed to dismantle the national sovereignty of borrower-countries in the interests of international capital, exercise rigid control over the actions of their respective governments, and ensure that the policy pursued thereby was consistent with the needs of foreign “investors”. The substance of the Washington Consensus concept represents nothing more than the mechanism for exercising such control. This explains the choice of over-simplified – yet highly-convenient for external-control purposes – methods of economic-policy planning. In issuing its rigid plan for monetary-supply growth, state-property privatization, and price and foreign-trade liberalization, the IMF simultaneously blocks freedom of action in all other areas of economic policy by the thusly-subordinated government. Such a policy doesn’t promote economic growth, but it does guarantee the manageability, transparency and predictability of action (or, more precisely, inaction) of the government, which is critical for international financial and trade capital interested in establishing control over the respective countries’ markets.

Under pressure by foreign creditors, the Russian leadership adopted the most primitive form of the Washington Consensus concept – the “shock therapy” strategy. That said, the lead role in formulating the country’s economic policy was diverted to the International Monetary Fund. After the firing upon the Supreme Council and state coup in 1993, and right up until the autumn of 1998, Russia’s national economic policy was effectively managed from without, the main parameters of which were developed by IMF experts and then formally adopted by the government and central bank in the form of the respective statements (memoranda) on economic policy.

As specialists had warned on numerous occasions, the main results of implementation of the Washington Consensus policy in Russia became: disintegration and degradation of the economy, a sharp drop in domestic prosperity levels, reductions in industrial efficiency and competitiveness, primitivization, and the severe undermining of the country’s R&D and manufacturing potential.

Implementation of the aforementioned economic policy left Russia – once endowed with a highly-skilled workforce, considerable science-and-technology potential, and a vast natural-resource base – an impoverished nation, rated between Lebanon and the Philippines in terms of per capita GDP, and reduced to the ranks of underdeveloped countries on the index of human-potential development.

Despite the numerous declarations and promises made by the adherents of the Washington Consensus policy in Russia, its systematic implementation failed to result in economic recovery. In fact, no such result was possible given the severe damages sustained by the key industrial features and business ties that frame the country's economic system. Disregard for the structural specifics of the Russian economy and reliance on the automatic functioning of self-organizing market processes triggered economic disintegration and fomented chaos. Attempts to apply the traditional methods of macroeconomic stabilization in order to restore market equilibrium by restricting the monetary supply were incapable of producing the necessary result given the severe imbalance of the situation. Under the conditions of disproportion typical of the Russian economy, the application of these methods was destined to splinter it into autonomously-operating sectors; the process was accompanied by a sharp drop in economic activity and depreciation of a considerable portion of the country's industrial and intellectual potential, which had been rendered unprofitable under the new system of economic valuations and relations.

Analysis of the substance of the “shock therapy” concept and the circumstances surrounding its “phasing in” by the Russian leadership clearly illustrate that it was imposed from without in the service of foreign interests. At the same time, the latter dovetailed nicely with the interests of the emerging Russian oligarchy, which was making a grab for excess profits and striving to solidify its privileged station in the corridors of power through wealth-holding and international recognition. The main obstacle in their path was the state as a system of institutions furthering social and national interests, and the Washington Consensus doctrine provided the necessary ideological foundation for its destruction. Replacing genuine institutions of state power with the facsimiles of a

corrupt administration, the emerging Russian oligarchy effectively privatized state functions and control over the country's wealth.

The policy being implemented was officially presented as the market-transformation, liberalization and stabilization of the economy. Although it led to the ravaging and deep decline of the entire national economy, which had spun into an unprecedented crisis, the policy turned out to be surprisingly effective for the ruling oligarchy, in that it facilitated the redistribution of vast national wealth in its favor. At the same time, the policy was rooted in an entirely respectable ideology, which ingeniously camouflaged the plundering of national wealth, illegal usurping of power, suppression of human rights and genocide of the bulk of the country's population under the guise of economic reform and democratic transformation.

Thus, the reason for selection of the pseudoscientific doctrine of the Washington Consensus as the ideological basis for the implementation of economic reforms was associated not with its validity or the adherence of its proponents to any particular liberal values, but rather with the simple convenience offered by the doctrine in terms of its ability to serve the interests of the ruling oligarchy forming in Russia over the "reform" years, on the one hand, and the interest international capital had in its implementation, on the other. Declaring the need for the government to remove itself from the business of economic regulation and social responsibility, reducing its role to the protection of private ownership rights and control of the monetary supply, the Washington Consensus doctrine became a convenient ideological basis for the practical operation of the levers of state power for the purposes of the appropriation – in the private interests of influential groups – not just of state property but also of government regulatory functions over currency circulation, subsoil use, real estate turnover and even law enforcement. The groups themselves became international, in which the interests of Russian influential circles fused with the interests of international financial speculators and multinational corporations. In essence, the former in this symbiosis of mutual economic interests profited by acting as the bridge for the latter, facilitating the transfer of control over the nation's wealth to international capital.

Predictably, the latter immediately assumed a dominant position on the stock market of privatized Russian enterprises – the logical continuation of predatory privatization in favor of its organizers and interested swindlers involved the resale of Russian enterprises to their foreign competitors.

The unwavering adherence of the Russian leadership to the doctrine of the Washington Consensus predetermined the substance of the economic policy pursued throughout the post-Soviet years, with the exception of the short-lived period of the sensible and highly-effective economic-stabilization policy implemented after the financial collapse and state bankruptcy of August 1998. As soon as the economy had achieved stable growth and pre-crisis production volumes had been regained, the pragmatic Primakov Government was sent packing, and the policy of economic modernization and development it had begun was quickly wound-up. Soon thereafter, the restrictions it had introduced on currency trading were abolished, monetary control was suspended, and an even broader campaign of economic deregulation was launched, with the government refusing to fulfill its social obligations and economic-development responsibilities. Having returned to the doctrine of market fundamentalism, the government was overwhelmed by the excess profits streaming into the country as a result of the price boom for the raw materials and energy commodities exported by Russia, funneling the bulk of its petrodollars towards the crediting of the US debt-security financial pyramid on the advice of Washington. Thus, a unique opportunity to modernize the Russian economy on a high-tech basis was squandered, and opportunities to achieve rapid growth by stimulating development of the new technological mode went unseized. If the hundreds of millions of dollars that had been invested in the American financial pyramids had been directed towards stimulating innovational and investment activity in the breakthrough areas of economic growth, Russia would not have been left so vulnerable to the global financial crisis. Quite the opposite – the country would have profited from it, exploiting the depressed state of developed countries to attract capital and technologies towards the development of its own state-of-the-art industries and securing new markets, just as China, India, and, to the extent possible, Belarus do.

CHAPTER 2 OUTLOOKS FOR FURTHER DEVELOPMENT OF THE GLOBAL CRISIS

2.1. Hitting bottom

The Russian economy, with its available labor resources and spare capacity, is potentially ready for an economic recovery. This potential could be realized under returned demand – foreign and domestic. Neither, however, is currently observed. The factors responsible for an upsurge in investment activity are similarly idle.

According to expert estimates, the outflow of capital caused by the servicing of private debt totaled USD 60–100 bln in 2009. Moreover, the financial performance of Russian industry was threefold worse than that of the previous year, with many manufacturing enterprises going into the red. This means that domestic resources for the investment-financing of Russian businesses are extremely limited. Nor is the influx of foreign resources to support the investment activity of Russian enterprises anticipated.

This contraction of investment activity is reflected in the production of investment goods, which was down by 39.5% in April. That said, reduced output has been observed in all investment machine-building sectors (Table 2).

Table 2

Production of investment-demand goods

| | March | April | January– April |
|---|--------------|--------------|-------------------|
| Manufacturing production | -20.5 | -25.1 | -22.0 |
| <i>Investment-demand production</i> | -34.3 | -39.5 | -36.3 |
| Production of other, non-metallic mineral products | -29.4 | -32.6 | -32.3 |
| Production of machines and equipment | -31.4 | -51.7 | -34.3 |
| Production of electrical equipment, electronics, and optics | -37.9 | -38.3 | -42.0 |
| Production of vehicles and equipment | -36.7 | -37.4 | -36.4 |
| Including passenger vehicles | -52.5 | -55.9 | -60.9 |
| commercial vehicles | -69.6 | -68.1 | -73.3 |
| Fixed-capital investments | -15.4 | -16.2 | -15.8 |

Source: Russian State Statistics Service, RF Federal Customs Service, Strategic Research Center – Bank of Moscow.

The progressive contraction of investment-demand goods output is driven by the drop in investment activity, which was down by 16.2% in April.

Indeed, the American economy has barely stabilized. The chief imbalance in the global monetary-financial system – the deficit in the current account of the US balance of payments – still lingers. It totaled USD 673 bln in 2008, with the cumulative US deficit carried over from 2000 reaching a staggering USD 5.3 trillion. As a result, US national foreign debt climbed to USD 4 trillion. Diagram 8 illustrates that the source of financing for the deficit in the US balance of payments has been the corresponding surplus of countries funding the American financial pyramid: China, Japan and Russia, etc.

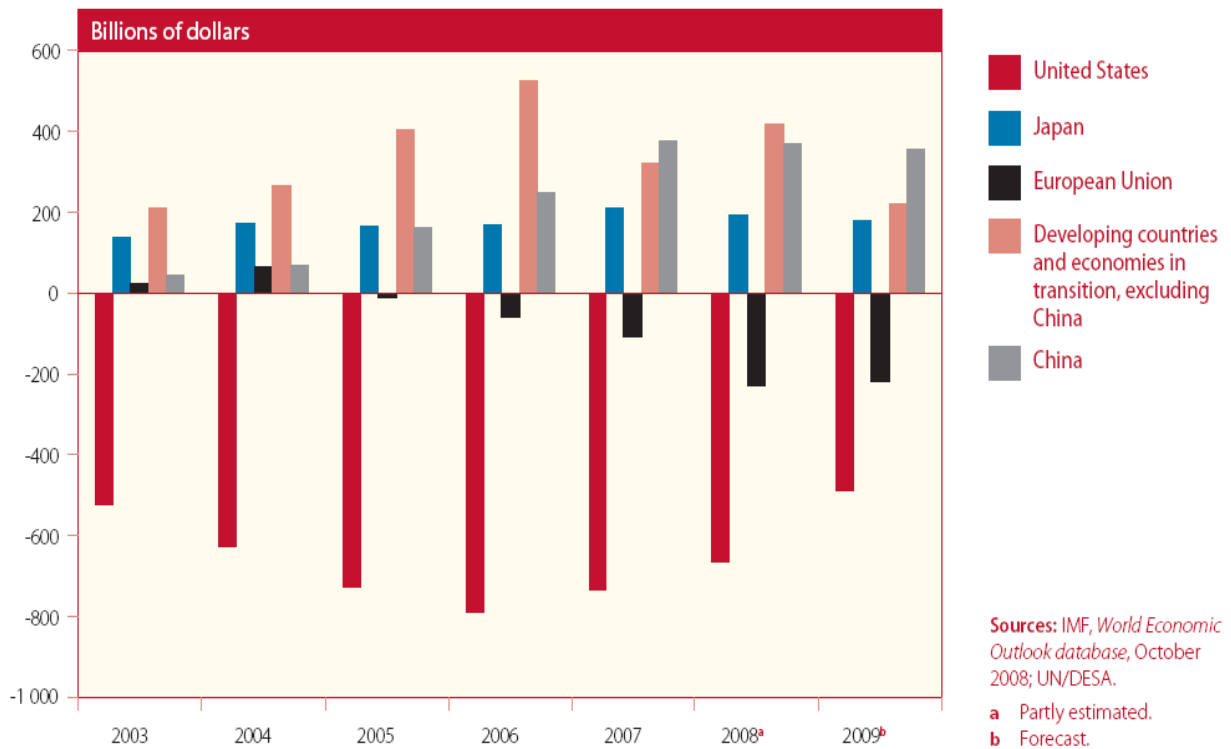


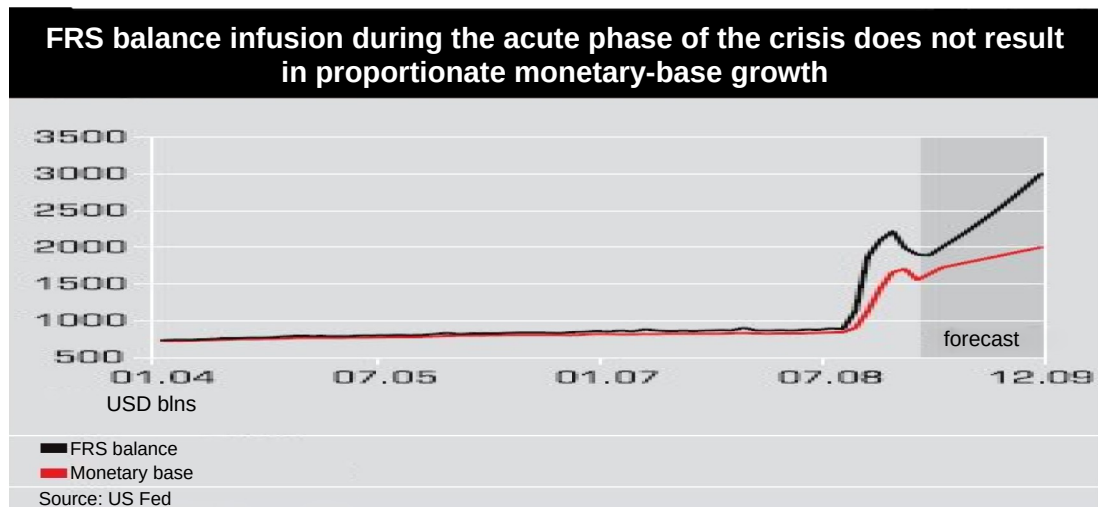
Diagram 8. Balance of payments in 2003–2009, in USD blns

The measures taken by the US monetary authorities and other global emission centers do not address the main sources of the crisis. Furthermore, relying on unsecured currency emissions to prop up the current system of financial institutions only exacerbates the existing imbalances and increases the risks – up to and including collapse of the entire system.

Today, the dollar-emitting flywheel is spinning ever faster under the pressure of the growing US national debt. According to available data, more than USD 2 bln must be printed daily for servicing purposes alone. Experts believe that during certain periods, which are occurring with growing frequency, this amount undergoes a manifold increase. In recent years, the US government system has regularly found itself in technical default, with American monetary authorities forced to correct the volume of government borrowing, and, consequently, correct upwards the emission of dollars. Just like any financial pyramid, the US debt-obligation pyramid is doomed to collapse. The sharp increase in dollar emissions occurring over the past few months (Diagram 9) indicates that the US monetary

system is entering hyperbolic growth mode, as mathematicians say – a mode fraught with catastrophe.

Diagram 9.



Source: M. Ershov; Queen Goes for Broke, Expert, No. 16, 27 April – 10 May 2009.

The ballooning of the US budget deficit from USD 500 bln last year to USD 1.85 tln (13% GDP) this year is propelling a steep rise in government debt. The total volume of American obligations already exceeds USD 50 tln (USD 16 tln – US Treasury; almost the same amount – corporate-sector liabilities; over USD 13 tln – household debt; USD 7–8 tln – state and municipal debt), which should also include the portion of medical- and pension-insurance-system obligations not covered by reserves (USD 25–30 tln), and which exceeds the resources of potential American creditors by several magnitudes. Servicing these obligations requires USD 3–5 tln in interest payments alone, which represents up to one-third of annual US GDP and is becoming increasingly problematic¹.

Servicing the growing avalanche of US obligations is only possible via new, increasing borrowings. Given the collapse of the major investment banks, falling commodity prices and Chinese export earnings, and the default of entire sectors and countries, however, there is no spare demand for US obligations in the volumes required. The US Federal Reserve System is forced to buy them instead – to the tune of almost USD 2 tln this fiscal year alone. The sharp acceleration of

¹ D.A. Mityaev; Implosion Dynamics of the Global Financial System (Scenarios and Strategies). Adaptation Opportunities and Strategy Choice for Russia. Mock-Scenario Presentation; M.: 2009; p. 118

dollar emissions for the direct acquisition of financial institutions' near-default obligations is leading to devaluation of the dollar and all dollar-backed assets.

Above and beyond these obvious monetary obligations, American financial institutions are saddled with off-balance-sheet liabilities (derivatives), whose volume exceeds official figures by a factor of ten. As D.A. Mityaev writes, just 5–7% of the US financial system constitutes a classic payment-and-credit arrangement (approximately USD 30–45 tln), with the remaining 93–95% of the system consisting of off-balance-sheet derivatives whose total volume stands at approximately one quadrillion US dollars (at the beginning of 2009, for example, the balance sheet of JP Morgan totaled approximately USD 2.5 tln while its off-balance-sheet instruments were over USD 97 tln; the Goldman Sachs balance sheet stood at about USD 1.5 tln, whereas its off-balance-sheet instruments had topped more than USD 50 tln). The actual volume of liabilities assumed by primary US financial institutions is double that of their capital reserves, which, compounding the problem, are suffering severe depreciation². Given their sheer magnitude, the refinancing or nationalization of these liabilities would lead directly to hyperinflation and the collapse of the dollar-based financial system.

The adjustment and mutual write-down of off-balance-sheet derivative liabilities and eliminating the US budget and balance-of-payment deficits could stop the crisis in the global monetary-and-financial system. Yet, the American authorities are powerless to force private derivative-issuers to undertake the reciprocal clearance or other write-down of securities whose volume exceeds the entire FRS balance-sheet by a factor of tens. Burdened with their own overwhelming liabilities, they are no longer in a position to manage their common financial system. Just one of its pillars alone – the defaulted AIG Insurance Company – managed to issue derivatives in an amount exceeding the combined monetary supply of the world's twenty largest economies. It is unclear if and when American taxpayers will be able to pay off its debts³.

² *ibid*; p. 28

³ *ibid*; p. 63

In order to avoid default, the US Government needs to cut back sharply on state expenditures, which isn't realistic due to social considerations and counterproductive from the standpoint of anti-crisis policy. Recovery from the crisis presupposes developing new technological trajectories and a sharp upturn in innovational activity. This requires just the opposite approach – expanding state expenditures in order to stimulate investments. Even classical political economists like Samuelson¹ admit that “only massive infusions of budgetary expenditures financed by running a fiscal deficit will be capable of pulling Europe, America, and Asia out of the economic slump that will succeed the current disaster.”

Preserving today's global financial system will be next to impossible. In order to maintain the dollar's leading role, the United States must simultaneously jettison its colossal financial obligations, reign in government spending, and spur modernization of the economy. As D.A. Mityaev² rightly points out, in attempting to recover from the current crisis, the US authorities are using dependent rating agencies, banks and hedge funds to wage a financial war against vulnerable segments of the global financial system, in a move to mobilize resources for its own rescue by contracting capital and establishing control over other countries' assets that are clearly insufficient to support the dollar-based pyramid of American obligations. Despite the optimistic statements of American image-makers and the inflated ratings of American financial institutions, reduced confidence in US obligations and flight from the dollar are unavoidable.

Countries that have managed to retain their economic sovereignty (China, India) are refraining from opening their respective financial systems, demonstrating stable growth despite the crisis. Their lead is being followed by the major countries of Latin America and Southeast Asia, which are resisting the appropriation of assets by speculative capital. Through currency swaps, China is quickly creating its own system of international settlements. The maneuvering room left for the US FRS is inexorably shrinking – the American economy must

¹ P. Samuelson; In Terms of Economic Policy, Obama Would Be Wise to Take the Middle Path; <http://www.econorus.org>

² D.A. Mityaev; Implosion Dynamics of the Global Financial System (Scenarios and Strategies). Adaptation Opportunities and Strategy Choice for Russia. Mock-Scenario Presentation; M.: 2009

weather the main hit of capital depreciation. The US financial system has entered a self-defeating vicious circle: increasing monetary emissions to save its financial institutions undermines faith in the dollar, which provokes capital flight, which only serves to worsen its position and leads to more monetary emissions.

2.2. Predictions for further development of the economic crisis

Proceeding from the above, the most likely sequence of events includes: depreciation of a significant portion of financial capital; devaluation of the dollar and the loss of its status as the world's dominant reserve currency; regional fragmentation of the global monetary-and-financial system. The crisis will end with the capital remaining after the collapse of the dollar-based financial pyramid and bursting of the other financial bubbles flowing into production under the new technological mode. Following restructuring of the global economy on the basis of the new technological mode, which will continue for another 3–5 years and feature changes to the composition of leading companies, countries and management practices, the next long wave of economic growth will commence. That said, the net effect of the negative trends associated with dismantling of the old technological mode and the positive aspects entailed in creation of the new one will be determined by the growth speed of the new technological mode compensating for the shrinking of the obsolete part of the economy.

It therefore follows that the process of self-destruction of the global financial system is inevitable. D.A. Mityaev is right in that there are only three possible scenarios for further development of the crisis, programmed by the logic inherent in development of the current economic system.

- 1) Scenario of rapid transition to a new long wave of economic growth (optimistic). It would entail gaining enough control over the crisis to allow the world's advanced nations to contain the downturn within the obsolete sectors and peripheral regions of the global economy and channel the remaining resources towards stimulating innovational activity and spurring development of the new

technological mode. That said, the structure of the global financial system would undergo a dramatic transformation, becoming multi-currency and featuring a reframing of the list of major countries and recalibration of their relative weight. Government institutions of strategic planning and financial-flow regulation would be strengthened, up to and including at the global level, with the possible emergence of a global currency. The globalization process would become more manageable and balanced in terms of advanced-nation interests. A strategy of sustainable development would replace the doctrine of liberal globalization. The war on terror, global warming, and other threats to humanity would be used as unifying goals to rally the world's advanced nations together.

2) Catastrophic scenario, accompanied by the collapse of the current American-centric financial system, the formation of relatively self-sufficient regional monetary-and-financial systems, destruction of the bulk of international capital, a sharp drop in the standard of living in the “golden-billion” countries, worsening recession and the erecting of protectionist barriers between regions.

3) “No-change” scenario, accompanied by growing chaos and the destruction of many institutions – both at the core and on the periphery of the global economy. Provided the preservation of certain elements of the current global financial system, new centers of economic development would appear in the countries that had managed to outpace the others in terms of their formation of the new technological mode and “harness” the new long wave of economic growth.

In essence, the “no-change” scenario represents a combination of elements of the catastrophic and controlled transition from the crisis. That said, it may be catastrophic for some countries and regions and optimistic for others. It bears mentioning, however, that the institutions at the core of the global financial system would survive by appropriating the resources of peripheral countries through establishing control over their assets. This would be achieved by exchanging the emission of reserve currencies for the property of receiving countries via the banks and corporations surviving at the core.

The sequence of events has thus far been unfolding according to the “no-change” scenario, which has been accompanied by stratification of the world’s advanced nations at different depth levels of the crisis. Suffering the greatest damage are the countries with open economies, where the extent of industrial-production and investment declines stands at 15–30%. Countries with autonomous financial systems and receptive domestic markets protected from attacks by financial speculators continue to grow (China, India), quickly increasing their relative economic weight.

The optimistic scenario presupposes extensive restructuring of the global monetary-and-financial system, including creation of the following elements proposed by international-organization experts: a worldwide regulatory organization responsible for monitoring and assessing systemic risks; the harmonization of national financial-regulation laws; and the adoption of universally-binding global rules for financial institutions. These should include provisions envisioning managerial liability, stock-option transparency, the elimination of internal conflicts of interest at risk-assessment institutions, credit-leverage restrictions, the standardization of financial products, and cross-border bankruptcy procedures.

Many authoritative scholars in Russia and overseas have written about the need for such reforms in the global monetary-and-financial system. Yet, the creation of such a universal regulatory system for the global and national financial markets requires both the goodwill of the states involved and consensus among the national political and business elites of the world’s advanced nations, which is scarcely possible given the current conflicts of interest. G20 summit meetings have demonstrated the unpreparedness of the political leadership of the US, EU, and Japan, which have monopolized the right to emit the world's reserve currencies, to make the necessary dramatic changes to the existing system of monetary-and-financial relations. Even the cosmetic measures approved by the G20 on tightening financial discipline and beefing-up the responsibilities entailed in assessing risks associated with the issuance of debt securities were instantly breached by the US monetary authorities when they expanded opportunities to exploit formal methods

of debt-security valuation to manipulate the financial-stability indicators of credit organizations. As disappointment in the ability of the world's advanced nations to agree on new principles for the regulation of global monetary-and-financial relations grows, so too does the likelihood of the catastrophic scenario.

Countries with strategic-planning systems are counting neither on market forces nor on the wisdom of international financial institutions that insist on following the course charted by the US FRS to further the interests of the American oligarchy. Under the din of conversation on the solidarity of the world's advanced nations in stabilizing the global financial system, China is quietly constructing its own monetary-and-financial system of international settlements via currency swaps with interested countries. In no rush to yield their sovereignty or follow Washington's recommendations are India, Brazil, Venezuela, Iran, and a number of other major developing countries that have embraced a pro-active industrial, research-and-development and structural policy.

Aside from these emerging markets, even G8 countries preaching the "export" of neoliberal ideology are resorting to measures designed to protect their respective economies by expanding domestic sources of financing.

As talk of the mutual rejection of protectionist measures and maintenance of the status quo continues, the current global economic system is quickly eroding. The WTO and IMF have lost their erstwhile effectiveness and authority. Developed and developing nations alike have drifted considerably from the once seemingly-unshakeable dogma of liberal globalization. That said, the more decisively a given country pursues an independent, pragmatic policy of supporting and defending its national economy, the more effective it turns out to be. All of which raises the question: is it really worth fighting to save the existing global financial system? Would preserving it be to Russia's advantage? Or perhaps it would be better for the country to advance an initiative on the formation of a radically-new structure of international financial and economic relations?

2.3. Does Russia need the existing world order?

In order to answer that question, the intricate web of national and transnational-capital interests must be untangled, insofar as these are the factors that determine the processes by which national incomes are distributed and wealth is accumulated in today's world.

At present, global economic development is determined by the confluence of two opposing trends: subordination of the global economy to the interests of the international financial oligarchy and transnational capital, on the one hand, and competition among national economic systems, on the other. As these trends converge, a unique combination of internal and external factors is created in each country. Combination variations range from the utter dependence of the majority of African countries, whose economies are uniformly dominated by transnational capital, to the powerful economies of China, the US, and Japan, where national economic policy is generally crafted to reflect the interests of national capital and domestic manufacturers.

Positioned between these two extremes are the countries of Latin America, which are attempting to carve out at least some niches for internal capital in an environment dominated by transnational corporations; EU countries, which have abandoned their national sovereignty in economic policy in favor of European transnational capital; Arab countries, including Muslim states, where policies to attract foreign capital for the development of natural resources are combined with the staunch defense of cultural values and national interests; and the rapidly-developing countries of Southeast Asia, where the promotion of national interests dominates the very strategy for development and foreign-capital attraction.

Formation of the specific economic model for each country is accompanied by a complex and acute struggle for control over the institutions of state power between the representatives of transnational and national capital, between the global oligarchy and the national elite. These groups have different – often opposing – interests, different values, and different mechanisms for exerting influence over the economy. The dominant countries in global trade and

international finance, principally the US, Great Britain, Japan, and Switzerland, are simultaneously transnational-capital staging countries. In fact, this last factor forms the crux of the relatively-high degree of harmonization between the interests of their national elites and those of the global oligarchy. Underdeveloped countries are almost entirely deprived of internal sources of investment and depend exclusively on transnational capital, which sets the groundwork for the comprador-type nature of their national elites. Conflicts between the interests of transnational and national capital are resolved by forcing the latter into the service of transnational corporations and incorporating the respective national elite into the outer bands of the global oligarchy.

Positioned between these extreme cases are the remaining countries, which attempt to promote their national interests in international competition by exploiting their competitive advantages to anchor their respective positions in the global economic system. The national interests of each country are determined, first and foremost, according to the principles of preserving its national independence, ensuring the prosperity and high standard of living of its citizens, and retaining its national culture and the ability to pursue its inherent spiritual values. These interests, in turn, dictate the respective priorities of international cooperation.

States intent on preserving their independence protect their national markets, bring the attraction of foreign capital and international cooperation under national control, and, where necessary, restrict foreign investments in sectors critical to the pursuit of national interests, support domestic manufacturers, and promote improvements to the competitiveness of the national economy. In the cultural arena, the state makes the national culture and its informational, educational and developmental policy a priority; national spiritual values are purposefully promoted and shielded from the overwhelming influence of the transnational pop culture, which stupidifies the nation and undermines its morale.

For their part, the global financial oligarchy and big transnational capital strive to establish total control over the global market and each of its component

countries, erasing economic, cultural and political borders between nations and subordinating the competitive advantages of each to their narrow interests, all the while forming their own informational, legal and even coercive infrastructure. Today, they represent a formidable – if not the most powerful – economic force, controlling more than one-half of global trade-and-finance turnover and the most profitable industrial sectors in various countries, including oil, mining, electronics, power, automobile manufacturing and many other areas.

In terms of economic turnover, many transnational corporations outperform even major countries, bring national governments under their control, and exert decisive influence over the formation of international law and operation of international institutions. Five hundred transnational corporations encompass over 1/3 of industrial exports, 3/4 of global commodities trade, and 4/5 of the trade in new technologies, employing tens of millions throughout the globe and operating in practically every country. In terms of corporate origin and headquartering, transnational corporations are roughly distributed equally between the US, the European Union and Japan. They have a decisive influence on the foreign economic policy pursued by these countries and their subordinate international organizations, and use this influence to pursue their interests on the global market.

The relationships between transnational and national capital, and between the international oligarchy and the national elite, take shape differently depending on country and time. Initially, transnational capital springs from intermediary activity in international trade and financial operations. Emerging as a powerful stimulus for capital growth are international – and subsequently world – wars, which sharply increase demand for government borrowing and create numerous opportunities to gain excess profits. Extending loans to all warring sides, the financial oligarchy always comes out ahead, participating in the next redivision of the world, simultaneously raking in concessions from the losers and interest payments from the victors. Through its financing – and frequent provocation – of military conflicts, the global oligarchy has won a dominant position in the financial

systems of Great Britain, France, and later, the United States, other Western countries and their respective colonially-dependent states.

The main procedure employed by the financial oligarchy to exert political influence and advance its interests involves establishing control over the institutions of state power in various countries and their subsequent dismantling and replacement by international law and international institutions. The lynchpin of this strategy entails forcing the respective countries into debt dependency, buying-off and demoralizing their national elites, and running a public disinformation campaign. This is accomplished with the help of wide-ranging informal structures and contacts, through which the right staffers for government institutions are selected, official decisions are crafted, and ‘realpolitik’ is formulated. For many decades now, the doctrine of market fundamentalism and radical liberalism has unwaveringly served as the ideological underpinning of this policy. Using the most diverse methods – from bribing people in positions of power to organizing revolutions and civil wars – to weaken and eventually disband national institutions of state power and political, moral and cultural control, the global oligarchy eliminates barriers to the free movement of transnational capital and subordinates the economies of whole countries and continents to its narrow interests.

Unlike the interests of nations, which have always dovetailed with stability and friendly international relations, the interests of the global oligarchy lie exclusively in creating conditions ripe for the reaping of excess profits and the strengthening of its world dominance. Creating prime conditions for this result are wars, revolutions and economic crises, which lead to the erosion of national security systems and institutions of state power, the outbreak of chaos, the destruction of economic structures – and the opening up of additional opportunities for their subversion to the interests of transnational capital.

The domination strategy pursued by the global oligarchy is not yet all-encompassing. It is not interested in all types of activity and does not strive for control over all of the planet’s resources. It is geared towards seizing and holding

the “commanding heights” of the global economy and national economic systems – a position that allows it to dictate the rules of the game to the rest of the world. The efforts of the global oligarchy are principally focused on establishing control over the most profitable business areas, where the sources of excess profit involve gaining political, natural and intellectual monopolies – the administration of government debts, the printing of money, financial services, banking operations, audit and legal services, international trade, drug trafficking, natural monopolies, energy, and the use of new technologies. The remaining sectors, where the mechanisms of market competition eliminate opportunities for the generation of monopolistic hyper-profits, are less attractive to transnational capital and therefore left largely to the respective national business circles. That said, the greater the economic power of the latter, the greater the degree of alignment and mutually-beneficial partnership between the global oligarchy and national capital, which exerts influence on formulation of the rules of the game in any country.

For the purposes of harmonizing the interests of the global oligarchy and the national interests of the most developed countries, the racist theory of the “golden billion” was developed, pursuant to which a comfortable planetary existence can only be guaranteed to a billion people living within the most prosperous nations, while the remaining countries are doomed to play a mere raw-exports and cheap-labor role to serve the interests of transnational capital. Far from being purely theoretical, this doctrine is actively applied in practice to regulate international relations. Countries ranking themselves among the “chosen ones” are permitted to protect their internal markets, conduct an aggressive export policy, support domestic manufacturers, preserve their national culture and social mores, and impose their interests on others – up to and including via the use of force. The rest are expected to blindly follow the recommendations of international organizations, which clearly reflect the interests of the global oligarchy, and to refrain from hindering the access of transnational capital to their domestic markets, or the penetration of their cultural arenas by the stupefying and destabilizing technology of cultural and public-moral destruction.

These “others” are drawn into various arrangements of unequal foreign-economic exchange, under which their domestic resources are funneled abroad and their dependency on – and subordinate relationship to – the “donors” of transnational capital is reinforced. The most sophisticated arrangements of unequal foreign-economic exchange imposed by the global oligarchy on dependent countries involve drawing the latter into traps: foreign debt, a natural-resources specialization in the international division of labor, and the abandonment of sovereignty in trade and fiscal policy.

Stimulating foreign borrowing, which is effected via the respective domestic institutions of state power, achieves the simplest exploitation of the economic potential of the respective countries. By extending loans to states or acquiring their securities, transnational capital – without assuming any particular risk – generates a decent rate of return on interest while the borrower-country is dragged into a debt pyramid in which it needs to borrow more and more just to cover previously-assumed loans. Given that the economic growth rate of the vast majority of countries (0–4%) is much lower than the interest rate on the global lending-capital market (8–20%), the “debt trap” kicks in automatically. As soon as costs to service the government debt become commensurate with the flow of earnings into the government budget, allocation of the national income of the respective country comes under the control of foreign creditors. Via the tax-and-budget mechanisms of the respective debtor-countries, national manufacturing forces begin operating for the enrichment of international speculative capital. Thus, the developing nations of Latin America wound up paying much more in interest than they had ever taken out in loans, just as their overall debt burden continued to mount.

The trap laid when an economy specializes in natural-resource production boils down to the unequal foreign-trade exchange that occurs due to the “price scissors” phenomenon – the difference between raw-materials prices – formed on the basis of global market-competition – and finished-goods prices, which are elevated by the intellectual royalty on the exclusive copyrights held to the respective manufacturing technology. Drawn into a raw-materials specialization,

the country falls into the trap of the recurring exchange of its natural-resource royalty on depleting deposits for the intellectual royalty on the price of imported finished goods, which finances scientific-and-technical progress overseas, spreads the “price scissors” wider, and undermines the country’s limited resource-and-production potential.

Essentially the entire arsenal of the policy envisioning the dismantling of national-sovereignty institutions for the purposes of achieving the world dominance of the global oligarchy was unleashed against the USSR in the process of its destruction and continues to be used today against Russia and other CIS countries. The numerous statements by the ideologues of the new world order and the concrete actions by advanced Western nations and international organizations with respect to Russia leave no doubt that within the framework of the new world order, it has been relegated to the role of a raw-materials colony charged with softening the blow of natural-resource and environmental crises that threaten the prosperity and stability of developed countries.

It follows from the above that preservation of the existing system of international financial relations would be inexpedient for Russia and most other world countries lacking the ability to emit global currency. The current crisis affords us the opportunity to reconsider these relations so as to factor in the interests of all participants. However, so long as Washington has the capacity to force preservation of the status quo on dependent NATO countries and Japan, any such reconsideration will remain out of reach and the remaining countries will be left with a choice between the interests of international capital and their own national interests.

An overview of anti-crisis policy at the international and national levels evidences the lack of substance of the first and the varying effectiveness of the second. The latter is more effective in countries whose economies are better shielded from foreign markets and rest primarily on domestic sources of financing. It therefore follows that countries pursuing an independent economic policy and enjoying a self-sufficient financial system have a better chance of successfully

overcoming the crisis. That said, formulation of an effective national anti-crisis policy must rest on the understanding of the patterns of modern economic development ignored by the G8 ruling elite.

CHAPTER 3. THE CRISIS IN ECONOMIC THEORY

Modern socio-economic development is characterized by the leading role played by scientific-and-technological progress (STP) in supporting economic growth. According to various estimates, STP accounts for 70 to 95% of GDP growth in developed countries. A key role in the formation of scientific-and-technological progress is played by: the society's intellectual potential, support institutions for innovational activity, and the state's R&D and innovation policy. This section analyzes these components of Russia's socio-economic development in the context of changes to the global economy.

The role played by STP in modern economic development probably presents the most challenging problem to the study of economics. Stubbornly ignored by the majority of theorists dwelling in virtual models of market equilibrium, STP is nonetheless the chief concern of business practitioners operating in the real economic world. The fact that today's most popular fields of economic science find themselves in such a paradoxical state evidences the ongoing crisis in the discipline, where the most significant factor of economic growth is treated as an anomaly. The severity of this problem demands an analysis of the fundamental pillars of modern economic theory, which has been exposed as being incapable of either predicting or providing effective recommendations for recovering from the global financial crisis.

3.1. Fallacy of the concept of market fundamentalism

Following the works of T. Kuhn⁵, it can be deemed proven that the development of scientific thought unfolds unevenly, and can be presented as a

⁵ T. Kuhn; Structure of Scientific Revolutions; M.: AST, 2002

sequence of successive scientific paradigms, each of which synthesizes previous experience and better explains the causes of observed phenomena than the preceding one. The scientific paradigm includes basic assumptions, the research methods applied in the discipline in question, and the perception that researchers have of the ways in which scientific problems are solved. The development of any field of knowledge constitutes a sequential substitution of scientific paradigms, during which basic theoretical concepts are reconsidered. The scientific paradigm prevailing until very recently in global economics was formulated at the end of the 19th – beginning of the 20th Centuries under the influence of works by A. Smith, D. Ricardo, J.S. Mill, A. Marshall, and L. Walras. Their followers constructed an elegant – though not reflective of actual economic processes – mathematized theory of market equilibrium. This theory is based on the theorems introduced by the classicalists on the rationality and optimum behavior of business entities and refers to itself as neoclassical. According to the axioms it encompasses, a firm's market behavior is determined by its drive to generate maximum profits under clearly-defined internal and external conditions. At the same time, it is implied that the business entity has a clear grasp of the production and market capabilities it has at its disposal, as is the belief that its behavior is necessarily the result of a rational choice between the multitude of options of which it is aware.

Despite its clear divergence from the actual processes of economic development, the neoclassical paradigm remains a mainstream economic concept – both in terms of publication number and in that it accounts for the bulk of the basic curriculum of many economic disciplines. Insofar as it forms the respective mindset of many political and business leaders, lending a certain logic to the conduct of economic policy by a slew of national elites dependent on international capital (including the Russian elite), an analysis of the essence of this wildly-popular and influential economic religion warrants further scrutiny.

In order to understand the essence of a particular theory, the substance of the axioms forming its foundation must be sorted out. In the neoclassical paradigm, these axioms include: the concept of the entire gamut of business entities acting as

economic agents, whose motivation boils down to gaining maximum operating profit; and the assumption that all of these economic agents act absolutely rationally, given all available technical capabilities, as they compete freely in an institutional vacuum. The consistent result of any neoclassical interpretation of the economic behavior of business entities entails the situation of market equilibrium, which is characterized by the most efficient resource use but never observed in practice.

Although under modern interpretations of neoclassical theory its axioms are elaborated upon with the addition of various stipulations and clarifications, they essentially remain unchanged, spawning the respective distortions in the understanding of economic processes. We shall discuss the most relevant of these from the point of view of the understanding of the working mechanisms of economic-development processes.

Today's dominant paradigm of market equilibrium features an assumption of the rational behavior of economic agents, directed by the singular motivation of maximum profits. At the same time, the significance of all other motivations for economic behavior is ignored, including its ideological direction and moral limitations.

The neutralization of spirituality in the scientific interpretation of economic behavior is explained by the difficulties in its formalization and by it being the natural outgrowth of a certain ideological tradition. On the one hand, reducing the motives for economic behavior to the maximization of profits greatly simplifies its mathematical modeling and allows certain hypotheses concerning the properties of the economic system to be rigidly proven. On the other, these properties are then used to justify a highly-specific economic policy that has thusly received a “scientific” basis.

Yet, a prime example of the scientific baselessness of neutralizing the human component in the modeling of economic behavior involves a juxtaposition of two of the most logically-developed theories built on the neoclassical foundation – the currently-popular theory of market equilibrium and the theory of optimal economic functioning, as formulated by Soviet economist-mathematicians⁶. Although they purport to prove conceptually-opposite results (the first proves the optimality of the market organization of economics, the second – centralized planning), these ideologically-opposed academic schools nevertheless share a common foundation – reducing economic behavior to maximum profit. It’s just that the first proceeds from maximizing the income of economic agents, whereas the second envisions maximizing the national income of society as a whole. Each theory uses as scientific proof of its validity conceptually-opposite economic ideologies based, respectively, on the market and command principles of economic-system management. That said, each provides rigid mathematical proof of the attainability of optimal (most efficient) resource use and public-welfare maximization, provided compliance with the same assumptions about the rationality and informedness of economic agents. The difference is that in the first case these are viewed as private individuals, and in the second – as state agencies.

⁶ N.P. Fedorenko; “Questions of Optimal Functioning of the Economy”; *M. Nauka* (“Science”), 1980

In essence, each of the aforementioned academic schools deifies business entities, ascribing to them supernatural qualities of the absolute knowledge of all possible economic-system conditions and the absolute will to make optimal decisions. That said, taken as the absolute criterion of validity is the maximization of economic well-being, measured in monetary terms. It's just that under the theory of optimal economic functioning, the state acts as the business entity maximizing national income, whereas under the theory of market equilibrium, the latter is attained via maximization of the income of private individuals. At its ideological core, this is nothing more than the cult of the Golden Calf, presented in the respectable scientific form of rigid mathematical models.

Of course, assumptions as to the rationality of economic agents and the reduction of their motivation to the maximization of profits are objectively grounded in the ideal model for the behavior of the market trader. But even the architect of the theory of the “unseen hand of the market” found at the core of the classical – and subsequently-widespread and currently-popular neoclassical – economic paradigm, A. Smith, stressed the fundamental significance of ethical values in economics. The seminal work by M. Weber on Protestant ethics exposed the logic of the rationalization of economic behavior and its focus on maximum profit and wealth as the result of the specific transformation of a religious worldview. It was the essence of this transformation that boiled down to the reduction of divine providence to material success measured in monetary terms. This sanctification of wealth, at its ideological core equivalent to the cult of the Golden Calf, foreshadowed the dominant motive of the maximization of profits in economic behavior as the principal means of attainment of success in life – not just in the material, but primarily in the spiritual, sense.

It must be acknowledged that the spiritual state of *homo economicus*, whose entire motivation is reduced to achieving maximum profits, turned out to be a highly-effective driver of economic development. In fact, competing with likeminded entities for profits, economic agents strive for endless improvements to the efficiency of their production and products. This mass race of economic agents for maximum profits emerged as the key driver of the economic upswing among Protestant societies that roused European civilization from its medieval slumber and set it on a path of rapid economic growth.

Yet, on this path, mankind was forced to bring the Golden Calf no shortage of sacrifices. The pauperization of millions of peasants during the industrial revolution, bourgeois revolutions and world wars, annihilation of the aboriginal population of North America – these are but a few of the bloodier episodes witnessed in affirmation of the ideology of economic rationality. Society splintered into antagonistic classes, and the enrichment of the entrepreneurial elite was largely achieved via the merciless exploitation of the labor of the working class. This massive, open and outrageous violation of the teachings of Christ in the Christian world required ideological justification. This was achieved scientifically by the theory of market equilibrium, which proved with mathematical precision the optimality of economic behavior geared towards the maximization of profits for society as a whole. Mass poverty and monstrous social inequality were explained as the unavoidable price of heightened industrial efficiency influenced by the “natural” laws of market competition. The genocide of the populations of the North American, African and Asian colonies was written off as a result of the relative backwardness of the respective peoples – their inability to reap profits from the economic exchange.

In essence, the neoclassical paradigm in economics has fulfilled and continues to fulfill a religious function, convincing people to believe in the infallibility of the free market through the cult of the Golden Calf, which determines economic behavior and justifies the system for the distribution of national wealth and income in Western countries. This pseudoscientific religion has its dogmas, cloaked in rigid mathematical theorems of market equilibrium and communicating the respective taboos and principles governing the adoption of decisions on economic policy. The religion’s “symbols of faith” include the prohibition against government interference in market forces and the ultimate superiority of private property, which is elevated to the status of a “sacred right”.

At the same time, the discordance between the theory of market equilibrium and the actual behavior of business entities means that it cannot be relied upon in studies of the processes of economic development. The interpretation –

characteristic of the neoclassical approach – of economic growth as a function of changes to economic equilibrium, over time, as influenced by the reaction of businesses to an increasing supply of manufacturing resources within the framework of a set number of technological capabilities added little to the understanding of the mechanisms of modern economic development. Accumulating over the decades were numerous facts that fit poorly into the neoclassical theory of economic growth, whose divergence from reality was becoming increasingly apparent to thoughtful researchers. Back in 1971, then-President of the American Economics Association and Nobel Laureate V. Leontiev spoke of the problem in his official annual address. In 1972, his successor and fellow Nobel Prize Winner, D. Tobin, addressed the issue as well. In 1980, R. Solow, classicalist of the theory of economic growth, sounded the alarm of the crisis in neoclassical economics in the same official address. Since then, a mountain of books has been written about the inability of neoclassical theory to explain many economic phenomena, due to the divergence of its axioms from reality. Today, the disconnect between neoclassical theory and reality remains unacknowledged by only the most closed-minded apologists for market fundamentalism, of whom, it must be said, there is no shortage among the ranks of those determining economic policy in countries the world over, including Russia.

The fundamental indeterminacy of the range of manufacturing capabilities, the economic effectiveness of new technologies, the variance among business entities in terms of their ability to adapt to innovations and obtain/absorb market information – this is but a partial list of the properties of economic reality insufficiently reflected in neoclassical economic theory. The latter reflects economic reality in a simplified fashion – in particular, the actual process by which decisions are made. The concept of economic equilibrium greatly simplifies the substance of economic processes and ignores a number of important properties of the actual competitive struggle between diverse businesses in an uncertain market environment.

The most anomalous facts of serious consequence to challenge the neoclassical paradigm were the transition to a knowledge-based economy and the emergence of STP as a determining factor of economic growth. The neoclassical paradigm proved incapable of explaining either the causes or the driving forces of modern economic development. It was powerless to predict the protracted economic crisis and depression of the mid-1970s or the global financial crisis and recession unfolding today. Not only were these episodes not predicted on the basis of the neoclassical models of economic growth – they were left without substantive explanation by the theory of market equilibrium, just as uneven economic growth and the indeterminacy of technological change were.

The surprising persistence of the neoclassical paradigm and its popularity in big-business circles, which generously sponsor the imposition of its resulting mindset onto public opinion, is explained by the respective economic and political interests. Neoclassical economic theory serves as the scientific basis for the ideology of market fundamentalism and liberal economic policy, the pursuit of which only furthers the interests of big capital anxious to see the government regulation of its activities minimized. The ideology stakes its claim to societal primacy, insofar as it reduces social relations to the power of money. It justifies the forms of neo-colonialism observed today that allow the issuers of global currency (primarily the US dollar) to exploit all of humanity via the unequal exchange of unsecured currency symbols for actual wealth. This is precisely why it is so actively imposed by Washington – directly through political pressure and indirectly via the respective international institutions and heavily-financed expert community – on the ruling national elites for the purposes of exploiting the countries they control.

3.2. New scientific paradigm of economic development

Of course, it would be less than accurate to assert that the whole of economic science has “sold out” to international capital. Swimming against the tide of the generally-accepted economic thought that serves as apologetics for

modern monetary imperialism, many scholars are conducting objective research into real economic processes, successfully identifying their mechanisms and describing the patterns of economic development. Three decades ago, the structural crisis and its accompanying protracted depression prompted the activation of research into macroeconomic dynamics and a search for new approaches to its explanation. At the center of this attention was the long-forgotten idea of J. Schumpeter concerning the uneven nature of economic growth and innovation as a factor of this unevenness. According to this theory, innovation disturbs economic equilibrium, which is then restored at a new level under the influence of the processes of economic competition. As the economic system transitions to a new state of equilibrium, the first entrepreneur to incorporate the innovation gains excess profit, the amount of which drops as other businesses begin to apply the new technology. The incorporation of innovation and subsequent process of economic-equilibrium restoration at a new level is expressed in the unevenness of economic growth⁷.

Gaining new life was the theory of long or “Kondratiev” waves of economic growth, named after N.D. Kondratiev, who first formulated the hypothesis of their existence. In the 1980s, new evidence was produced of their existence and interconnection with the patterns of global technical-economic development. In particular, proven was the link between the formation of long waves and bursts of innovational activity, emergence of new technological modes, and structural shifts in energy and transportation infrastructure².

As a result of yesterday’s research into scientific-and-technological progress at the micro and macro levels, new facts incompatible with traditional beliefs about economic theory were identified. Simultaneously with this criticism of neoclassical theory, researchers gained new knowledge of the substance of the processes of economic development, thereby stimulating the development of a new scientific paradigm.

⁷ J.A. Schumpeter; *A Theory of Economic Development*; M.: Progress, 1982; J.A. Schumpeter; *Business Cycles*. NY, 1939

² Freeman, Marchetti, S.Y. Glazev, Mikerin, Tesla

Over the past three decades, the fundamental axioms of classical economic theory have come under sharp scientific criticism. Empirical research into the behavior of firms under real market conditions was able to establish that the motivation of business entities is hardly restricted to the maximization of profits or any other indicator of economic productivity. The fact of an actual business entity's limited information on market conditions and restricted access to technological capabilities was proven, with the significance of the transaction costs and other expenses associated with its obtainment also established. Cast in doubt was the very possibility of attaining economic equilibrium as a result of the decisions made by actual business entities. But the most devastating blow of all was likely sustained by the axiom concerning the rational market behavior of businesses. Numerous studies into the actual behavior of firms clearly established the limited ability of business entities to make the calculations necessary to reach optimal choices. Under the concept of limited rationality developed by Simon, firms are guided not by the optimal but by the acceptable behavior option.

Overcoming the crisis in the study of economics has been associated with the broadening of its baseline assumptions to encompass a fuller reflection of reality. Important steps in this direction have been taken within the scope of so-called evolutionary economics, forming the next paradigm in economic science.

As introduced by Nelson and Winter, the term "evolutionary" underscores the basic idea of the new school – the concept of economic "natural selection"¹. Development of the most competitive business entities occurs thanks to the squeezing-out of other market participants from the economic arena. The process of economic natural selection forms a certain "organizational genotype" – the properties and characteristics of businesses capable of surviving and growing in the changing economic environment. These properties include, in particular, the ability to produce and generate profit. The dynamics of the survival and growth of the business-entity population under conditions of a changing economic environment determine changes to macroeconomic indicators, including economic-growth indicators.

¹ R.R. Nelson, S.G. Winter; *An Evolutionary Theory of Economic Change*; Cambridge, 1982; p. 9

From the standpoint of evolutionary economics, each point on the trajectory of economic development is determined by the entire evolutionary background and “natural selection” of the business-entity population operating under the conditions of the respective economic environment. Evolutionary economics factors in the complexity of business-entity behavior and the indefiniteness of numerous production possibilities. The behavior of firms is viewed not simply as a rational choice among a range of production possibilities, but as a variable determined by said range – as well as by existing decision-making procedures and economic-environment conditions.

As in the real world, business entities under the evolutionary theory have no inherent objectives or behavioral motives other than the goal to survive and grow – they are formed during the search and “natural selection” processes under interaction with the economic environment. Inter alia, the motive for the maximization of profit is determined by the market organization of public production and supported by the institutions formed thereby. However, it certainly doesn’t always play the leading role in the behavior of business entities – in conditions of incomplete information, they often make due with generation of the minimum profit level required to sustain production or find themselves guided by other goals, depending on the specifics of the economic situation at hand. Under command-economy conditions, the behavior of business entities was determined by the need to fulfill the target plan on time, and the respective units were far more interested in concealing production capabilities and stockpiling manufacturing resources than in generating profits.

From the standpoint of evolutionary economics, routinized processes of the behavior of business entities, including standing production processes, resource-allocation processes, decision-making procedures, patterned reactions to economic-environment changes, other repetitive operations, and employee skills and standard conduct are taken as the primary research focus and basis of micro and macroeconomic dynamics. Their role in economic development can be compared to that of genes in biological evolution. Together, they not only constitute the

internal properties and basic “memory” of business entities and determine their behavior – they also constantly reproduce themselves and “adapt” during the course of the “natural selection” of business entities under the conditions of a changing market environment. That said, only the most important and useful to business survival in the current economic environment of all possible routinized processes of behavior become established as a permanent fixture.

Under the shift to an innovational path of development, procedures involving the search for new technical and organizational decisions to regulate the innovational activity of business entities gain newfound importance. In modern economics, these procedures are geared towards the search for new manufacturing possibilities for the purposes of increasing profit and improving the stability of business entities in the competitive struggle. Their result emerges as the formation, under the interaction with the economic environment, of new routinized procedures reinforced by “natural selection”. An example of this interaction involves the typical process of innovation spread – the introduction of an innovation leads to increased manufacturing profitability, which in turn stimulates an expansion of its sphere of application and routinization throughout the range of production possibilities. As these search procedures interact with the mechanisms of “natural selection” in the economic environment, the trajectory of technical-economic development is charted. In the market environment, the main objective criteria for this selection process are the economic efficiency of new routinized procedures, i.e. the ability to secure additional profit, and their impact on improvement of the firm’s market position (growth in sales volume and market share, enhancement of product quality and competitiveness, etc.). In a command economy, these criteria include improvements to the business entity’s ability to generate formal indicators of economic growth, and enhancements to its logistic support and impact on the processes of national economic decision-making.

Procedures involving the search for new technical and organizational decisions make up an important part of the “genotype” of business entities, determining their ability to adapt to the changing economic environment. These

procedures chiefly include the informational processes that form the organization's "memory" of innovational research, development and imitation, and its ability to change existing structures, relations, behavioral patterns and decision-making processes. These procedures can be partially formalized and established in the respective organizational structures (R&D laboratories, design-and-engineering offices, prototype-development centers, etc.). But no less a role is played by the informal values and behavioral patterns reinforced in the organization's collective memory, the skills, abilities and motivation of its personnel, and the professional language its employees use to ensure its proper functioning.

The evolutionary economic theory incorporated achievements in the theory of organizational behavior, the theory of innovational processes, and economic history. An important epistemological source of evolutionary economics was the modern biological theory of natural selection. In economic science, the forefathers of evolutionary economics were J.S. Mill, K. Marx and J. Schumpeter, who used the methodology of the evolutionary approach in their research. Among contemporary scholars working under the evolutionary approach, noteworthy are A. Alchian, who introduced the idea of evolutionary selection to economic theory, Nelson and Winter, in whose works the evolutionary approach was elevated to the level of a new paradigm in economic science, and K. Freeman, G. Dosi and Peres, who further developed it in specific research on technical-economic evolution.

Essential to the theory of economic development, in terms of their identification of its characteristic properties of disequilibrium, unevenness and cyclicity, have been the schools of thought that advocate the evolutionary approach and rely on an understanding of the patterns of scientific-and-technological development. Over the past few decades, they have formed the basis for a new paradigm of an economic science whose adherents have united under the GLOBELICS international research network. In Russia, intensive research within the scope of this scientific paradigm is being conducted at the State University of Management (leading School of Research "Theory of the Effectiveness of Socio-Economic Development in the Dynamics of Interaction Between Technological

Modes and Public Institutions”), at Saint Petersburg State University, at the RAS Central Economics and Mathematics Institute, at the RAS Institute of Economics, at the National Institute of Development, at the Economic Strategy Institute, and at the Civil Service Academy.

A distinctive feature of this scientific paradigm is its evolutionary approach to the study of economic-development processes in the actual system of mediating technological, manufacturing, financial, commercial, and social interconnections and interdependencies that presupposes the penetration of fluctuating factors into their internal logic, rhythm and mechanisms of interaction. As a result of the extensive research conducted within this scientific paradigm, the following patterns of long-term economic development can be considered established:

- unevenness due to the alternation of business-cycle long waves;
- conditionality of intermittently-occurring structural crises in the global economy on deep technical shifts that dramatically alter the structure, composition and interplay of economic-growth factors;
- disequilibrium in the processes of technical-and-economic development, each of whose lifecycle has an internal logic and inherent limits;
- non-linear trajectory of the development, dissemination and substitution of technologies;
- uncertainty and variation of technological trajectories at the beginning of the lifecycle of the respective areas of technical-and-economic development, followed by reductions in competition and the formation of global monopolies;
- gaps between the lifecycle phases of technological evolution, the ability to overcome which depends on the state of innovational and institutional systems.

The study of these and other patterns of technical-economical development has permitted researchers to develop a series of practical applications with respect to economic policy, aimed at stimulating innovational activity at the macro and micro levels, managing innovations, conducting government structural and science-and-technology policy, and creating the respective institutions for STP support. Many of the recommendations developed within the framework of this scientific paradigm have found practical application at the state and business level in the EU, the US, Japan, China, Brazil, Korea, South Africa, and other successfully-developing countries¹. Unfortunately, the recommendations developed specifically for Russia have been largely ignored by federal agencies, although they have been successfully implemented in a number of the country's regions².

Though surprising, the fact is that clear and plentiful evidence of the limitations of neoclassical theory, which simplistically reflects economic reality and ignores a number of important properties of the actual competition that occurs

¹ www.globelics.org

² Materials from the 5th International Conference "GLOBELICS-RUSSIA-2007", 19–23 September 2007, Saratov

between diverse businesses in an uncertain market environment, has not been duly accepted by the academic community. In the interests of big international capital, universities and research centers in the world's most advanced countries continue to be dominated by a dogmatic approach to the argument for free-market mechanisms and a denial of the leading role played by the state and public institutions in supporting long-term economic development.

The generously-financed “mainstream” has spawned a vast number of doctrinaire works that have nothing whatsoever to do with real economics. As a result, public opinion has come to be dominated by Utopian perceptions about the mechanisms of market self-organization, which plays a significant role in the political support for the course of liberal globalization that has been persistently extended by the leadership of the US, the EU, and international financial organizations. Analogous with religious doctrines based on faith, these perceptions have come to be characterized as market fundamentalism, founded in turn on the dogma of the “unseen hand” of the market as the universal mechanism for the optimization of economic- and even social-management processes.

The unpreparedness of the world's leading countries for today's crisis, whose depth has not been seen since the days of the Great Depression, has largely been the result of the attempts of “free market” apologists and neoclassical-dogma adherents to conceal behind their verbose speeches the findings of the serious scientific research conducted over the past three decades in advanced countries into the processes of economic development. Politicians and civil servants enthralled by the policy of globalization failed to heed timely warnings of the looming financial and structural crises in the global economy, which were issued by the aforementioned scholars and authoritative international organizations alike⁸.

The discrepancies between the actual processes of economic development and the economic fields conducting related research, on the one hand, and the neoclassical doctrine, on the other, have today become so wide that a disciplinary split has begun to occur between these two schools of economic thought. In order

⁸ United Nations Conference on Trade and Development / UNCTAD / World Investment Report 2009

to separate the objective science studying modern processes of economic development from the pseudoscientific doctrine lingering in the virtual models of market equilibrium, a new scientific discipline has been established – knowledge-based economics – whose very name underscores its differentiation from traditional economic science.

CHAPTER 4. PATTERNS OF MODERN ECONOMIC DEVELOPMENT

4.1. Knowledge-based economics in management theory and practice

The establishment of knowledge-based economics as an independent subject of research is associated with the qualitative changes that have occurred in the accumulation of knowledge and the elevation of its economic significance to the status of the principal factor of production in the science-and-technology revolution. Per expert assessments by specialists in the informatics field, the volume of knowledge at mankind's disposal has been doubling every twenty years since the middle of the last century. According to E.V. Popov and M.V. Vlasov³, “of the total volume of knowledge, measured in physical terms, at mankind’s disposal, 90% has been obtained over the last 30 years, while 90% of the total number of researchers and engineers ever trained throughout the entire history of civilization are our contemporaries. This is the clearest sign yet of the transition from an economy based on the use of capital and natural resources to an economy based on knowledge. Developing this thought to its logical conclusion indicates that human society is evolving into a society of researchers living in an age of knowledge and new technologies.”⁴

According to Eliasson, while knowledge-intensive activities accounted for 30.7% of total US work time in 1950, this figure had already jumped to 45.8% by 1980. Machlup research has indicated that the GDP contribution by the economic sector responsible for the gathering and processing of information in the US rose from 29% in 1958 to 34% in 1980. In OECD countries, the GDP contribution of such sectors had reached 50% by the mid-1980s. The contribution of knowledge sectors (including all high-tech industrial sectors, information-communication technologies, and financial, insurance and consulting services) has accounted, on

³ V. Popov, M. Vlasov; *Minieconomic Institutions of New Knowledge Production – Urals Department, RAS Institute of Economics*; 2006

⁴ Bruce E. Tonn, *Research Society: Science and Technology for the Ages // Futures*, 2004, Vol. 36, No. 3; pp. 335–346

average, for 35% of all added value across OECD countries¹. According to OECD estimates, investments in information-communication technologies provided a ¼ GDP gain in developed countries between 1995 and 2005, with intellectual-asset investments adding 7.5–11%².

As noted by RAS Member V.L. Makarov³, “a knowledge-based economy has three distinct features. The first – the discrete nature of knowledge as a product. Specific knowledge is either created or it isn’t... The second feature is that knowledge, just like any other public good, is accessible to all without exception. The third feature is that knowledge, by its very nature, is an informational product – once it has been acquired, information doesn’t disappear as an ordinary material product does.” To be fair, it must be clarified that the second feature exists in theory only. In practice, universal access to knowledge is limited by a multitude of barriers – from educational level to commercial secret.

In due consideration of certain caveats, the following are classified as the main properties of knowledge as a specialized resource⁴:

- knowledge represents a common heritage;
- knowledge can be used but never expended;
- knowledge retains its usefulness no matter how much it is used;
- insofar as knowledge stores can never be depleted, everyone can use it without worrying that it will run out;
- knowledge isn’t subject to commodity shortages – knowledge sellers suffer no loss at the time of its sale, in fact, they remain its proprietors and are free to resell it again and again (unlike material things);
- the “unit cost” of obtaining knowledge does not depend on its “replication” or user number;
- knowledge is not subject to spatial restriction;

¹ Theory and Practice of Knowledge-Based Economics and Sociology / Science Council under the Fundamental Research Program, Presidium of the Russian Academy of Sciences “Economics and Sociology of Knowledge”; M.: Science, 2007, p. 61

² OECD Work on Innovation – A Stocktaking of Existing Work – OECD Science, Technology and Industry Working Papers, 2009/2

³ V.L. Makarov; Knowledge-Based Economics: Lessons for Russia // RAS Bulletin, No. 5, 2003

⁴ M. Bendikov; Intellectual Resources and Their Role in the New Economy // Director’s Consultant, 2002, No. 9 (165), pp. 22–30

- certain types of knowledge are time sensitive – they become obsolete, sometimes instantly;
- obsolete knowledge does not disappear without a trace;
- as an economic category, knowledge only acquires value in the context of a specific application strategy;
- slowing – and to a greater extent stopping – the process of knowledge acquisition in an effort to conserve its stores leads to its depreciation;
- as a rule, the more the knowledge the higher its price and quality (in the material world the reverse is true: fewer goods lead to higher price and quality);
- knowledge volume increases constantly (as opposed to exhaustible material resources);
- with each transfer of knowledge, the number of its possessors increases (with a new possessor added to the previous one);
- any economic activity creates a greater volume of knowledge (information) than it consumes;
- the new-knowledge generation process is unpredictable – research findings do not always depend on the amount invested;
- delivering knowledge to the consumer can be achieved instantly, in real time;
- knowledge-generation overhead costs are insignificant compared to the cost of expenditures on knowledge acquisition, where said cost is concentrated (as opposed to the material world, where the process of replication and consumer delivery is more expensive than the creation process);
- unlike material goods, replicated knowledge generates increasing profitability;
- knowledge can be disclosed, stored, transferred, and sometimes even used uniformly –with the help of digital codes.

Thus, the characteristic and specific properties of this new economic resource – knowledge and information – are its globality, inexhaustibility, intangibility, volatility, universality of conceptualization, invariability to

application method, etc. It is on these properties, left unexplored under the neoclassical paradigm, that the knowledge-based economy is built.

It is also important to mention that, unlike the models of market equilibrium and production functions that assume the interchangeability of production factors, knowledge in its practical application is often inseparable from its carrier – the individual within a research, engineering or business collective. In this connection, the well-thought-out management of knowledge at enterprises takes on added significance¹. According to research into the changes to employment patterns occurring over the past century, “whereas in 1890, 60% of the total workforce was comprised of agricultural workers, unskilled laborers and operators, this figure had fallen to just 20% of the employed in 2000. On the other hand, the number of professionally-qualified salaried employees – skilled workers, technicians, managers, etc. – has risen considerably. Their labor is grounded in knowledge, and it is precisely this type of labor that characterizes the new age.”¹ That said, the humanitarian and ethical components of this process are gaining particular importance. As G.B. Kleiner notes, the ““civilization of knowledge” does not resemble a “civilization of robots”. The processes of the creation, dissemination and use of personal knowledge are impossible without the ethical component – without the fostering of an atmosphere of trust in interpersonal relations. This means that corporations of the future will have to be built on an entirely different foundation than today’s enterprises are.”²

At the same time, as a number of researchers have commented, “whereas, at the beginning of the 20th Century, transformation of the biosphere into the noosphere (sphere of reason) looked like an irreversible trend associated with the increasing complexity of mankind’s social activity and growth in scientific thought⁴, by the end of the 20th – beginning of the 21st Centuries, this trend had evolved into the basic

¹ M.S. Gertler, D.A. Wolfe; Local Social Knowledge Management: Community Actors, Institutions and Multilevel Governance // Future, 2004, Vol. 36, No. 1; pp. 45–65

¹ Theory and Practice of Knowledge-Based Economics and Sociology / Science Council under the Fundamental Research Program, Presidium of the Russian Academy of Sciences “Economics and Sociology of Knowledge”; M.: Science, 2007, p. 29

² G.B. Kleiner; Emergence of the Knowledge-Based Society in Russia: Socio-Economic Aspects // Social Sciences and Modernity; 2005; No. 3

⁴ V.I. Vernadsky; Philosophical Musings of a Naturalist; M.: Science, 1988, p. 30

pattern of the survival and ongoing development of mankind. Under the influence of two revolutions – scientific-and-technical and IT – a fundamentally new economy emerged, in whose creation the decisive role came to be played not by material factors but by knowledge, information, and the innovative thought processes and creative human behavior that give rise to know-how.”¹

The “Theory and Practice of Knowledge-Based Economics and Sociology” illustrates that “analysis of the phenomenon of the knowledge-based society points to the conclusion that under modern socio-historical conditions, knowledge should be regarded, first and foremost, as the ability to act. Thus, knowledge becomes a fundamental principle not just of economics, but of society as a whole. ... Emerging in operations featuring complex systems of human dimension is a new type of integration of truth and morality – a new type of target-rationalized and value-rationalized action. Scientific discovery and technological activity within such systems presupposes consideration of the whole range of possible trajectories for further system development. Real system impact for the purposes scientific discovery or technological change always entails the problem of selecting a particular development scenario from among numerous possible scenarios. Aside from knowledge, serving as the terms of reference in this selection process are the moral principles that impose prohibitions against methods of system experimentation and transformation that pose a danger to man. Social assessment, including its ethical components, adheres to the new ideals of rational action transforming previous perceptions of the link between truth and morality. The objective of “knowledge politics” is to establish control over new scientific and technical knowledge, i.e. formulate the rules governing its generation and dissemination, establish penalties for the violation of said rules, reinforce knowledge with certain formal attributes (as with the restrictions featured in intellectual-property law) and, in certain cases, restrict the application of new knowledge and technical artifacts.”¹

¹ V.N. Ivanov, A.V. Ivanov, A.O. Doronin; Management Paradigm of the XXI Century – Volume 1; M.: Moscow State Industrial University, 2002

¹ Theory and Practice of Knowledge-Based Economics and Sociology / Science Council under the Fundamental Research Program, Presidium of the Russian Academy of Sciences “Economics and Sociology of Knowledge”;

The research findings cited above point to the critical role played by the generation and accumulation of new knowledge in supporting modern economic growth. At the same time, though it certainly reflects important elements of the accumulation of intellectual potential, growth in the quantitative indicators of a knowledge-based economy (R&D and education expenditures, academic and student numbers, etc.) does not guarantee its effective use. The latter requires the existence of institutions that support the materialization of knowledge into new technologies and a socio-economic environment conducive to innovational activity.

Due to the objective uncertainty of innovation results and the nonlinearity of the economic effects associated with their integration – many of which are external – the mechanisms of market competition do not allow for the optimal use of available scientific-and-technological and intellectual potential. This predetermines the critical dependence of the processes of intellectual-potential accumulation and realization on the general business culture and the policy pursued by the respective government, which bears the bulk of expenditures on science and education, long-term investments in infrastructure development, and programs to foster a favorable investment climate.

Over the past few decades, the role played by the government in financing R&D and stimulating innovational activity has steadily increased in all countries except the post-Soviet states. “OECD statistics indicate that since the 1960s, member states have experienced steady growth (averaging 3% per year) in annual knowledge investments (i.e. in science, education, public and private training and software development). Thus, between 1985 and 1992, OECD countries spent an average of from 8 to 11% of their GDP on knowledge-related investments. In 1998, their total knowledge investments reached 8.8% of GDP.”¹

Today, while the state finances from one-third to one-half of R&D expenditures, one-half of these funds are absorbed by non-governmental structures. “In the US, government expenditures on science and development work have increased by more than a factor of 1.5 over the last 5 years (from USD 83,769 mln in 2000 to

M.: Science, 2007

¹ Theory and Practice of Knowledge-Based Economics and Sociology / Science Council under the Fundamental Research Program, Presidium of the Russian Academy of Sciences “Economics and Sociology of Knowledge”; M.: Science, 2007, p. 60

USD 132,193 mln in 2005). Over the same period, such growth in science-related expenditures has been characteristic of other economically-developed countries – Germany, Japan and France. In the US, R&D expenditures account for 2.7% of GDP, in Germany – 2.5% of GDP, and in Japan – 3.4% of GDP. Following the collapse of the USSR, R&D funding in Russia dropped sharply. In 2000, it accounted for just 1.05% of GDP, in 2003 – 1.28%, bearing in mind that Russia’s overall GDP is significantly lower than in most other economically-developed countries.”²

According to OECD experts, a 1% hike in government R&D grants increases the likelihood of innovational success by 0.85% and boosts the country’s share of new-product sales by 0.7%. That said, the impact of innovations on economic growth is higher in those countries where R&D is more intensive. Thus, the effect of increasing returns on R&D grants is achieved, which leads to more competitive advantages for leader-countries, thereby allowing them to consistently enhance the efficiency of their innovational activity. Research in 16 OECD states has proven the positive and significant effect increased R&D expenditures have on improvements to economic efficiency.

As grants to support innovational activity grow, the associated management process becomes more complex, and the role of the government in coordinating such activity increases. That said, methods for the indirect stimulation of innovational activity – tax privileges, state procurements, and the formation of innovational infrastructure – gain particular importance³.

Research into the properties of an innovational economy based on knowledge and STP as the leading factor of economic growth has allowed us to single out the following system properties as distinct from the traditional concepts of the neoclassical paradigm. First, serving as the primary resource of a knowledge-based economy is information, which, unlike ordinary natural resources, neither disappears nor divests. Second, the growth in informational-services volume is characterized by the law of increasing returns ($Q = kN^2$, where N – participant number) instead of the law of diminishing returns characteristic of

² *ibid*, p. 180

³ OECD Work on Innovation – A Stocktaking of Existing Work – OECD Science, Technology and Industry Working Papers, 2009/2

traditional economies as industrial scale increases. Third, an innovational economy is characterized by a contraction in the research-and-manufacturing lifecycle of products. Fourth, it features global production scales and worldwide infrastructure, the most critical element of which is the Internet. Fifth, the development of an innovational economy is accompanied by formation of the respective institutions: venture funds, specialized securities markets, intellectual property, etc.¹

Specialists in the field of innovational economics are convinced that “the new realities of life have led to fundamental, qualitative changes in public administration itself, in which the state has evolved from the subservient functionary of market demands into the intellectual-informational center of its regulation, forecasting-and-strategic planning, and social rejuvenation, without which the market economy as such would have disappeared long ago. It was the rise of the intellectual state that engendered and affirmed a fundamentally-new type of management distinct from operational administration – target-program management.

This radical change to the regulatory role of the state in the modern world, and its acquisition of new characteristics – informational-analytical, forecasting-and-strategic, and, consequently, social and democratic – have been the most important result of the post-industrial revolution. First and foremost, it is to this sign of the times that the Russian state failed to respond: finding itself in crisis, it dragged the whole of Russian society down with it, unable to fulfill its most important function – that of ensuring national security.”¹

It must be noted that the process of formation of the modern state – primarily as a state of development – is far from over. Even in the most developed and prosperous countries, the state apparatus is burdened by bureaucracy and corruption, and civil servants tend to go with the flow, short-sighted in their adoption of poor decisions. With the collapse of the USSR and the global system of socialism, the neoliberal wave swept away the strategic-planning system that

¹ Theory and Practice of Knowledge-Based Economics and Sociology / Science Council under the Fundamental Research Program, Presidium of the Russian Academy of Sciences “Economics and Sociology of Knowledge”; M.: Science, 2007, p. 153

¹ V.N. Ivanov, A.V. Ivanov, A.O. Doronin; Management Paradigm of the XXI Century – Volume 1; M.: Moscow State Industrial University, 2002, pp. 7–8

had been operating in many developed countries as well as at the international level. It is hardly surprising that today's financial crisis has exposed the inability of the systems of government economic management prevailing in the world's most advanced countries to adopt decisions at odds with the current interests of the most influential corporations. Most short-sighted have been the countries that, following IMF advice, have dismantled their national economic-security and currency-control systems. In particular, the offhand dismissal of objective economic patterns and blind adherence to the false dogma of the Washington Consensus displayed in the implementation by post-Soviet countries of market-transition policy has played a critical role in the destruction of their intellectual potential.

4.2. Mechanisms of long-term technological shifts

In terms of its substance, long-term technical-and-economic development is the process of the successive substitution of major, technologically-linked manufacturing complexes – technological modes⁹. This structuring of the process of global technical-and-economic development has demonstrated its effectiveness in a number of studies measuring technological changes to the modern economy¹⁰.

The studies conducted within the scope of this economic school have resulted in the identification and description of the manufacturing-set groupings, interlinked by uniform process flows, that form cohesive reproduction systems – technological modes (TM). Each such mode constitutes an integral and stable formation, within whose framework the reproduction cycle occurs, including the extraction and acquisition of raw materials, all stages of their processing, and the output of the range of final products that respond to the respective public-consumption type. The approximate lifecycle of a technological mode spans a century, while, in terms of economic development, the period of its dominance lasts only about 40 years (this period gradually contracts as STP speeds up and

⁹ D.S. Lvov, S.Y. Glazev; *Theoretical and Practical Aspects of STP Management / Economics and Mathematical Methods*; 1986, No. 5; S.Y. Glazev; *Theory of Long-Term Technical-and-Economic Development*; M.: VIdar, 1993

¹⁰ B.N. Kuzyk, Y.V. Yakovets; *Integrated Macro-Forecast of the Innovational-Technological and Structural Dynamics of the Russian Economy through 2030*; S.Y. Romyantseva; *Economic Long-Waves: A Multifactor Analysis* – St. Petersburg: Published by the University of St. Petersburg, 2003

scientific-and-production cycles shorten). The development of a technological mode is nonlinear, and can be represented as a sequence of two logistic curves²², the first of which represents production growth under the new technological mode in its embryonic phase (as the previous mode continues to dominate), the second – in its mature phase, during which the new technological mode replaces the outgoing mode and becomes the main driver of economic growth (Diagram 10).

Diagram 10.

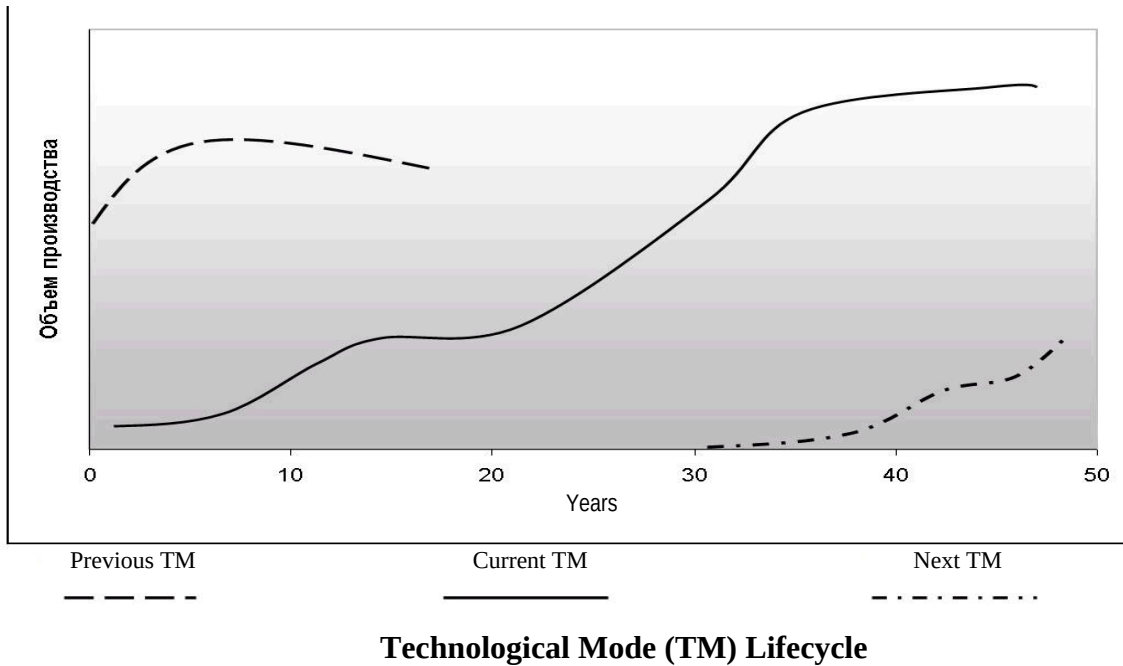
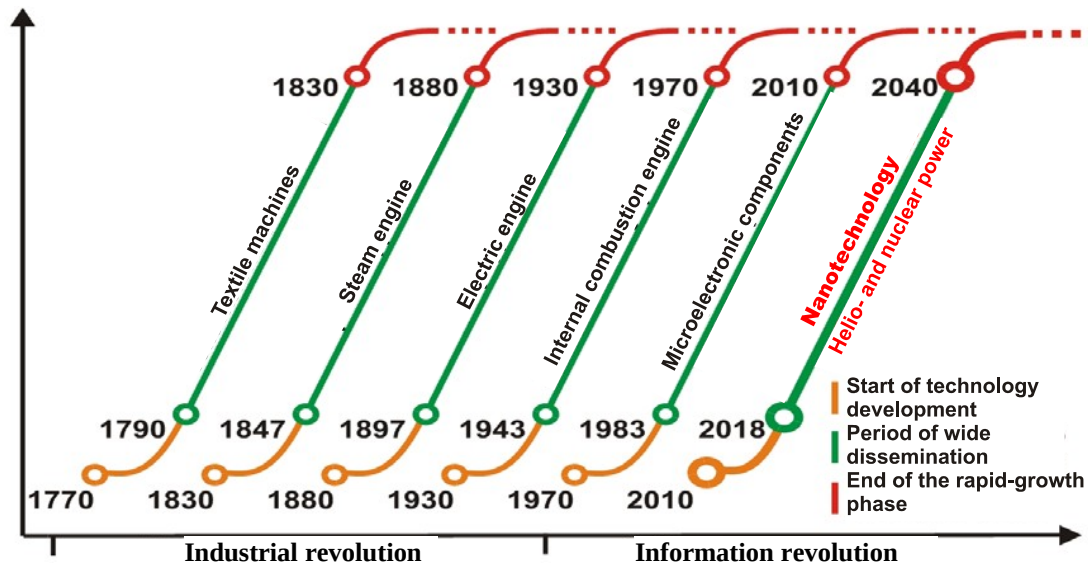


Diagram 11.

²² Evolution of Technical-and-Economic Systems: Opportunities and Limits for Centralized Regulation; D.S. Lvov, S.Y. Glazev, G.G. Fetisov // M.: Science, 1992



Substitution of technological modes throughout the course of modern economic development

Each technological mode has a complex structure, comprised of elements of varying functional significance. The overall complex of baseline technological manufacturing sets forms the **technological-mode core**. The technological innovations determining the formation of the technological-mode core and revolutionizing the technological structure of the economy have been dubbed the “**key factor**”. Sectors that intensively use the key factor and play a leading role in dissemination of the new technological mode are its **carrier sectors**.

By this point in global technical-and-economic development (beginning with the Industrial Revolution of the 18th Century), researchers have been able to identify the lifecycles of **five** successively-alternating **technological modes**, including the Information-Technology technological mode that currently dominates the structure of the economy (Diagram 11, Tables 3, 4).

The key factors of the technological mode dominating today are microelectronics and computer software. The manufacturing sets that form the mode’s core include electronic components and devices, computer technology, radio and telecommunications devices, laser equipment, and computer servicing.

Generation of the technological innovations that determine the development of this technological mode occurs inside the respective complex of sectors and is mediated by the strong non-linear feedback links that exist between them.

It follows from the existing rhythm of long-term technical-and-economic development that the current technological mode is approaching its growth limits – the sharp hikes and drops in energy prices and the global economic crisis are clear signs of the concluding phase in the lifecycle of the dominant technological mode and the start of the structural transformation of the economy on the basis of the next mode. Today, the reproduction system of the **next, sixth technological mode** is forming, the emergence and growth of which is poised to determine the course of global economic development over the next two-three decades.

Chronology and characteristics of technological modes

Table 3

| Mode characteristics | Technological-mode number | | | | | |
|--------------------------------|--|---|---|---|--|---|
| | 1 | 2 | 3 | 4 | 5 | 6 |
| Period of dominance | 1770–1830 | 1830–1880 | 1880–1930 | 1930–1970 | 1970–2010 | 2010–2050 |
| Technological leaders | Great Britain, Belgium | Great Britain, France, Belgium, Germany, USA | Germany, USA, Great Britain, France | USA, USSR, Western Europe, Japan | USA, EU, Japan | USA, EU, China, Japan, Russia (?) |
| Developed regions | Europe | Europe | Europe and Russia, North America, Japan | Europe and USSR, North America, Japan, Newly-Industrialized Countries (NIC) | Europe and Russia, North America, NIC, Brazil, Australia | Eurasia, America, Australia |
| Technological-mode core | Textile industry, textile machine-building, iron smelting, iron refining, canal construction, water engine | Steam engine, railroad construction, transportation, machine- and steam-ship building, coal and tooling-and-machining industry, iron and steel industry | Electrical engineering and heavy machine-building, production and rolling of steel, power transmission lines, inorganic chemistry | Auto- and tractor-making, non-ferrous metallurgy, manufacture of durable goods, synthetic materials, organic chemistry, oil production and refining | Electronics industry, computing and fiber optic equipment, software, telecommunications, robotics, gas production and refining, information services | Nanoelectronics, molecular- and nanophotonics, nanomaterials and nanostructured coatings, nanobiotechnological and nanosystem engineering |
| Key factor | Textile machines | Steam engine, machine tools | Electric engine | Internal combustion engine, petrochemical industry | Microelectronic components | Nanotechnologies, cellular technologies |
| Emerging core of the next mode | Steam engines, machine-building | Electric power, heavy machine- | Auto-making, organic chemistry, oil | Radio-electronics, aircraft engineering, | Nanotechnologies, molecular biology, | |

| | | | | | | |
|--|--|--|---|----------------------------|---|---|
| | | building, inorganic chemistry | production and refining, non-ferrous metallurgy, road-building | gas industry | genetic engineering | |
| Advantages of this technological mode over the previous mode | Mechanization and concentration of production at factories | Growth in the scale and concentration of production based on the use of the steam engine | Increased manufacturing flexibility based on the use of the electric engine, production standardization, and urbanization | Mass and serial production | Individualization of production and consumption, enhanced manufacturing flexibility | Sharp drop in the energy- and materials-intensity of manufacturing, design-engineering of materials and organisms |

Institutional structure of technological modes

| Socio-economic mode characteristics | Technological-mode number | | | | | |
|---|--|---|---|--|--|---|
| | 1 | 2 | 3 | 4 | 5 | 6 |
| Economic-regulatory structure in leader-countries | Destruction of feudal monopolies, restriction of trade unions, freedom of trade. | Freedom of trade, restriction of government interference, emergence of industry-wide trade unions. Formulation of social legislation. | Expansion of state regulatory institutions. Nationalization of natural monopolies, key infrastructure, including social infrastructure. | Development of government-run social-service institutions, military-industrial complex. Keynesian government regulation of the economy. | Government stimulation of R&D, growth in science and education expenditures, liberalization of financial-institution and capital-market regulation. | Strategic planning of science-and-technology and economic development. E-Government. Development institutions and financing funds for innovational activity. |
| International economic-regulatory structure | Combination of domestic-trade protectionism and foreign-trade freedom. | Freedom of international trade. State support for national trade monopolies. | Imperialism and colonialism. | Economic and military dominance of the USA, USSR. | Dominance of US financial institutions. Regional blocks, liberal globalization. | Emergence of global-regulation institutions. Glocalization. Multi-currency global financial system. |
| Main economic institutions | Competition among individual entrepreneurs and minor firms, their merging into partnerships supporting the pooling of individual capital. | Concentration of production at major organizations. Development of joint-stock companies facilitating the concentration of capital on the principles of limited liability. | Business mergers, concentration of manufacturing into pools and trusts. Dominance of monopolies and oligopolies. Concentration of financial capital within the banking system. Separation of management from ownership. | Transnational corporations and oligopolies on the world market. Vertical integration and concentration of production. Divisional hierarchical control and dominance of technical structures at organizations. | International IT-based integration, integration of manufacturing and sales. Restricted corporate governance structures. | Strategic alliances. Integrational business, science and education structures, techno-parks, public-private partnership. |
| Organization of innovational activity in leader-countries | Organization of scientific research at national academies, scientific associations, and local science-and-engineering societies. Individual engineering and innovational entrepreneurship and partnerships. Professional staff training. | Formation of scientific-research institutions. Faster development of professional education and its inter-nationalization. Formation of national and international systems of intellectual-property protection. | Creation of in-house scientific-research departments. Inclusion of university-educated researchers and engineers in the manufacturing process. National institutes and laboratories. Universal primary education. | Specialized scientific-research departments at businesses. State subsidizing of military scientific-research and design-and-engineering work. Government involvement in civil R&D activity. Development of secondary, post-secondary and professional education. | Horizontal integration of R&D, manufacturing engineering. Computing networks and joint studies. State support for new technologies, cooperation between universities and industry. Universal higher education. | Transition to perpetual innovational process, inclusion of R&D costs in product unit costs. Commercialization of science and science-and-production integration, computer-tracking of product lifecycles. |

The starting point for the onset of the sixth technological mode should be viewed as the development of nanotechnologies to transform substances and engineer new objects, as well as cellular technologies to alter living organisms, including methods of genetic engineering. The mid-1990s witnessed the dawn of the industrial application of nanotechnological methods, thanks to the development of linear-measurement tools and nano-scale manipulation, which in turn gave rise to the technical ability to create nano- and cellular technologies. First and foremost, this has entailed the invention of the scanning-electron and atomic microscopes, as well as the use of the respective metrological systems. The list of baseline inventions whose integration marks the starting point for the trajectory of the sixth technological mode should include such achievements in molecular biology as the discovery of the mechanisms by which the genetic information responsible for the cellular-regeneration of organisms is transmitted, the decoding of plant, animal and human genomes, the invention of the technology for the cloning of living organisms, and the discovery of stem cells. The sixth chapter of this study features a description of the formation of the technological trajectory of the sixth technological mode, based on the discovery of new matter properties and the creation of materials with the engineering-designed characteristics that result from atomic and nano-level manipulations.

Technological-forecasting methods allow us to determine the main development thrusts of the new TM: biotechnologies, based on achievements in the fields of molecular biology and genetic engineering, nanotechnologies, artificial-intelligence (AI) systems, worldwide information networks and integrated high-speed transportation systems. Flexible manufacturing automation, space technologies, engineering-designed construction materials, the atomic industry, and air transport will undergo further development. Growth in atomic power and natural-gas consumption will be enhanced by the expansion of hydrogen use as an environmentally-friendly energy commodity, with the use of renewable-energy sources also spreading significantly. Production will undergo further intellectualization, accompanied by the shift to a perpetual innovational process in

most sectors and continuing education in most professions. The transition from a “consumer society” to an “intellectual society” will conclude, in which quality-of-life and “liveable space” considerations will gain new importance. The manufacturing arena will shift to environmentally-friendly and waste-free technologies. Within the consumption structure, informational, educational and medical services will dominate in terms of their significance. Progress in information-processing technologies, telecommunications, and financial technologies will result in further globalization of the economy and the formation of a single world market for goods, capital and labor.

Alongside the industries at the core of the new technological mode, rapidly-growing areas of nanotechnology application will become its carrier sectors. These will include the carrier sectors of the fifth technological mode: electrical engineering, aviation, aerospace and atomic industries, instrumentation, machine-tooling, education and communications. Above and beyond these sectors, the revolution linked to the spread of nanotechnologies will encompass medicine (whose efficacy will grow by leaps and bounds with the use of cellular technologies and methods to diagnose genetic diseases), agriculture (thanks to the application of achievements in molecular biology and genetic engineering), as well as the creation of engineering-designed new materials. Thanks to the rise of nanomaterials, the carrier sectors of the new technological mode will also include: chemical metallurgy, construction, shipbuilding and auto manufacturing.

The management culture will undergo significant changes. Experiencing further development will be CAD (Computer-Aided Design) systems, which, together with marketing technologies and technological forecasting, will allow for the transition to the automated management of the entire product lifecycle on the basis of so-called CALS-technologies, which are emerging as the dominant culture for production management¹¹. Accepted in most industrially-developed countries, CALS (Continuous Acquisition and Life-Cycle Support) is the integrated information-environment technology based on international standards for uniform

¹¹ A.F. Kolchin, M.V. Ovsyannikov, A.F. Strekalov, S.V. Sumarokov; Product Lifecycle Management – M.: Anacharsis, 2002, 304 pp.

information-exchange among all participants in the product lifecycle: product developers, customers and suppliers, as well as operating and service personnel.

In terms of the integration of nanotechnologies themselves, developed countries are applying the “Bringing the product from laboratory to market” strategy, which minimizes the most complex and risk-filled phase of the product cycle – the application of R&D output in the manufacturing process.

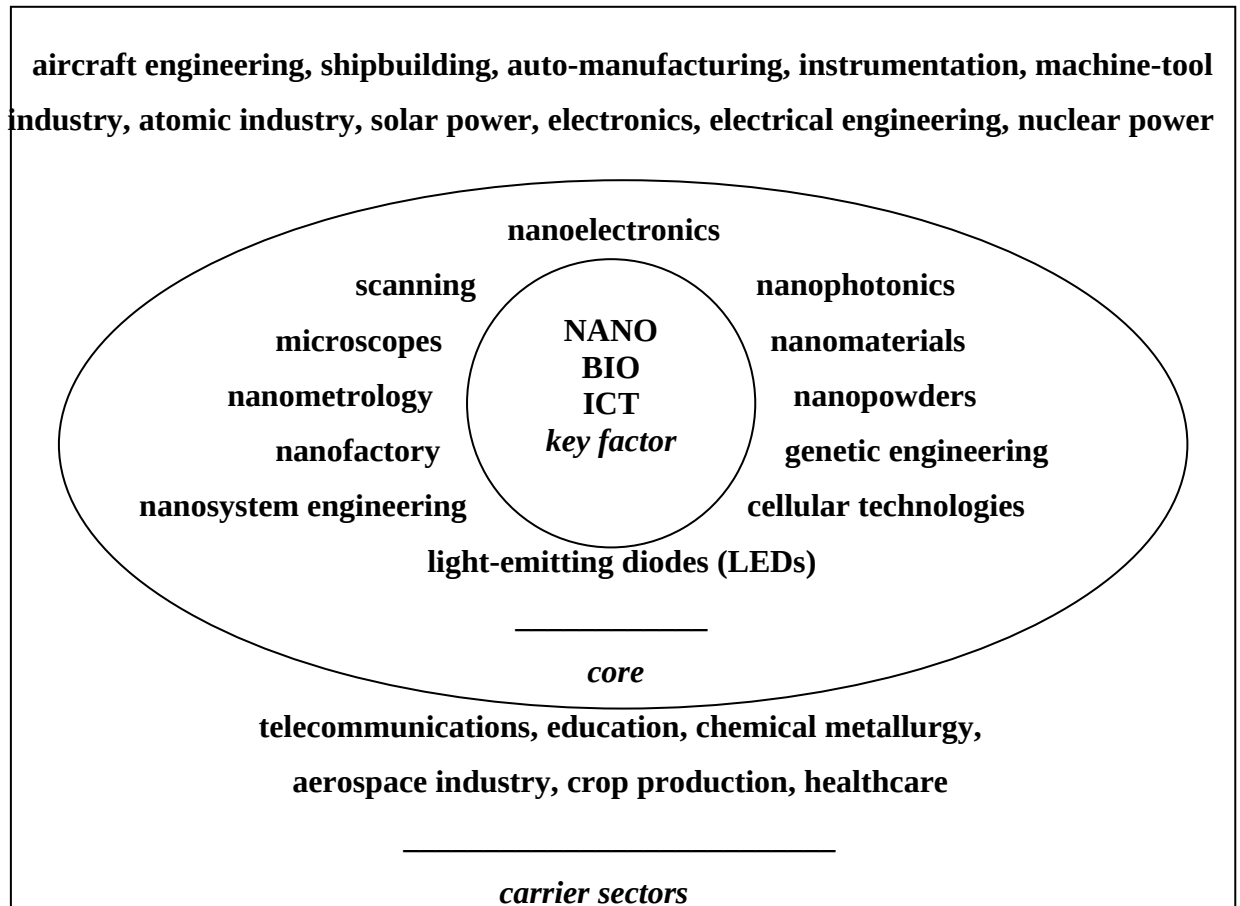
Proceeding from the above, the **structure of the new (sixth) technological mode** can be illustrated as follows (Diagram 12):

Key factor: nanotechnologies, cellular technologies and methods of genetic engineering, based on the use of scanning-electron and atomic microscopes and the respective metrological systems.

Core: nanoelectronics, molecular- and nanophotonics, nanomaterials and nanostructured coatings, optic nanomaterials, nano-heterogeneous systems, nanobiotechnologies, nanosystem engineering and nanoequipment.

Carrier sectors: electronic, nuclear and electrical-engineering industries, information and communication sector, machine-tool industry, shipbuilding, auto-manufacturing, instrumentation, pharmaceutical industry, solar power, aerospace industry, aircraft engineering, cellular medicine, seed farming, construction and chemical metallurgy.

Diagram 12.
Structure of the new (VI) technological mode



As shall be demonstrated below, expansion of the new technological mode is supporting a manifold increase in the efficiency of production and a reduction in its energy- and materials-intensity.

There is continuity between the technological mode dominating today and the emerging mode. Studies¹² indicate that the mature technological mode serves as the source of the initial intellectual, material and financial resources (start-up capital) for the new one. It provides a framework for the baseline technologies of the new technological mode and the generation of demand for the respective products. The first accumulation-contour of the new technological mode emerges as a superstructure resting on the process flows of the previous one. Its formation

¹² V.E. Dementiev; Long-Waves in Economic Development and Financial Bubbles – Pre-print # WP/2009/252 – RAS Central Economics and Mathematics Institute, 2009

is accompanied by the development of new, technologically-relevant aggregates that generate their own demand for new products, and formation of the second accumulation-contour – the new technological mode enters expanded-reproduction mode on the basis of its own technological foundation.

Formation of the new technological mode's reproduction system is a lengthy process with two qualitatively-different stages. The first – the emergence of its key factor and core under the dominance of the previous technological mode, which objectively limits the onset of production under the new technological mode due to its own needs for expanded production. The exhaustion of economic opportunities under this process marks the dawn of the second stage, which begins with the substitution of the dominant technological mode by the new one and continues of as a new long-wave of the economy.

This determines the dynamic of fixed-asset investments typical of long-waves. Within a single long-wave, economic growth occurs on the basis of a sequence of two qualitatively-heterogeneous “Kuznets Swings”: 30 years – on the basis of investments in the production of capital goods, the next 30 years – on the basis of investments in the production of consumer goods¹. A policy of faster growth entails bringing these cycles closer together and synchronizing them as much as possible. That said, technologically-trailing countries gain an advantage – under formation of the new technological mode's reproduction system, they can gear themselves towards the investment-and-technology experience that has been amassed by developed countries, thereby optimizing the structural composition of emerging process flows to ensure the integrity and optimal scale of the respective technological manufacturing sets.

The substitution of technological modes requires certain changes to social and institutional systems that remove organizational barriers and facilitate the mass penetration of the technologies of the new technological mode and its particular consumption and lifestyle type. During the growth phase of the new mode, the

¹ S.Y. Rumyantseva; Dynamic Forces of Long-Waves. Problems of N.D. Kondratiev's Methodology Development; // St. Petersburg University Bulletin, Series 5, Economics, 1998, Issue 3, No. 19; J.W. Forrester; Innovations and Economic Change // Futures, 1981, Vol. 13, No. 13

majority of process flows under the previous mode adjust to suit its demands. As the next technological mode develops, a new type of infrastructure emerges to overcome the limitations of the previous type, and there is a shift to the new types of energy commodities that lay the foundation for the emergence of the next technological mode.

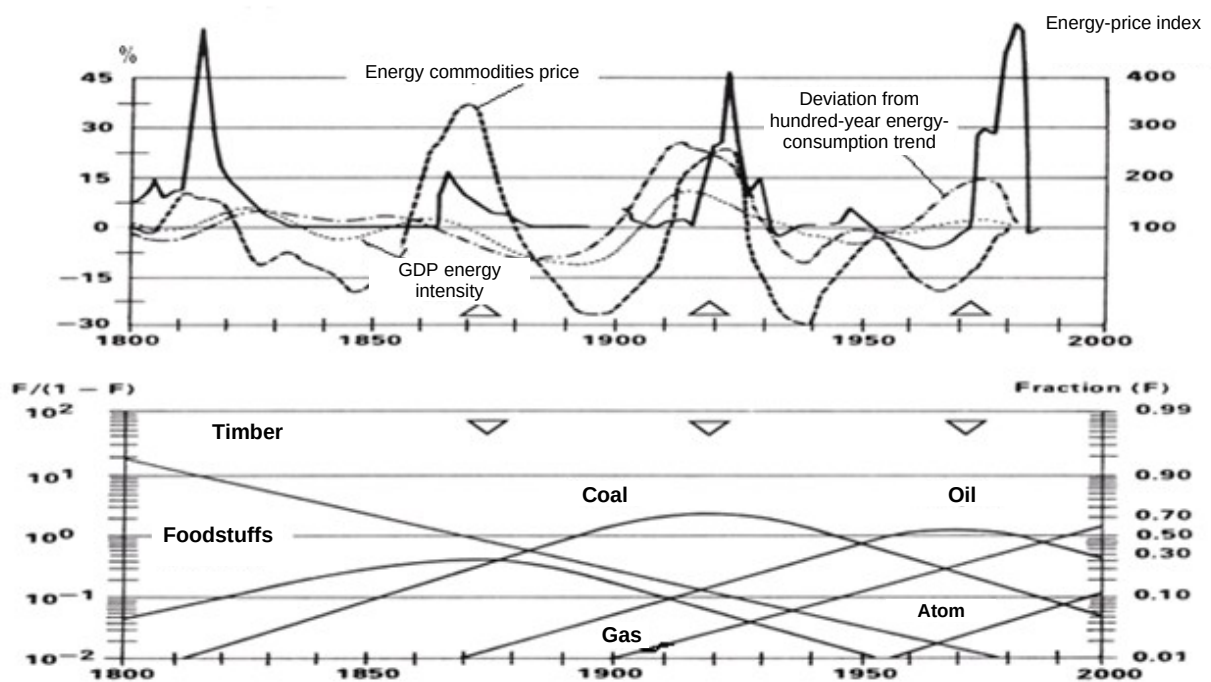
The nature of technical-and-economic development changes at different stages of the technological-mode lifecycle. The formative phase of the new technological mode is accompanied by a considerable number of options for its baseline technologies. Competition among business entities using alternative technologies leads to selection of the most effective options. As the respective social needs are updated during the growth phase of the technological mode, the development of its primary industries focuses on ramping-up the output of several universal models, concentrated within the small number of production units that have managed to integrate the new technology. As the aforementioned social needs are saturated, the need arises to tailor the product-line of primary industries to emerging consumer preferences, to lower manufacturing costs, and to improve product quality in order to boost demand. As the variety of manufacturing output expands and the reproduction system of the new technological mode begins to “branch off”, production specialization increases. The decreasing relative-efficiency of highly-concentrated production at the last growth phase of the technological mode prompts major business organizations to diversify their manufacturing programs. Conclusion of the lifecycle of the technological mode is accompanied by saturation of the respective consumption type, overproduction of the respective goods, and the overaccumulation of capital in the respective manufacturing set.

The growth phase of the new technological mode is accompanied not only by a reduction in production costs, which tends to accelerate as its reproduction system begins to form, but also by changes to economic valuations to reflect reproduction conditions. The technological-mode substitution process begins with sharp growth in prices for energy commodities and raw materials, conditioned by

their overconsumption in the swollen process flows of the over-mature TM. This price spike corresponds to the maximum deviation of energy consumption from the hundred-year trend (Diagram 13). Over the next such period, energy-consumption grows thanks to a more effective energy commodity – one that satisfies the requirements of the new technological mode.

Diagram 13.

Energy commodity price fluctuations and structural shifts in energy consumption



Source: A. Grubler, N. Nakicenovic, Long Waves, Technology Diffusion and Substitution, *Review XIV (2)* Spring 1991:313-342 (Fig. 16, pg. 333).

F – share of the energy commodity in the total consumption of primary energy resources.

The leap in prices for energy commodities and raw materials leads to plummeting production profit in the technological manufacturing-sets of the dominant TM. This serves as a signal for the mass-integration of new, less energy- and materials-intensive technologies. Occurring simultaneously is the release of capital from industries of the over-mature technological mode that have reached their growth limits. As the capital is redirected to industries within the new TM, the latter experiences growth. Price ratio changes promote efficiency

improvements within the technological manufacturing-sets of the new TM, and, as the previous technological mode is squeezed out – lead to improved efficiency within the whole of public production. Moving forward, as the respective social needs are saturated, consumer demand and prices for the products of the new TM drop, its technical-improvement capacity is exhausted, and the manufacturing within the sectors it comprises becomes cheaper, efficiency growth in public production slows. In the concluding phase of the lifecycle of this – now dominant – technological mode, which occurs at the dawn of the next, the economic growth rate slows and the relative – and possibly absolute – efficiency of public production drops.

The phenomenon of the gradual reduction in the technical-improvement capacity of any production-and-technical system is well-known in the theory and practice of technological forecasting, and is reflected in various laws of the diminishing efficiency (performance) of evolutionary technical refinement. In particular, according to “Grosch’s Law”, if a technical system improves on the basis of a rigid scientific-and-technical principle, then, as its development reaches a certain level, the cost of its new models grows as the square of its efficiency. Due to the congruence between the productive elements of the technological mode and their synchronized development, the efficiency reduction in their technical refinement occurs more or less simultaneously and is manifested in the abrupt slow-down of the economy’s technical-development rate and a drop in the economic indicators that reflect STP contributions to gross national product. Throughout the lifecycle of the next technological mode, these fluctuations in public-production efficiency and various structural ratios and proportions are repeated once again¹³.

Depending on the respective phase of the dominant technological mode’s lifecycle, the dynamic forces of economic growth change¹⁴. During the formative period of the new technological mode, the leading role is played by innovators –

¹³ S.Y. Glazev; Theory of Long-Term Technical-and-Economic Development; M.: VlaDar, 1993

¹⁴ V.E. Dementiev; Long-Waves in Economic Development and Financial Bubbles – Pre-print # WP/2009/252 – RAS Central Economics and Mathematics Institute, 2009

the first to develop its baseline innovations. Their activity creates the conditions for the replacement of the previous technological mode with the new one, which come into play following the respective price hike for energy commodities and change in the production-efficiency ratio in favor of the technological manufacturing-sets of the new TM. During the TM growth phase, the trajectory of its formation is clearly charted, production scale grows, and its technological structure ossifies. During this phase the role of innovators diminishes, and the routine activity of business-imitators comes to the fore. Each of these phases lasts for approximately two decades. They are characterized by different mechanisms of economic growth, distinct from one another in terms of the interplay between financial and industrial capital.

As has been previously mentioned, the lifecycle of the new technological mode begins while the previous mode is still dominant – rooted in industrial and institutional structures and embedded in influential circles and social organizations. This period is marked by the significant inertia of industrial capital, invested in material and intangible assets, in the organization and training of personnel, in relations with suppliers, distributors and clients. Only a few of those open to radical innovation have the internal resources at their disposal necessary to achieve it.

Financial capital is more mobile than industrial capital. Insofar as it is in liquid form, it flows easily into new arenas – including innovative projects. Thus, during the formative phase of the new technological mode, the decisive role in decision-making about investments in baseline innovations – and financing of the R&D necessary to achieve them – is played by financial agents (venture fund managers, bank administrators, etc.)¹⁵. Opportunities for the mass penetration of new technologies arise with the formation of excess capital on the financial market. This occurs as the growth opportunities for the previous technological mode are exhausted, when the most far-sighted financiers, confronted by dropping growth rates and profitability in the industries they credit, begin to search for fundamentally-new investment opportunities. It is in this sense that V.E. Dementiev refers to the leadership of financial agents in supporting

¹⁵ Carlota Perez; Finance and Technical Change: A Long-Term View / H. Hanusch and A. Pyka, eds., The Elgar Companion to Neo-Schumpeterian Economics – Cheltenham: Edward Elgar, 2004

technological development¹⁶.

Government investments, educational-center funds, and venture-financing institutions play a leading role in the emergence of the new technological mode. In conditions of the formation of the technological trajectories of the new TM, removing the bulk of the risk, the state gives innovators the ability to implement their science-and-technology projects in a situation dominated by a high degree of competition among alternative technical solutions and insufficient demand for related output. Financial agents must have the ability to assess the commercial potential for new knowledge and must not hesitate in making innovation-investment decisions. When this potential becomes clearer as the growth trajectory of the new technological mode forms, what comes to the fore are the skills involved in rapid technology duplication and the accelerated output of products that may well be imitations of versions already available on the market. As a result, the leadership role in technological development during this phase shifts to manufacturing agents and industrial capital.

The works of C. Perez and V. Dementiev illustrate the triggering mechanism for financial crises in the process of technological-mode shifts¹⁷. Reduced production investment under a dominant technological mode that has already achieved peak growth creates tremendous excess capital searching for areas of application. During this phase, the securities of the cutting-edge businesses forming the growth trajectory of the new technological mode come under wide investor demand. However, production investments remain risky under the as-yet-unformed new technological mode, its technological-growth trajectories remain unclear, and fierce competition among various science-and-technology ideas continues. This creates favorable conditions for financial speculation for the purposes of appropriating the funds of trusting investors under the guise of breakthrough investment projects.

¹⁶ V.E. Dementiev; Long-Waves in Economic Development and Financial Bubbles – Pre-print # WP/2009/252 – RAS Central Economics and Mathematics Institute, 2009

¹⁷ Carlota Perez; Finance and Technical Change: A Long-Term View / H. Hanusch and A. Pyka, eds., The Elgar Companion to Neo-Schumpeterian Economics – Cheltenham: Edward Elgar, 2004; V.E. Dementiev; Long-Waves in Economic Development and Financial Bubbles – Pre-print # WP/2009/252 – RAS Central Economics and Mathematics Institute, 2009

The sorting of businesses according to investment attractiveness allows issuer groups posting stable growth in the market value of their securities to stand out from the pack. The opportunity to profit on this growth stimulates further demand for such securities. The search for alternative methods of capital investment heats up the market for yet another speculative asset – real estate. Active investor demand leads to maturation of the financial bubble on the stock and real-estate markets at the end of the lifecycle of the dominant technological mode. As expressed by C. Perez, a financial bubble is a merciless method for the concentration of available investments in new technologies¹⁸. Its bursting due to a financial crisis leads to the depreciation of a significant share of capital and the beginning of a long-wave depression¹⁹. And, although a financial crisis worsens the investment climate and is capable of provoking a “time-out” in the baseline-innovation development process²⁰, the bursting of the respective financial bubble allows for the recalibration of investments towards tangible assets. As a result, recovery from the depression begins – supported, first and foremost, by new-sector growth.

Even older sectors experience some revitalization. That said, their modernization occurs on the basis of the new technological mode, whose key factor penetrates all areas of the economy and yields new opportunities for production-efficiency and product-quality improvements. As the long-wave of economic development surges, demand for energy commodities and raw materials grows, leading to certain price increases.

Today, the new technological mode is leaving the embryonic phase of its development – unfolding now is the process of its replacement of the previous TM, which has reached its outer growth limits. This process is being manifested as a crisis in the economies of the world’s most-advanced countries and accompanied by spikes and subsequent drops in energy-commodity and other raw-materials

¹⁸ Carlota Perez; *Great Surges of Development and Alternative Forms of Globalization*; 2007 (www.carlotaperez.org)

¹⁹ B.J.L. Berry; *Long-Wave Rhythms in Economic Development and Political Behavior* – London, 1991, pp. 122–125

²⁰ S.Y. Rumyantseva; *Specifics of the Paradigm Shift in Long-Wave Technical-and-Economic Fluctuations* // *St. Petersburg State University Bulletin, Series 5; Economics*, 1998, Issue 2, pp. 74–79

prices. Measures to save the banking system or resuscitate the financial market are insufficient to overcome these crises. They must be augmented by programs to stimulate the growth of the new technological mode, whose rise is the only factor capable of creating the next long-wave of economic growth.

4.3. Recovery from the global crisis

It follows from the above that under any scenario, economic recovery occurs on a new technological basis – one with new manufacturing opportunities and qualitatively-new consumer preferences. As a result of the emergence of the new – sixth – technological mode, major changes occur in the structure and relative significance of the factors of production. As has been previously mentioned, the shift from a mass-production economy to a knowledge-based economy is drawing to a close, where primary value is placed not on the means of production but on action skills – at hand is the transition from a “mass-consumption” society to a “creative-consumption” society, a “development” society, where critical importance is placed on scientific-and-technical and intellectual potential, and quality-of-life and “liveable space” considerations gain prominence. This, in turn, prompts the need for serious changes to the system of economic institutions and mechanisms of business-activity management, whose unpreparedness for the development of new types of economic activity delays formation of the new technological mode.

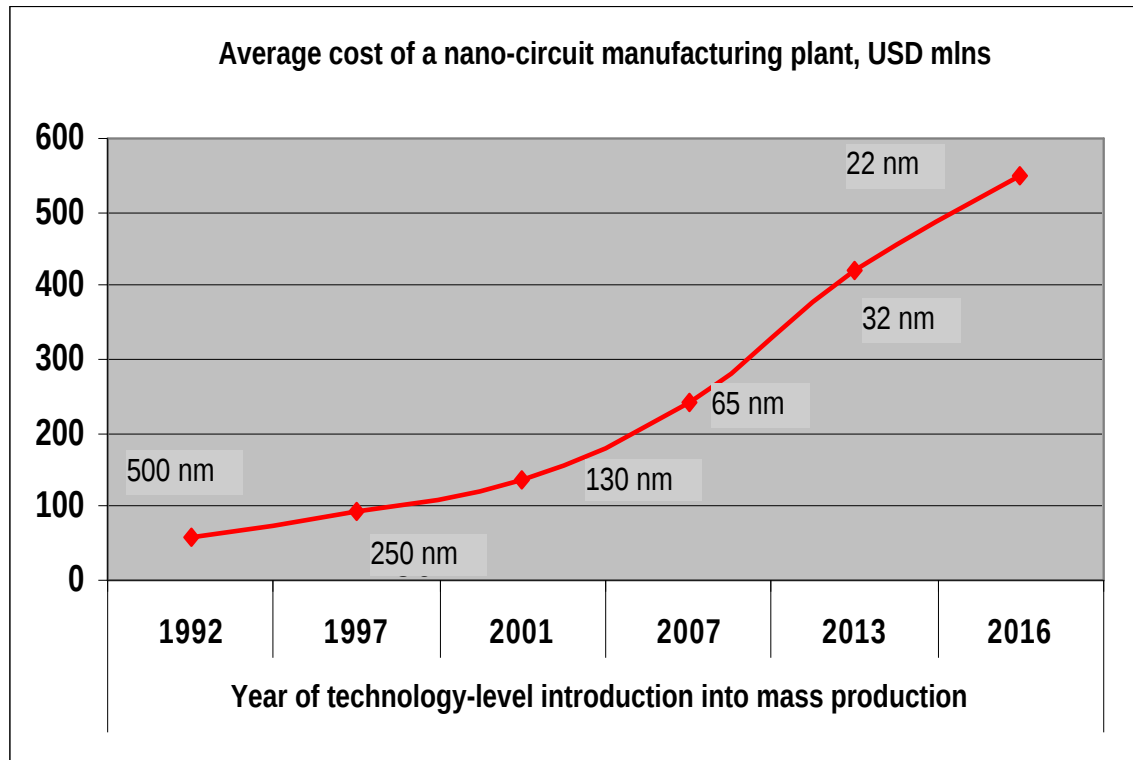
One of the distinctive features of the baseline technologies of the new technological mode is their high degree of integration, which necessitates a comprehensive policy for their development envisioning the simultaneous creation of technologically-linked industrial clusters and the respective consumption arena and management culture. Successful operation in a knowledge-based economy developing along an innovational path requires significant improvements in managerial qualifications, a creative approach to problem solving, and the mastery of inventive-activity methodologies.

Today, expansion of the new technological mode is being held back by the small scale and nascent state of the respective technologies, as well as by the unpreparedness of the socio-economic environment for their broad application. While

the costs entailed in the development of new technologies and their scope of application grow exponentially (production volumes at the new technological-mode core are growing at a pace of about 35% per annum despite the crisis), its weight in the overall structure of the current economy remains insignificant. The anticipated qualitative leap and transition to the next long-wave of economic growth will only occur following completion of the structural transformation of the world's most advanced economies on the basis of the new technological mode, which is expected at the mid-point of the next decade. Economic growth will become less energy- and materials-intensive. Thus, demand for energy commodities and natural resources will grow at a significantly slower pace than that of finished-product output, thanks to the manifold increase in baseline-technology efficiency.

Further unfolding of the current crisis will be determined by the confluence of two distinct processes – destruction of the previous technological mode's structure and construction of the new mode's structure. That said, today's financial, business and political institutions will either undergo restructuring to satisfy the growth requirements of the new TM or cease to exist.

History shows that the shift in technological modes and propulsion of the global economy onto a new long-wave of economic growth will be accompanied by changes not only to the technological structure of the economy – but to its institutional system and the composition of its leading businesses, countries, and regions as well. The sooner a given structure can align itself with the growth trajectory of the new TM, the lower the necessary investments will be. Conversely, the price of admission for latecomers climbs with each passing year. A prime example of this phenomenon is the forecast for the capital-intensity of nanoelectronic-component production (Diagram 14). As the respective technology becomes refined, its reproduction becomes more expensive. At the same time, the advantages of leaders capable of protecting their monopoly on technological superiority through intellectual-property institutions grow. As the relevant technology enters the mature phase, its reproduction by market newcomers becomes prohibitively expensive.

Diagram 14.

Transition to the new technological mode requires massive investments in the development of its component technologies and modernization of the economy on the basis thereof. As a rule, the need for such investments greatly exceeds the capabilities of existing financial institutions, many of which are confronted by capital depreciation and ultimately founder in the structural crisis that accompanies the substitution of technological modes. Increasingly growing in prominence in such an environment is the role of the government, which is in a position to concentrate the resources necessary to develop new technologies and assume the risks associated with the respective investments. That said, the forms and methods of resource-concentration are determined by state functions, among which a prominent role is played by national security considerations. To date, expenditures related to the arms race have played a key role in mobilizing resources for the development of cutting-edge technologies. Yet, the ultimate effectiveness of such resource spending has always been determined by the ability of economic systems to broadly develop new technologies beyond the defense-industry arena.

The experience of the past two structural crises in the global economy (in the 1930s and 1970s) indicates that they were extremely painful for the world's

most advanced countries yet full of new opportunities for developing countries. The Great Depression of the 1930s spilled into the Second World War, which resulted in the destruction of the existing core of the international economic system (European colonial empires) and the formation of two adversarial global political-economic systems. The leadership of American capitalism in the transition to the new long-wave of economic growth was assured by the tremendous growth in defense contracts to develop new technologies – and by the flow of global capital into the US, while its main competitors were experiencing destruction of industrial potential and depreciation of their capital.

The depression of the mid-1970s – early 1980s led to an arms race defined by its broad application of information technologies that threatened to drag the world's most advanced countries into “star wars”. The subsequent collapse of the global system of socialism, which hadn't managed to position its economy onto the new technological mode in time, allowed the leading capitalist countries to exploit the resources of formerly-socialist countries for a “soft landing” onto the next long-wave of economic growth. The capital flight and “brain-drain” from ex-socialist countries and the colonization of their economies eased the structural transformation of the national economies at the core of the capitalist system, which had thus far stimulated creation of the next technological mode via the expansion of the arms race into the space race. It was on this growth wave of the new technological mode that newly-industrialized countries rose – countries that had managed to create its key industries in due time and lay the groundwork for their rapid growth on a global scale. The political result was liberal globalization, with the US in the leading role as the issuer of the world's primary reserve currency.

Recovery from the current depression will likewise be accompanied by far-reaching geopolitical and economic changes. As in previous instances, leading countries are demonstrating an inability to implement the radical institutional innovations capable of channeling freed-up capital into economic restructuring on the basis of the new technological mode, continuing to perpetuate the existing institutional system and service the economic interests lurking therein instead.

Unlike in previous cases, where recovery from depression had been achieved thanks to escalating military expenditures and drawing on the resources of vanquished countries, the world's most advanced nations are left with no such options today. The war on international terror they have provoked (and the accompanying sacrifice of individual peripheral countries) is incapable of generating sufficient tension to draw in global resources on the scale required. Also out of steam is the financial war Washington has been waging against vulnerable national financial systems, tying them to the dollar via the imposition of its monetarist macroeconomic policy with the assistance of the dependent IMF, rating agencies and agents of influence. The capital drained therefrom is no longer enough to service the labyrinth of mounting US debt, the cost of which is now approaching one-third of the country's GDP. Also growing is the anticipation of a catastrophic scenario entailing the collapse of the core of the global capitalist system and its servicing financial institutions. The new centers of the global economy – China, India, Brazil and Iran – are forming on the next long-wave of economic growth. The global financial system is becoming multi-currency, featuring the formation of powerful regional economic unions capable of independent development.

All of which leads to the obvious conclusion stated in the foreword to this study: for any country, the necessary condition for a manageable recovery from the crisis entails the development of a domestic strategy geared towards the preservation of its economic potential and outpacing creation of the factors and key industries of the new technological mode. This assumes the protection of strategic assets and the domestic market from incursions by foreign speculative capital and the implementation of an active science-and-technology and structural policy to develop competitive enterprises in promising areas of economic growth. The latter is impossible without a national financial-investment system resting on domestic sources of credit and protected from the destabilizing influences of the global financial market.

CHAPTER 5. STATE OF RUSSIA'S TECHNICAL-INDUSTRIAL POTENTIAL

5.1. Measuring the growth of the new technological mode

The period of technological-mode substitution in the leading countries burdened by the excess capacity of the obsolete TM creates a window of opportunity for technological breakthroughs by the countries now lagging behind. This is precisely how the “economic miracles” of the last century occurred. The economies of Japan and Western Europe, thoroughly devastated at the end of the Second World War, recovered on the basis of the then-new fourth technological mode, whose rapid growth thrust them into the ranks of global leaders. By the 1960s, Japan and the other newly-industrialized countries were forecasting the contour of the next – fifth – technological mode before anyone else. Having created the timely capacity for the development of its key factor – microelectronics – they outpaced other countries in the modernization of its carrier sectors and managed to take the lead during the substitution of the fourth technological mode with the fifth and the structural crisis of the 1970s prompted by that process.

Earlier still, a similar leap during the transition from the second technological mode to the third was made by Russia and the US, which had joined the ranks of global leaders by the end of the 19th century. The next sprint ahead was taken by the US during the replacement of the third technological mode by the fourth, when, as a result of the structural crisis of the 1930s and subsequent Second World War, the US claimed the lead position in the global system of capitalism. Russia, rocked by revolution and the ensuing civil war, was thrown off the long-wave of economic growth offered by the third technological mode, although it had been outpacing other countries during its formation process at the beginning of the 20th century. The subsequent industrialization and electrification of the economy, while reducing the gap with advanced countries, nevertheless created a relatively-outmoded technological structure for the economy. A significant part of this

economy was reconstituted after the war, which lent the Soviet economy its technical multiformity, overloaded its structure, and rendered faster development on the new long-waves of the fourth and fifth technological modes impossible²¹.

The process unfolding today of the substitution of the fifth technological mode by the sixth is giving Russia the opportunity to take a technological leap forward on the crest of a new long-wave of economic growth. The necessary condition for seizing this opportunity entails creating the capacity for the emergence of the key factor and core of the new technological mode, as well as the faster modernization of its carrier sectors. The prerequisites for this outcome are analyzed below.

Of course, the emergence of the new technological mode, just as the development of its key factor – nanotechnologies – is not occurring in a vacuum. The necessary prerequisites are created during the previous period of technical-and-economic development.

A country-by-country qualitative analysis of the trajectory of technical-and-economic development²² demonstrates that the technical development of our economy has been unfolding along the same trajectory followed by other countries, the only difference being that it has occurred much more slowly. The relatively slower rate of technical development posted by the Soviet economy has been explained by its recurring technological multiformity, which complicated the timely reallocation of resources into the development of new technologies. By the end of the 1980s, simultaneous reproduction under the third, fourth and fifth technological modes existing in the Soviet economic structure had stabilized. That said, due to the lack of a mechanism for the reallocation of resources from obsolete technological modes into the new one, the expansion of the latter occurred at a much slower pace than in countries with a developed market economy.

²¹ Evolution of Technical-and-Economic Systems: Opportunities and Limitations for Centralized Regulation; D.S. Lvov, S.Y. Glazev, G.G. Fetisov // M.: Science, 1992

²² S. Y. Glazev; A Theory of Long-Term Technical-and-Economic Development; M.: VlaDar, 1993

With the shift in developed capitalist countries to the growth phase of the fifth TM, the technological lag of the Soviet economy began rapidly expanding. Beginning in the 1980s, the growth rate posted by the sectors of the fifth TM in developed and newly-industrialized countries reached 25–30% annually – 3–4 times higher than the overall industrial-output growth rate²³, with their contribution to GDP growth climbing to 50%²⁴. This illustrates that, during the aforementioned period, the fifth technological mode had entered the rapid-growth phase, accompanied by accelerated improvements to economic efficiency. The administrative system of economic management that had developed in the USSR by that time proved itself incapable of supporting such rapid industrial growth rates under the fifth technological mode or undertaking economic restructuring on its basis. The growing technological lag prompted a search for ways to reform the Soviet economy, which was not geared towards economic development as it should have been, and, in the end, concluded with the capitulation of the communist leadership and its primitive rejection of the country's system of centralized planning of the national economy. This, however, did not lead to the automatic formation of effective mechanisms and institutions of development. Quite the opposite – during the chaotic destruction of industrial-economic formations that ensued, the greatest blow was sustained by the country's high-tech sectors – in terms of development level, the economy was relegated to the ranks of underdeveloped countries.

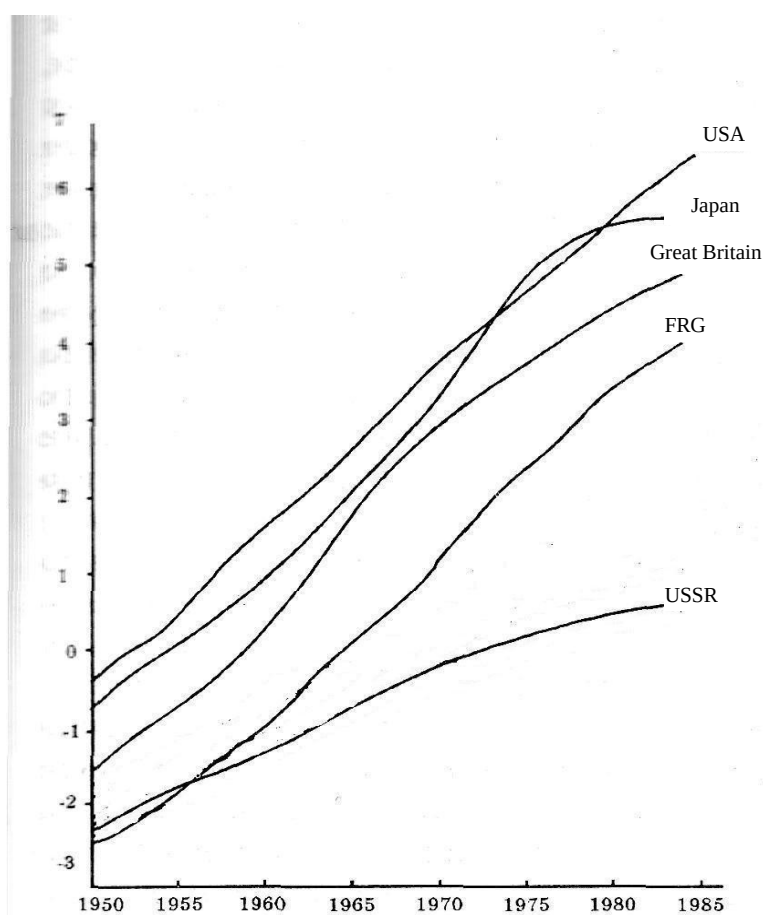
An important factor in the emergence of the new technological mode is the development level of the previous mode. Used to measure the development level of the fifth TM in Russia were indicators for the output of goods representing the core of the fifth technological mode, as well as indicators reflecting the state of the mode's carrier sectors – the saturation level of the communications, computing and electronics markets as well as Internet density. Dynamic ranges of the respective indicators were plotted using multivariate statistical analysis (the key component

²³ Science-and-Technology Breakthrough Strategy; A Collection of Scientific Works Edited by Y.V. Yakovets, O.M. Yun; M.: MFK, 2001

²⁴ Problems of Information-Based Economies; Issue 5; Russia's National Innovational System: Problems of Formation and Development: A Collection of Scientific Works / Edited by R.M. Nizhegorodtsev; M.: LENAND, 2006

method), for the purposes of obtaining a generalized growth trend for the fifth TM. The findings of this analysis indicate that unlike developed capitalist countries, where the fifth technological mode began rapidly expanding in the mid-1980s, its growth rate in the USSR remained modest throughout the period – outpacing the overall rate of economic development only slightly (Diagram 15).

Diagram 15. Generalized growth indicator of the fifth technological mode in its embryonic phase

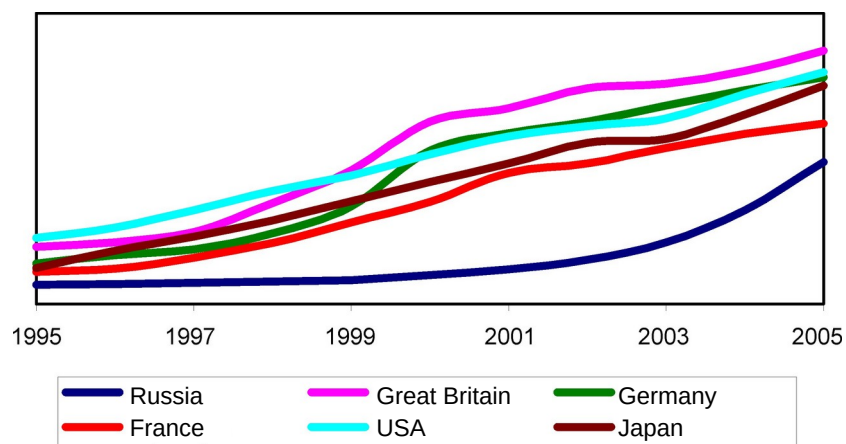


Source: S.Y. Glazev; A Theory of Long-Term Technical-and-Economic Growth; M.: VlaDar, 1993

Following the collapse of the USSR, the subsequent policy of economic “shock therapy” led to the dramatic destruction of the country’s science-and-production potential. Machine-building output volume suffered a four-fold collapse. The industry itself – key to the modern economy – was degraded. According to experts, the share of the contemporary technological mode in Russian machine-building output volume dropped from 33% in 1992 to 21% in 1998¹, with its share in the overall economy in the first half of the 1990s dropping from 6% to 2%¹. The recovery that followed the 1998 default left industries under the modern technological mode essentially untouched. With the exception of the export-oriented segment of the military-industrial complex and IT, they continued to degrade.

At the same time, the tracking of fifth-TM growth during the post-Soviet era indicates that following an extended period of stagnation and a growing lag, its general trend began growing rapidly in the first years of the new century (Diagram 16).

Diagram 16. Generalized growth indicator for the fifth technological mode



[S.Y. Glazev; *Development of the Russian Economy in an Environment of Global Technology Shifts. Scientific Paper. Moscow, 2007*]

¹ V.N. Borisov; *The Machine-Building Complex in the Reproduction Process: Methodology and Sampling Frame of Analysis and Forecasting: Doctor of Sciences in Economics Thesis Synopsis; M., 2001.*

¹ *Science-and Technology Breakthrough Strategy. A Collection of Scientific Works Edited by Y.V. Yakovets, O.M. Yun; M.: MFK, 2001.*

Yet, the output level of the electronics industry constituting the core of this technological mode remains ten-times lower in Russia than in developed countries (Table 5). Russia's share of the global market for electronic devices and parts is no more than 0.1–0.3%. The country has the same share (0.2%) on the global information-services market – 25 times lower than that of China and 15 times lower than that of India²⁵. In Russia, the contribution of information-and-communication technologies to economic growth is half that of developed countries and lags behind even Thailand²⁶.

Table 5

Per capita electronics production in developed countries, in USD

| | |
|--------|------|
| USA | 1260 |
| Japan | 1100 |
| EU | 500 |
| Russia | 14 |

Source: O. Sukharev; Information Sector of the Economy: Problems of Development.
// Investments in Russia No. 8, 2006.

At the same time, in terms of the development level of one of the carrier sectors of the fifth technological mode – aerospace technologies – Russia ranks among the world's leaders. In particular, the share of Russian firms on the space-

²⁵ O. Sukharev; Information Sector of the Economy: Problems of Development // Investments in Russia; 2006; No. 8

²⁶ D. Valiano; Information Technologies: Expense Item or Growth Factor? // Interregional Researcher Group – Institute for New-Economic Problems; 2006; No. 2-3

launch market is approaching one-third²⁷. In truth, however, the share of earnings by Russian companies on the global space-technology market stands at just 2%²⁸.

Russian industry continues to maintain its forward position in the atomic, aircraft engineering and defense industries. Its information-and-communication sector is also developing at a rather brisk pace. Yet, its weight in the overall Russian economy accounts for just 5–7% of GNP compared to 30–45% in developed countries²⁹. Despite the leading position held by Russian mathematicians and the relative advancement of the country's programming industry, domestic participation on the global computer-software market – valued at USD 400–500 bln annually – is just over USD 200 mln, i.e. 0.04 %.

As indicated by the measurement findings and available assessments, at the current growth stage of the fifth technological mode, which has now reached the mature phase, it is being spread throughout Russia by the respective carrier sectors, while the core itself remains immature. According to RAS Member E.A. Fedosov, sectors classified as comprising the core of the fifth technological mode such as “the production of microelectronics and electronic devices, wireless equipment, optoelectronics, civil aircraft engineering, high-grade steel, composite and new materials, industrial equipment for high-tech sectors, precision and electronic instrumentation, devices and equipment for telecom systems and modern communications networks, computers and other IT equipment components have all experienced a significant decline from 1990–1991 levels. It is very difficult to

²⁷ Science-and Technology Breakthrough Strategy. A Collection of Scientific Works Edited by Y.V. Yakovets, O.M. Yun; M.: MFK, 2001

²⁸ D.E. Sorokin; The Challenge for Russia – M.: Science, 2003

²⁹ Problems of Information-Based Economies; Issue 5; Russia's National Innovational System: Problems of Formation and Development: A Collection of Scientific Works / Edited by R.M. Nizhegorodtsev; M.: LENAND, 2006; O. Sukharev; Information Sector of the Economy: Problems of Development // Investments in Russia; 2006; No. 8

overcome the lag behind global levels in such technologies – even with robust investments”³⁰.

During the mature phase of the dominant technological mode, closing the technological gap in its key technologies requires colossal investments, even as the acquisition of imported technology allows for the swift satisfaction of current demand. Such is the case in our country, as evidenced by the growing stock of personal computers, Internet users, and other indicators of the expanding use of technologies under the fifth technological mode and its carrier sectors, which currently stands at about 20–50% annually³¹.

It follows from the above that in Russia, expansion of the fifth technological mode is “catch-up – imitational” in nature. Expansion of the carrier sectors of the fifth technological mode is occurring on the basis of imported technology, which is robbing the economy of chances to suitably develop the key technologies forming its core. This means that the Russian economy is being dragged into the trap of unequal exchange with the mode’s foreign core, where the bulk of the respective intellectual rent is generated.

Judging by an analysis of the spread of the new (sixth) technological mode in various countries, its development in Russia is also lagging behind. However, this lag is occurring at the initial phase of development and may yet be overcome during the growth phase. This will require getting ahead of the widespread restructuring of the global economy and developing the key industries at the core of the new technological mode, whose subsequent expansion will open the door to intellectual-rent receipts on a global scale. Russian science has the necessary potential and knowledge-base to make it happen – as well as a number of highly-promising achievements whose well-timed practical development could secure a leading position for Russian enterprises on the crest of the next long-wave of

³⁰ E.A. Fedosov; *Innovational Path to Development as the Global Trend for the Long Haul*; 2006; No. 9

³¹ O.G. Golichenko; *Russia's National Innovation System: Current Status and Development Paths*; M.: Science, 2006

economic growth. Russian researchers have taken first place in the discovery of cloning technology, stem cells, and optoelectronic measurements. A survey of recent research findings points to the conclusion that Russian science-and-technology potential features all of the prerequisites necessary for faster development of the new technological mode³².

The problem remains the timely, practical development of the country's science-and-technology capacity in the areas key to the formation of the new technological mode. While Russia's science-and-education infrastructure has the necessary human resources potential, underfunding has led to a "brain drain" and the loss of technical knowledge overseas. The reform period saw the emigration of approximately 5 mln specialists – more than during and after the Civil War⁴⁶. According to available statistics, up to one-half of the graduates from Russian institutions of higher education specializing in such key factors of the new TM as molecular biology and genetics are leaving the country. It must be acknowledged that aside from the atomic and aerospace industries that have managed to amass certain competitive advantages, Russian industry has no manufacturing enterprises under the new technological mode. Their swift establishment is the decisive factor in the country's future development.

5.2. State of Russia's production potential

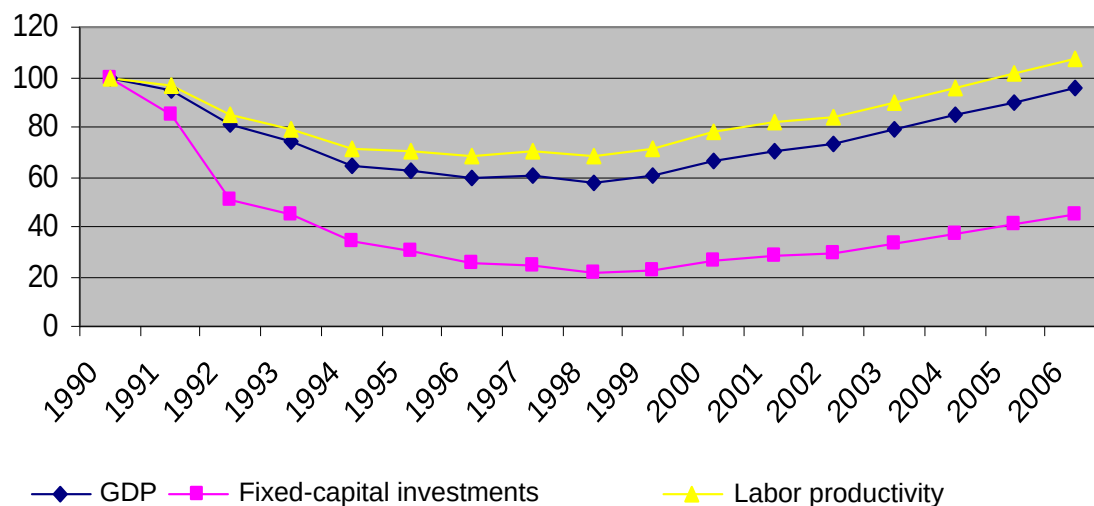
Despite the ongoing economic revival, the overall state of the economy is a function of the sharp and protracted decline in production and investments that occurred recently. By 1998, Russia's production level had plummeted by 42% since 1990, with fixed-capital investments collapsing by 79%. While GDP has been growing stably since 1999, it has still barely recovered to its pre-reform level (Diagram 17) and remains lower than that of any other G8 country, half that of India's and only one-quarter that of China's.

³² L. Ratkin; *The Nanotechnology Potential of the Russian Economy // Investments in Russia*; 2006, No. 11

⁴⁶ L. Myasnikova; *Paradigm Shift. The New Global Project // The Global Economy and International Relations*; 2006, No. 6

Diagram 17

**Growth rate of key economic indicators
(in percentages against 1990)**



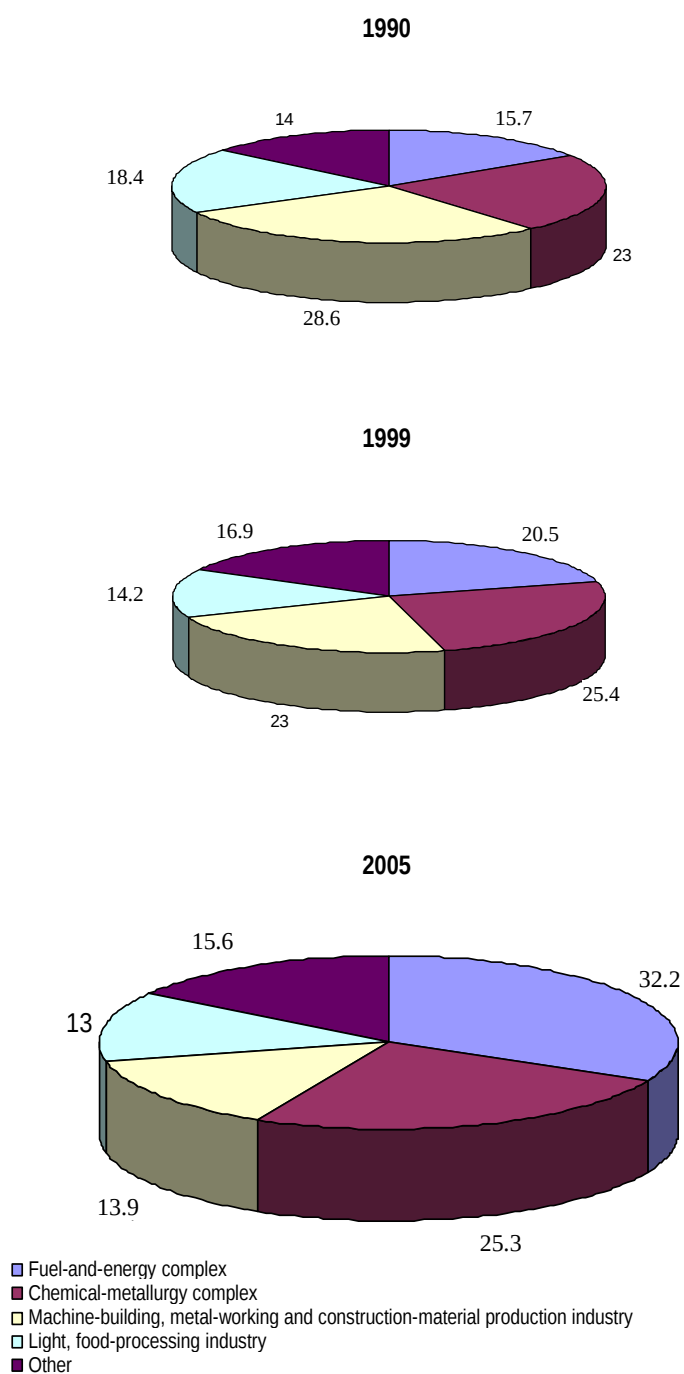
Sources: Russian Statistical Annual; 2003: Stat. Dig. / Rosstat (RF Federal State Statistics Service), M., 2003, pp. 30–31;

Russian Statistical Annual; 2005: Stat. Dig. / Rosstat, 2005, pp. 149, 323, 661;

Forecast for RF Socio-Economic Development in 2007, pg. 203.

That said, overall production structure has deteriorated dramatically – unlike other successfully-developing countries that actively promote the production of high value-added goods, Russian GDP gains have been chiefly attained via energy exports and trade growth. The share of industrial-output structure occupied by the country’s fuel-and-energy and chemical-metallurgy industries has shot up, just as the machine-building share has contracted (Diagram 18) – a trait characteristic of countries on the raw-materials periphery. Sectors with high added-value have continued to deteriorate. But the greatest devastation has been suffered by high-tech industries, investment and agricultural machine-building, light industry and industrial consumer goods, where output levels have fallen several times over, as well as by sectoral research.

Diagram 18
Industrial output structure (in percentages)



Sources: Russian Industry; Stat. Dig. / Rosstat, M., 2000, pg. 97;
 Russian Industry 2005; Stat. Dig. / Rosstat, M., 2006, pg. 128;
 Russia in Figures 2005; Stat. Dig. / Rosstat, M. 2005, pp. 372–373.

Industrial-output declines have not yet been associated with capital retirement of the same magnitude. At the same time, due to the four-fold reduction in production investments, depreciation levels have approached 50%³³, while the renewal coefficient hit only 3.4%, foreshadowing the growing technological lag of the Russian economy. The average age of Russian equipment topped 20–30 years – twice that of equipment ages in developed countries. Engulfed in the most serious regression were the most progressive industries, which, against the backdrop of continuing global STP, caused Russia to lag 15–20 years behind in terms of the development level of the key technologies of the modern technological mode. Most of the enterprises at the core of the modern TM have essentially been wound-down, squeezed out of the domestic market by import substitutions.

Russia occupies less than 0.3% of the global market for high-tech products – two orders lower than the US position, an order lower than that of Mexico, and threefold below the spot held by the Philippines³⁴. According to experts, the production of high-tech home electronics, instrumentation and machine-tooling has been relegated to the “uncompensated technological-lag” zone³⁵. Relentless destruction of the core of the modern technological mode represents the destruction of the technological foundations for stable economic growth and solidification of the Russian economy’s obsolescence.

As has been demonstrated above, a structural crisis is overcome via the introduction of new technologies that open up production opportunities – technologies whose development secures a breakthrough in terms of improving the efficiency of the economy and its successful transition to a new growth phase. If the crisis unfolds normally, the resulting decline in economic activity leaves the

³³ Russian Statistical Annual – RF Federal State Statistics Service, 2007

³⁴ Materials for the Meeting of the Council on Competitiveness. The RF Ministry for Economic Development and Trade; M.: 2006

³⁵ V.A. Salnikov, D.I. Galimov; Competitiveness of Russian Industrial Sectors – Current Status and Outlooks // Problems of Forecasting; 2006, No. 2

promising enterprises of the new technological mode unaffected – enterprises with growth potential and the capacity to become the “driver” of the country’s future economic growth. Quite the contrary, it is against the backdrop of general decline that output growth in fundamentally-new goods and investment and innovational activity in promising areas are observed. Investments in new technologies turn out to be more lucrative than existing reproduction structures that are beginning to lose their profitability. What occurs is the “creative destruction”³⁶ of the technical structure, its modernization on the basis of the expansion of the new technological mode, which creates new opportunities for economic growth. Capital is intensively redirected from obsolete enterprises into new ones, as continuing to invest in existing areas begins to be riskier than investing in innovations³⁷.

The economic crisis currently unfolding in Russia is fundamentally different than the classical method for renewal of the economy’s technological structure and is pathological in nature. The production decline suffered by the country’s high-tech sectors has turned out to be much more severe than the industrial average. Moreover, the higher the sector's technical level, the worse the decline has been. The innovational activity of enterprises has dropped sharply. If, at the end of the 1980s, the share of USSR industrial enterprises involved in the development and implementation of innovations stood at about 2/3, this figure has dropped to 10% today (in developed countries, this share exceeds 70%)³⁸. The intensity of innovational activity in the manufacturing industry has plummeted to 1%, while the innovation level of related products has dropped to 10%³⁹.

³⁶ J. Schumpeter; *A Theory of Economic Development*; M.: Progress, 1982

³⁷ A. Kleinknecht; *Long Waves, Depression and Innovation* // *De Economist*; 1986, No. 1

³⁸ *Innovational Development Path of the New Russia* / Ed.-in-chief V.P. Goreglyad; Center for Socio-Economic Problems of Federalism of the RAS Economics Institute; M.: Science, 2005

³⁹ O.G. Golichenko; *Russia's National Innovation System: Current Status and Development Paths*; M.: Science, 2006

The most devastating damage has been suffered by the country's science-and-technology potential, which constitutes the primary source of modern economic growth. That said, the most punishing blow has been dealt to the applied sciences – falling victim to the privatization process that destroyed the bulk of sector R&D and engineering departments⁴⁰.

5.4. State of Russia's science-and-technology potential

One of the main reasons for the collapse of the Soviet economy was its growing technical lag behind the world leaders, which was conditioned by the bureaucratization of the processes of centralized planning and the stagnation of institutional monopolies. It had been anticipated that the transition to a market economy under the influence of competition processes would create the conditions necessary for a full realization of the society's pent-up intellectual potential, which, in terms of development level, had secured the USSR's rightful ranking as the planet's second-place superpower¹.

Contrary to popular expectation, however, the misguided reform strategy that ensued resulted in the Russian economy losing the bulk of its science-and-technology potential. According to various estimates, R&D expenditures in constant prices dropped by a factor of 5–12. At present, their share in GDP remains stuck at the unacceptably-low level for advanced countries of 1.1%⁴¹ (in 1990, it stood at 2.03%). If, in 1990, Russia's ranking in terms of this indicator was comparable with that of leading OECD countries, it is now closer to the group of countries with low scientific potential. Today, Russian expenditures per person employed in the research-and-development field (including the professor-instructor population at institutions of higher education) is

⁴⁰ A.A. Leirich; Scales and Dynamics of the Formation Indicators for the "New" Economic Sector // Interregional Researcher Group – Institute for Problems of the New Economy; 2006, No. 2–3

¹ Science on the Market Cusp / Ed. S.Y. Glazev; M.: Economics, 1992

⁴¹ Russian Science in Figures – 2008; M.: Center for Research and Statistical Science, 2008

8 times lower than in South Korea and 12 times lower than in Germany⁴².

Government attitudes towards science have been changing over recent years. Yet, “although science expenditures grew by 48.6% between 1999 and 2002, this growth, given the dramatic, manifold decline over 1992–1998, is still far from restorative. Total R&D expenditures in Russia are still 3–5 times lower than 1990–1991 levels. Even recommendations offered by the InterAcademy Council for developing countries concerning the need to boost R&D funding to 1.5% of GDP are being ignored⁴³.

Between 1990–2007, the number of personnel employed in the research-and-development field dropped by more than half (from 1,943,400 people to 801,000). That said, the greatest contraction was suffered by the direct participants in the scientific process – researchers (by 59.6% over 1990–2004) and engineers (by 70.2%)⁴⁴. The prestige of the scientist is sharply declining. According to public surveys, only 9% of the country’s residents view the profession of scientist as prestigious. In the US, by contrast, a survey conducted in 2002 found that the profession of scientist was regarded as being the most prestigious – 51% of the population named the profession most prestigious, with 25% calling it very prestigious and another 20% simply prestigious. It is hardly surprising then that the “brain drain” from Russian scientific organizations to other countries and occupations has resulted in the erosion of the country’s most productive age groups: “the average age of a Russian scientist is 48 years, PhD – 52 years, and post-PhD – 60 years. This age structure poses a serious threat to the continuity of knowledge in Russian science and will eventually lead to a slowdown in the transition to the new economy”⁴⁵.

⁴² Russia’s Scientific Potential 1995-2005 – Anal. Stat. Dig., M.: RAS Center for Research into Scientific Development, 2007.

⁴³ Theory and Practice of Knowledge-Based Economics and Sociology / Research Council under the Fundamental Research Program of the RAS Presidium “Knowledge-Based Economics and Sociology” – M.: Science, 2007, pg. 151

⁴⁴ Russia’s Scientific Potential 1995-2005 – Anal. Stat. Dig., M.: RAS Center for Research into Scientific Development, 2007

⁴⁵ Theory and Practice of Knowledge-Based Economics and Sociology / Research Council under the Fundamental Research Program of the RAS Presidium “Knowledge-Based Economics and Sociology” – M.: Science, 2007, pg. 141.

According to expert assessments, more than 20,000 scientists left Russia between 1989 and 2002, with another 30,000 currently working abroad under temporary contracts. Although this only represents about 5–6% of the personnel numbers behind the country's scientific potential, émigrés typically represent the most competitive scientists at the most productive point in their careers. The main reason cited by the vast majority (90%) of émigrés for their decision to live and work abroad is the low salary earned by scientists at home. Although it has risen significantly in recent years, it is still insufficient to support the influx of youth necessary to close the growing generation gap.

The decline in the country's science-and-technology potential has been accompanied by a similarly dramatic drop in the technical-industrial state of the Russian economy. Given the absence of any sort of explicit investment or structural policy by the government, technological shifts in the Russian economy have assumed a clearly-regressive nature and have resulted in the rapid degradation of its technological structure. That said, the most serious regression has engulfed the most cutting-edge industries and, against the backdrop of ongoing global STP, thrust Russia 15–20 years behind the curve in terms of the development level of the key technologies forming the contemporary technological mode.

The severe damage sustained by the country's science-and technology potential has led to a sharp drop in the competitiveness of the national economy and the loss of a significant portion of its potential for economic growth. That said, the most punishing blow has been dealt to the applied sciences – falling victim to the privatization process that destroyed the bulk of sector R&D and engineering departments.

Forced privatization resulted in the severing of science-and-production ties – across almost all industrial sectors, enterprises falling within science-and-production associations were privatized separately. As a result of such a formally-bureaucratic approach, enterprises were left without scientific support, and applied R&D and engineering departments – without orders. The first followed the path of

product primitivization, with the second simply degrading after suffering a manifold staffing and intellectual-potential loss. As a result, despite its tremendous applied R&D capacity, today's corporate sector has effectively been left without a science base. In developed countries, corporate industrial sectors fulfill 2/3 of overall R&D, whereas this figure stands at just 6% in Russia⁴⁶. "In Russia, the weighted share of innovational activity by individual enterprises has hovered at 9% for the last three years⁴⁷, which is significantly lower than not just OECD countries (where the figure stands at about 60%) but Eastern European countries as well (Romania – 28%, Slovenia – 32%, Poland – 38%⁴⁸).

Studies indicate that the majority of industrial enterprises lack any sort of systematic, streamlined marketing procedures for the selection and manufacturing-launch of new products, which is why 85-90% of newly-developed products lack the desired demand volume. At 85% of Russian enterprises, investment processes are not managed efficiently and are either implemented in cases of clear necessity or on an ad hoc basis⁴⁹. For now, corporations are preferring to finance short-term engineering projects capable of paying for themselves in 2–3 years. On average, 65% of Russian enterprises spend less than 1% of their total turnover on research and development⁵⁰. That said, the structure of expenses for technological innovation within Russian industry is dominated by marketing research and industrial engineering (50%), while R&D expenditures account for just 10% (there is an inverse relationship in developed countries)⁵¹ – the development of emerging technology is clearly becoming imitational in nature. At the same time, global

⁴⁶ A. A. Leirich; Scales and Dynamics of the Formation Indicators for the "New" Economic Sector // Interregional Researcher Group – Institute for Problems of the New Economy; 2006, No. 2-3

⁴⁷ Russian Science in Figures – 2003; Stat. Digest, M.: Center for Research and Statistical Science, 2003

⁴⁸ S. Radosevic; Patterns of Innovative Activities in Countries of Central and Eastern Europe: An Analysis Based on Comparison of Innovation Surveys // Comparative Economic Research. Central and Eastern Europe. Lodz., 1999. Vol. 2. No. 2. pg. 126

⁴⁹ A. Kudinov; Restructuring of Industrial Enterprises. Results and Outlooks; BKG. 29.12.2003

⁵⁰ I.G. Dezhina, B.G. Saltykov; Mechanisms for the Stimulation of R&D Commercialization; M.: IET. 2004

⁵¹ V. Karacharovsky; Capital Competition and the New Economy // Economist; 2006, No. 12.

practice indicates that R&D expenditures by major corporations are quite high, accounting for 3–20% of their respective budgets and averaging 8–10%⁶.

The figures cited above point to the fact that the economic environment existing in Russia today is incapable of effectively using inventions and emerging technologies. Yet, thanks to the country's ongoing science-and technology potential, their generation continues: "according to the innovational-activity indicator, measured as the number of domestic patent applications (including those filed abroad) per 10,000 people, Russia continues to be ranked at the middle of the pack (with a figure of 2.62) – ahead of the countries of Central and Eastern Europe (Czech Republic, Poland, Hungary (0.6–0.7)) but behind the leader-countries, where the same indicators now approach 4.5–5.5. Russia's share in the total number of patent applications filed annually by foreign claimants in OECD countries does not exceed 0.5%, although the overall number of Russian patent applications filed abroad is growing"¹.

The same overview of the state of R&D commercialization yields data on the relatively high demand for developments by Russian researchers abroad. This is reflected by the continuous growth in financing by the foreign partners of the International Science and Technology Center in Moscow, which has shot up from USD 1.1 mln in 1997 to USD 47 mln in 2003.² As reflected by the data cited above, as well as by the statistics on scientist emigration, the main reason for the essential destruction of sectoral research was not the noncompetitiveness of Soviet R&D and engineering departments, but the halt in demand for sectoral R&D due to the destruction of major science-and-production associations during the industrial privatization process. Russia's best scientists and engineers, left without orders for R&D projects from Russian enterprises within the aircraft-manufacturing, aerospace, shipbuilding, electronic and other high-tech industries, found

⁶ Innovation, Patents and Technological Strategies. Paris: OECD, 1996.

¹ I.G. Dezhina, B.G. Saltykov; Mechanisms for the Stimulation of R&D Commercialization; M.: IET. 2004, pg. 6

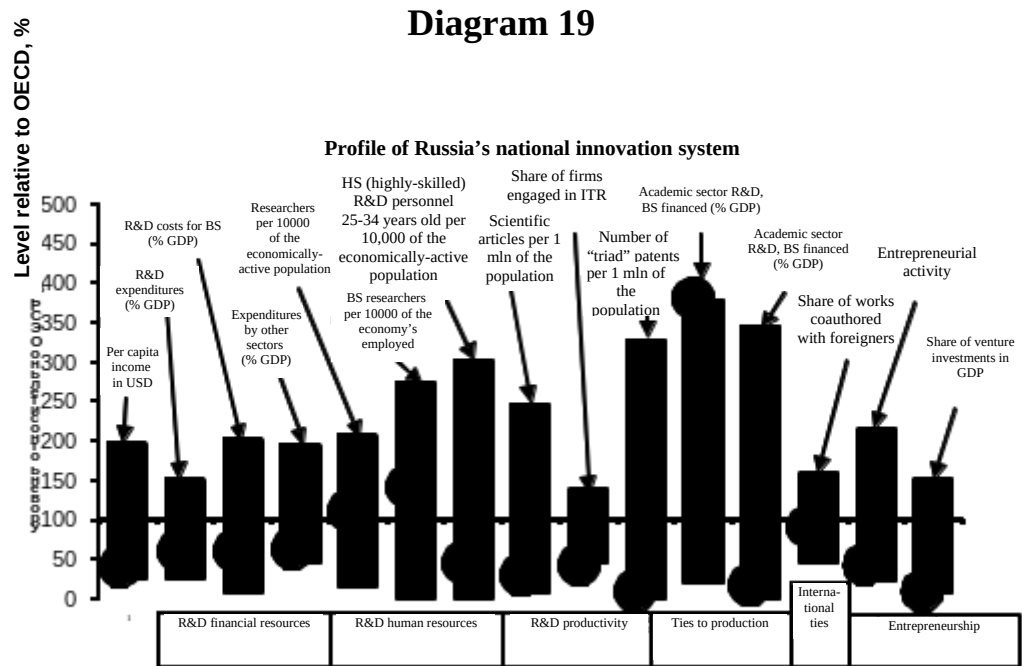
² *ibid.*

themselves in demand by Boeing, Airbus, Microsoft and other foreign corporations desperate for the achievements of the Soviet applied sciences in the struggle to defeat potential Russian competitors.

In current conditions, degradation of the country's science-and-technology potential leads to the permanent loss of opportunities for ongoing socio-economic development. Further declines in the competitiveness of the Russian economy are being predetermined by the shape of its innovational system – across all indicators of innovational activity, it trails far behind those of developed OECD countries (Diagram 19). That said, degradation of the country's science-and-technology potential continues, as evidenced by the falling value of R&D capital assets and the deterioration of their productivity. Compared to 1997, the number of new manufacturing technologies created in Russia in 2003 had dropped by a factor of 1.4, with the production of fundamentally-new (by international standards) technologies falling by a factor of 1.6⁵². In 2006, the number of the first grew by 15%, while the number of fundamentally-new technologies created fell by 13%⁵³.

⁵² Information-Based Economy and the Concept of Modern Management: Materials of the First Drucker Readings / Ed. R.M. Nizhegorodtsev; M.: *Dobroe Slovo* ("The Good Word"), 2006

⁵³ Russian Statistical Annual – RF Federal State Statistics Service, 2007



Source: O.G. Golichenko; Russia's National Innovation System, M., 2006, pg. 32

In order to overcome the degradation of the country's innovational potential, investments in science and education must be ramped-up dramatically. Yet, government efforts have thus far been limited to supporting the country's surviving science-and-technology potential, whose overall level continues to drop compared to that of advanced countries. According to V.L. Makarov, investments in the knowledge sector averaged about 4.7% of GDP across all OECD countries by the beginning of the 21st century, while this figure stood at just 1.6% of GDP in Russia². In terms of the contribution of high-tech sectors to GDP, the Russian economy trailed the average OECD level by more than a factor of two³, while their share in total exports was 20-times lower than the European average⁴.

With the destruction of its own science-and-technology potential, the Russian economy is recalibrating towards an imported technological base – yet another sign typical of countries on the raw-materials periphery. According to

² V. Makarov; Contours of the Knowledge-Based Economy // Economist, 2003, No. 3

³ D.S. Lvov, S.Y. Glazev; Theoretical and Practical Aspects of STP Management / Economics and Mathematical Methods; 1986, No. 5

⁴ Science-and-Technology Breakthrough Strategy; A Collection of Scientific Works Edited by Y.V. Yakovets, O.M. Yun, M.: IFC, 2001.

input-output balance statistics provided by Rosstat, the share of imports in the domestic consumption of machine-building goods in 2002 stood at 43.7%⁵. According to specialists at the RAS Institute of National-Economic Forecasting, if the current trend continues, up to 60% of the technology needed to modernize the Russian economy will have to be acquired abroad¹.

The steady degradation of the country's science-and-technology potential is foreshadowing the Russian economy's slide towards the periphery of the global economic system. Natural-resource specialization, extremely low wages, insignificant scientific-research funding, capital flight, "brain drain," erosion of national income through the servicing of foreign debt – all of the distinctive features of a peripheral country can be rightly ascribed to the Russian economy today. According to statistics on average life-expectancy, the share of wages in GDP utilization, the human-capital development index, and the percentage of capital exports in the accumulation fund, Russia has slipped to the level of the "backward" countries. Over the reform years, the relative level of its labor productivity has dropped dramatically (from 45% above to 25% below the worldwide average⁵⁴).

5.5. Disintegration of the Russian economy

The measurements of changes to technological structure mentioned above demonstrate the pathological technical multiformity of the Russian economy, which unlike the case with successfully-developing countries, cannot be overcome via the relatively-higher development rates of advanced technological modes (the growth rate of the fifth technological mode in newly-industrialized countries – China, India and Brazil – outpaces the overall rate of economic growth by more than a factor of five); rather, it is exacerbated by the destruction of high-tech industries. This degradation of the technological structure and its stagnation at the

⁵ B.N. Kuzyk, Y.V. Yakovets; Integrated Macro-Forecast for the Innovation-Technology and Structural Dynamic of the Russian Economy Through 2030 / B.N. Kuzyk, Y.V. Yakovets, Authors, Foreword by A.D. Nekipelov – M.: Institute for Economic Strategies, 2006

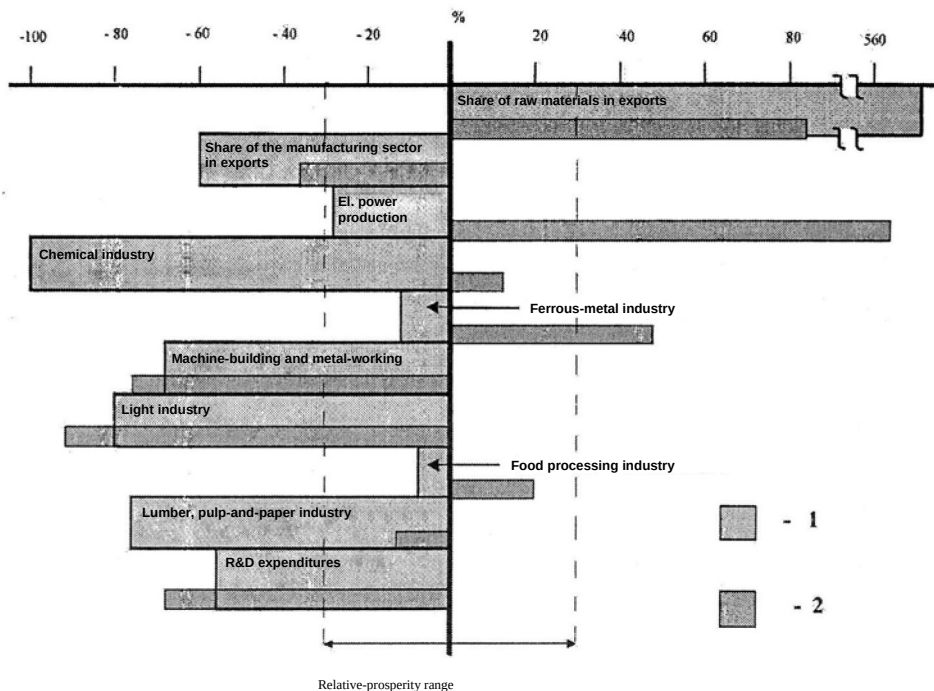
¹ N.I. Komkov, Organization and Outlook for the Making of a Technological Forecast for Russian Economic Development. Contribution of the Social Sciences to Development of the National Economy: Materials of the RAS UN Research Session, 17 December 2002, M., 2003

⁵⁴ See B.N. Kuzyk, Y.V. Yakovets

trailing level occurs as a result of the Russian economy being dragged into the vicious circle typical of colonially-dependent countries of the unequal foreign exchange of raw materials for finished goods.

Since the mid-1990s, the Russian economy has been struggling with a recurring raw-materials distortion – its natural-resource sectors (the oil-and-gas, metallurgy and forest-chemical industries) account for approximately 5% of the workforce, 10% of the payroll fund, one-third of the added-value and more than one-half of the total exports produced by the Russian economy⁵⁵. The latter becomes more primitive, assuming the role of a mere raw-exports supplier for the European Union and China stripped of the mechanisms for independent reproduction. This is abundantly clear from the national profile of Russian industry (Diagram 20), which has assumed a stubbornly-raw-materials character since the beginning of this century.

Diagram 20



National industry profile. Divergence of Russian industrial proportions from global averages (1) and change in Russian investment structure, 1990–2002 (2)

Source: Russia’s State Industrial Policy. Chamber of Commerce and Industry of the Russian Federation, 2003.

⁵⁵ N.N. Mikheeva; Resource Sector of the Russian Economy: Scales and Inter-Sector Interaction // Problems of Forecasting; 2006, No. 2

Primitivization of the economy has emerged as the result of the processes involved in the redistribution of national wealth via privatization, financial pyramids and the export of natural resources. The intensity of this redistribution has been extremely high, accounting yearly for up to one-half of the country's entire accumulation fund, assimilated by oligarchical clans and spirited out of the country. Forcing up prices for fuel and raw-materials, in turn, has resulted in the erosion of capital from manufacturing industries, agriculture and construction. These sectors have been deprived of the working capital driven out through the "price scissors" phenomenon and lost on the excessive interest rates charged on loans. As a result, only enterprises within the export-oriented raw-materials sector have had access to the resources of the financial market. That said, excess profits on the export of energy commodities and raw materials have not been transformed into investment growth and have largely remained abroad.

Disintegration of the economy intensified during the process whereby the existing contours of the redistribution of added-value among the sectors were reproduced. According to available estimates⁵⁶, the "price scissors" phenomenon and the depressed exchange rate for the national currency combined to create a situation in which the domestically-oriented sector transferred the lion's share of the added-value created thereby to the export-oriented sector and trade. The monetary authorities, in turn, seized about 7% GDP from the export-oriented sector and added it to the Stabilization Fund kept overseas. The excessive profit in the export-oriented sector – more than five-times higher than the normal rate in the domestically-oriented sector – perpetuates and exacerbates the gap between them, as reflected in the more than two-fold discrepancy between the intensity of capital-asset renewal and opportunities to attract labor resources and investments.

Coupled with the sharp drop in the production of high-tech products, these trends condemn the Russian economy to an unequal foreign-economic exchange and growing technological lag. In exporting raw materials and importing finished goods, Russia loses non-renewable natural-resource rent by exchanging it for

⁵⁶ A.R. Belousov; Long-Term Trends of the Russian Economy. Scenarios for Russia's Economic Development Through 2020; M.: Center for Macroeconomic Analysis and Short-Term Forecasting, 2005

intellectual rent and thereby financing science-and-technology progress and economic growth abroad.

The chaotic demolition of the structure of the Russian economy during radical reforms led to its disintegration and the splintering of once-whole process flows into autonomously-operating elements subsequently assimilated, in certain cases, into external reproduction systems. Disregard for the distinctive features of the Russian economy, coupled by the policy line pursued by the Russian government with respect to its self-directed abrogation of regulatory responsibilities and reliance on the automatic functioning of market self-organization mechanisms, triggered the destruction of technologically-complex types of economic activity and fomented chaos. The primitivization of economic policy and its reduction to the dictates of the Washington Consensus inevitably led to the destruction of the main reproduction systems of the economy and its crumbling into autonomously-operating sectors.

Overcoming the trend towards degradation of the country's science-and-production potential requires the dramatic ramping-up of investment and innovational activity. According to estimates by L.I. Abalkin, “in order to really modernize the economy, domestic investments must grow by about 18% year-on-year over the next 15 years. This is the first and deciding precondition for the creation of a favorable investment climate”⁵⁷. By our estimates, in order to achieve the expanded reproduction of capital assets, productive investments must double and R&D investments must triple. Given the maximized depreciation of outmoded production facilities, this must be accomplished over the next two-three years.

The existing mechanisms of investment activity are simply not up to the task at hand. Neither the stock market nor the banking system are fulfilling their role of accumulating savings and transforming them into investments. The main investors are the manufacturing enterprises themselves, who account for more than 60% of total industrial investments. That said, in the absence of any real mechanisms for refinancing by the Central Bank, it's hard to assume that the banking system will

⁵⁷ L. Abalkin; Musings on Long-Term Strategy, Science and Democracy // Economic Issues; 2006, No. 12

be able to ensure the necessary level of investment activity. Limited financial opportunities to update production persist, which is the leading factor hindering development of 4/5 of the total number of enterprises⁵⁸. That said, the aggregate contribution by banks in the financing of fixed-capital investments does not exceed 10%. Even lower has been the investment contribution by the stock market, which in Russia chiefly services financial speculators.

At the same time, the financial capabilities of the enterprises bearing the brunt of supporting the economy's investment activity are highly limited. The volume of depreciation allowances constituting the main source of investment financing is just 2.2% of total capital stock (14% in 1990), while a full half thereof is in desperate need of renewal. As noted by A. Sysoev⁵⁹, "the annual depreciation of industrial stock stands at 5-7%, while its restoration rate is just 1-1.5%. In essence, a persistent "depreciation-restoration" imbalance of approximately 3:1 has developed, making the total depreciation of all capital stock inevitable." In fact, the depreciation of electrical equipment at the majority of the largest thermal power-plants now exceeds 60%.

Nor are the opportunities to finance investments from profit great. With the exception of export-oriented sectors of fuel-and-energy and chemical metallurgy sectors, where profit volume remains quite high thanks to the favorable foreign-economic environment, the rate of return of domestically-oriented industrial sectors stands at just 6-8% – insufficient to finance the expanded replenishment of capital stock.

Fully one-third of all enterprises within the manufacturing industry, construction and agriculture are chronically in the red⁶⁰. As G. Gospodarchuk puts it,⁶¹ "analysis of the rate of return on non-financial corporation assets demonstrates that the credit terms offered at the macro-level of the financial market are only accessible to organizations involved in mining, coke and petroleum-product

⁵⁸ S.M. Iovchuk; *Innovational Factors Improving the International Competitiveness of Russian Industrial Products* // IIEPS RAS Digest; M.: 2004

⁵⁹ A.V. Sysoev; *Depreciation Policy as a Factor of Economic Investment Development* // *Problems of Forecasting*; 2006, No. 1

⁶⁰ S.M. Rogov; *Functions of the Modern State: Challenges for Russia: Scientific Paper*; M.: RAS USA and Canada Institute, 2005; *On the Outcome of Socio-Economic Development in the Russian Federation Through 2006*; M.: RF Ministry for Economic Development, 2007; *Russian Statistical Annual – RF Federal State Statistics Service*, 2007

⁶¹ G.G. Gospodarchuk; *Money for the Russian Economy* // *Cash and Credit*; 2006, No. 12

production and chemical and metallurgy production, as well as communications carriers.”

Aside from the collapse of the economy into domestic- and foreign-oriented reproduction systems, the macroeconomic policy pursued by the Russian government resulted in the disintegration of the financial and production spheres. The first – the capital-circulation sphere – is characterized by excess profit, high money velocity, and relatively-low risk. The second – the production sphere – is characterized by low profits, low money velocity, high risk and the overall degradation of production potential.

Analysis of the competitive capacity of various sectors of the Russian economy points to the uncertainty of the future development of even such technically-advanced industries as defense, aerospace and electrotechnical machine-building⁶². Breaking free of the raw-materials trap is proving more difficult with each passing year as a result of the growing global competition that Russia is clearly losing. Lost forever are chances to align itself with the core of the fifth technological mode, the precursors for which went unutilized. Chances for the timely formation of the key development areas of the sixth technological mode will taper away as its emerging structure assumes global proportions and countries begin to specialize their economies accordingly.

5.6. Underfunding of development – the main barrier to the recovery of the Russian economy

In an environment where the refinancing rate is constantly rising against the rate of return of the manufacturing industry, the only way to realize the country’s existing science-and-technology and production potential is to activate specialized credit institutions to provide targeted financing for promising and socially-important areas of the economy at acceptable interest rates: development banks and investment, innovation, venture and science-and-technology funds. In addition to that, the support infrastructure for innovational activity must also be developed:

⁶²V.A. Salnikov, D.I. Galimov; Competitiveness of Russian Industrial Sectors – Current Status and Outlooks // Problems of Forecasting; 2006, No. 2

science-and-technology centers, technoparks (technological clusters) and specialized state corporations. Although a number of such institutions have been created over the past few years, the majority continue to operate lethargically, simply placing the money they receive from the government on deposit. Their limited number and low impact, far below the standards found in advanced countries, is exacerbated by their inferior management quality, as evidenced by their inability to absorb the money received from the state and the results of oversight-agency audits showing their utilization of such funds for unintended purposes. Many of the recently-created innovation institutions are engaged in something more akin to imitation than actual work on developing innovations. Barely ten percent of their total number meet international standards¹.

In order to assess the opportunities lost in the arena of monetary policy during the period when oil prices were running high, let us suppose that Russia had abandoned the Central Bank and its national currency and embraced the US dollar and Euro in domestic circulation instead. Under that scenario, we would have had four times more money, three times lower inflation, and credits would have been twice as cheap and accessible.

The paradoxes generated by the monetary policy pursued in Russia during the post-crisis period will probably go down in economic history as some of the more absurd curiosities of the time. How, for example, could you ever explain to a right-minded person the situation that emerged in the Russian economy whereby the more currency receipts generated by the export of oil – the fewer credit resources available to Russian enterprises; the greater the flow of foreign investments – the fewer the opportunities for domestic accumulation; the greater the budget surplus – the higher the government's internal debt.

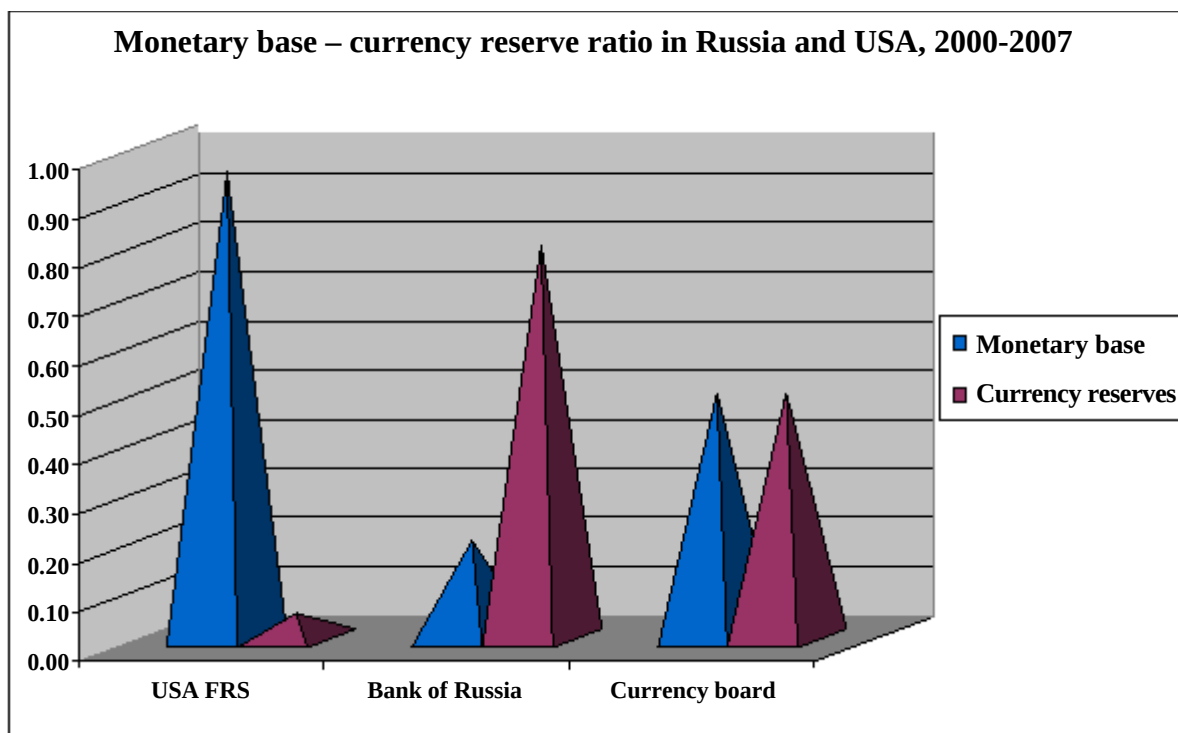
As an example, let's take a look at the structure of the monetary program of the Bank of Russia for 2006.

As of 1 January 2006, the Central Bank had accumulated RUB 5.245 trillion in net international reserves on the RUB 2.299 trillion of the monetary base in

¹ I.G. Dezhina, B.G. Saltykov; Mechanisms for the Stimulation of R&D Commercialization; M.: IET, 2004

circulation. In other words, for every ruble at work in the Russian economy, more than two were being reserved in foreign assets. By way of comparison, we note that the situation in the US is the reverse – the size of the country’s monetary base exceeds the volume of its gold and foreign-currency reserves several times over (Diagram 21).

Diagram 21



Throughout the pre-crisis years, the total volume of the currency reserves held by the monetary authorities exceeded the money supply by a factor of 1.5–3. This means that the monetary authorities have been artificially constricting the money supply more dramatically than even the most conservative model of monetary policy known as a “currency board” (when the country rigidly ties the money supply to the amount of currency reserves) implies. The twofold understatement of the monetary stock against the volume of reserved earnings results in a corresponding restriction of the money supply and opportunities to finance economic growth, increase investments, spur employment and boost household incomes. The inability of the monetary authorities to effectively manage the torrent of petrodollars into Russia has cost every Russian citizen at least half of

their potential earnings and been twisted into excessive interest rates and credit-accessibility problems for enterprises.

In all the years before the crisis, the Central Bank used a single channel for monetary emissions – the “growth in the net international reserves of the monetary authorities”⁶³, in other words, the acquisition of foreign currency. It poses no difficulty to demonstrate that tying monetary emissions to the growth in currency reserves in a situation where the money supply is quantitatively restricted leads to the outflow of money from most of the domestically-oriented production sphere, which, in the absence of access to credit, is forced to search for development funds by lowering wages or wind down production.

In 2006, for example, the CB pegged the upper limit for money-supply (M2 aggregate) growth at 28%. Given the approximate growth in currency reserves of USD 100 bln, monetary emissions should have exceeded RUB 2.5 trillion – equivalent to a doubling of the monetary base. In reality, it only grew by about RUB 796 bln – the remaining monetary emissions were sterilized via the reallocation of RUB 1.5 trillion in tax receipts into the Stabilization Fund, the attraction of RUB 229 bln into deposits and Bank of Russia bonds, and the ratcheting-up of regulations governing the mandatory reserves required to secure the liabilities of credit organizations to non-resident banks. Thus, over the year, the CB withdrew approximately RUB 1.7 trillion from the domestic market which otherwise could have been used to finance production and investment. *It follows from this policy that the more currency receipts flowing into Russia from the export of oil and gas, the less money remains for domestic production.*

Under the restrictions on money-supply growth imposed by the monetary authorities, both increasing earnings and boosting exports are rendered ineffective for the purposes of economic growth. Under currency-reserve growth, monetary emissions exceeding the upper limit for money-supply increase set by the CB results in a situation where the more currency receipts flowing into the country, the greater the volume of monetary-supply sterilization. At the same rate as revenues

⁶³ Main Thrusts of Monetary and Credit Policy for 2007

are received by oil companies, money is withdrawn from the state budget and banking system for the purposes of its freezing in the Stabilization Fund and the debt securities of the Central Bank. In other words, *the more petrodollars were flowing into the country, the less money was being provided for the development of other sectors of the economy and the budgetary sphere*. This stems from the logic of the “Main Thrusts of Monetary-and-Credit Policy”, limited exclusively to various options for the sterilization of “excess” liquidity¹.

Let’s try to get to the bottom of this paradox. The policy pursued by the Russian monetary authorities has proceeded from the well-known identity of monetary theory, which holds that the product of the amount of money and the velocity of its circulation is equivalent to the product of the volume of goods circulating on the market and their prices. This simple little formula is an article of faith for monetarism-worshipping vulgar liberals. Vulgar in the sense that they simplify economic reality to the extreme, basing it solely on the factors of free competition, the absolute rationality of businesses, their full awareness of existing technological opportunities and other non-existent – but handy for theorizing-purposes – abstractions.

The vulgar liberalism of Russian monetarists is even more primitive – in the identity cited above they discern only a direct relationship between the rate of price growth (inflation) and the rate of money-supply growth, viewing the velocity of their circulation and commodity-mass volume as constant. This explains the logic of their policy to restrict the money supply in an effort to control inflation.

The supposition of the existence of a certain upper limit – from the point of view of inflationary safety – for monetization of the Russian economy has been disproved by numerous studies demonstrating the lack of a statistically-significant relationship between inflation and the economy’s level of monetization⁶⁴ and the curious consequences of the baseless policy dictating the quantitative restriction of money-supply growth. At the same rate as the government was withdrawing taxpayers’ money from the Russian economy and sending it abroad, the same

¹ Main Thrusts of Monetary and Credit Policy for 2007

⁶⁴ Market Training / Ed. S.Y. Glazev – M.: Economics, 2004

taxpayers were heading overseas to borrow money to make up the cash shortfall. The volume of this peculiar circuit amounted to over USD 50 bln annually. That said, the government was lending out Russian taxpayers' money to foreign borrowers at a rate of 2–3% at the same time as they were being forced to borrow back the monetary resources they had parked abroad at the rate of 8–15% per annum. The net loss from this policy totals approximately USD 5 bln every year. This represents the *second paradox of Russian macroeconomic policy – the more currency receipts flowing into the country, the more capital the state sends abroad.*

Under this policy, even foreign investments are rendered ineffective. After all, according to its logic, the more capital foreign investors put down to acquire the shares of Russian enterprises, the more currency reserves grow, the greater the monetary emission under said growth, and the more money is sterilized by the monetary authorities. That said, over and above their reallocation of a significant portion of budgetary tax receipts to the Stabilization Fund, the monetary authorities have resorted to increasing the reserve requirements for commercial banks and unnecessary state borrowings, thereby removing even more available cash resources from economic circulation. As a result, the government's internal debt stood at RUB 1,092 bln at the end of 2006 and had risen to RUB 1,363 bln over 2007. In addition to the government's unnecessary state borrowings, the CB also borrows money on the market. In the end, the inflow of foreign speculative capital onto the financial market winds up as the outflow of money from its investment segment. *In essence, the greater the influx of foreign investments, the less opportunity there is for the domestic financing of investments.*

With this type of policy in place, there was no chance of a robust banking system developing in Russia. Insofar as the Central Bank rigidly controls the money supply and neglects the creation of a proper system for the refinancing of commercial banks, the growth of the latter is tightly restricted by the overarching upper limit on money-supply growth established by the monetary authorities. In essence, the monetary authorities squeezed domestic banks out of the country's financial arena in order to free up space for their foreign competitors. As a result,

commercial banks were unable to satisfy the growing demand for credits. Their most prosperous clients, reaching the level of international competitiveness, began turning abroad for their borrowing needs. Thus, the modest transaction volume of the domestic banking sector shrank even farther. *All of which leads to the fourth policy paradox – the greater the currency receipts of the Russian economy, the fewer the opportunities for development of the domestic banking system.*

The reasons for all of these paradoxical follies can be found in the very technology for money-supply planning thrust upon us by the IMF – a technology that has remained unchanged since 1992, despite the horrendous damage caused by its application. In essence, the technology boils down to the annual planning of money-supply growth based on target benchmarks to control inflation, the GDP-growth mandate imposed from without, and assumptions about the constant velocity of money circulation. That said, neither the Central Bank nor the government have any viable models for calculation of the relationship between money-supply growth and the level of inflation. As used by monetary-authority analysts, the one-dimensional regressive relationships between the money-supply growth rate and inflation are burdened by a high degree of autocorrelation and lack substance. Reducing all factors responsible for the generation of inflation to money-supply growth is a gross and erroneous simplification¹ leading to a chronic under-monetization of the Russian economy that results in the artificial reduction of investment opportunities and the slowdown of economic growth.

Instead of fulfilling its duty to implement anti-monopoly, science-and-technology and investment policy, the Russian government has been waging a battle against inflation with monetary methods, withdrawing about one-fourth of all tax receipts from the economy and placing it with the Stabilization Fund. Other inflationary factors found no place within the virtual consciousness of our monetary authorities – they just didn't fit into their vulgarized version of monetary theory. The authorities have reduced it to the simple and direct relationship between money-supply growth and the inflation rate. Thus, unlike developed

¹ S.Y. Glazev; On the Practicality of the Quantity Monetary Theory or How Much Does Money Authority Dogmatism Cost. – Economics issues, No. 7, 2008

countries that manage to keep inflation low when running a deficit, we have had high inflation under even surplus budgets. And no sacrifices associated with the quantitative restriction of money-supply growth (curbing wage, investment and social-expenditure increases) help – the monopolists and criminals who control the markets under the condonation of a corrupt government continue to raise prices under any macroeconomic policy. Just the reverse – by reducing final demand, worsening terms for the financing of production, and dampening investment and innovational activity, this policy leads to the depression of the demand for goods and the acceleration of money circulation which, according to the same fundamental identity of monetary theory, results in higher inflation.

Thus, we arrive at the fifth paradox of the government's monetary policy – the more money the monetary authorities sterilize, the harder it becomes to suppress inflation.

The protracted decline in production and the crisis experienced by most sectors within the manufacturing industry, construction and agriculture are the direct result of the government's policy of the quantitative restriction of money supply. Only an insignificant fraction of all businesses have had and continue to have access to credits. The latter have been extended at high interest rates under the imposition of excessive security requirements, short-term periods, and unfavorable terms. The vast majority of enterprises have been forced to develop using their own resources alone – the share of bank credits in the investment financing of big and medium-sized businesses is no more than one-fifth. For small businesses, credit has been completely out of reach.

Suffice it to say that in Russia, the ratio of total banking-sector capital to GDP is five times lower than it is in other G8 countries. Its growth rate could have been much higher if the Central Bank and the government had created the conditions necessary for such an improvement. In fact, however, the sterilization operations conducted by the monetary authorities cause interest rates to rise and credit accessibility to fall. By maintaining the refinancing rate at a level significantly higher than the average rate of return across the production sphere, the Central Bank

has effectively blocked development of the entire banking system by limiting money demand to short-term speculative operations and high-profit sectors.

Within the structure of the financing sources available to Russian enterprises for capital investments, bank credits remain insignificant compared to their weight in developed countries, standing at just 8–10 percent. By comparison, the figure in the US is 40%, in the EU an average of 42–45%, and in Japan – 65%. According to estimates, 93% of Russian banks cannot issue a single credit in excess of USD 10 mln. Underdevelopment of the business-lending system and the utter lack of mechanisms for long-term financing of the production sphere have been the direct result of the restrictive policy of the financial authorities, who have failed to fulfill their main role in the market economy – the organization of credit.

Throughout the pre-crisis years, the Bank of Russia persisted in implementing the polar opposite of its rightful role in money-supply organization – rather than creating money, it busied itself with removing money from the economy. In essence, the Central Bank reduced its mission to supporting the exchange rate for the US dollar by buying it on the domestic market and funneling the acquired currency abroad to finance the US budget deficit. The government augmented the policy by sending about one-quarter of its total tax receipts the same way.

In the meantime, the very *raison d'être* of the Central Bank is its implementation of the state monopoly on the organization of money circulation and monetary emissions to ensure favorable conditions for economic development. Aside from a stable currency, these conditions include accessible credit, mechanisms for the accumulation of savings and their transformation into long-term investments, technology for the stable refinancing of expanded reproduction, and ensuring the timely creation and development of new knowledge and technologies.

The shocking primitiveness of the policy pursued by the Russian monetary authorities, which reduces it to the buying and selling of foreign currency, is particularly dramatic against the backdrop of the monetary policy implemented by developed countries, which proceeds from the development interests of the respective national economies. The primary objectives of the US FRS are first and foremost to support the long-term growth of monetary aggregates with a view to potential for production increases, to maintain reasonable long-term interest rates, and to boost employment. As is well known, global economic growth in the modern age began with the Industrial Revolution in Europe, which became possible thanks to the organization of cheap, long-term lending by the state, which created the mechanism for the emission of national currency. The economic miracle of the swift recovery of post-WWII Western European countries became possible thanks to the mechanism for the refinancing of commercial banks under promissory notes by industrial enterprises, which were then recalculated by the central banks of the countries involved. Japan was able to achieve its rapid, systematic growth via the cheap financing resources created by the state's credit-and-financial system on the basis of its citizens' long-term savings. The economic growth currently experienced by China is being fed by the emission of credit resources extended at low interest rates for the purposes of modernizing manufacturing enterprises as well as via state banks.

Unfortunately, all of this vast experience with the successful crediting of economic growth has been disregarded by Russia's monetary authorities. The chief result of their policy has been a money-supply deficit, leading to increasing interest rates, the emission of cash equivalents, the "dollarization" of the economy, and, in the end, to higher transaction costs, lower competitiveness by domestic goods-producers, and the degradation and reduction of production.

Unlike developed countries, which make active use of the state monopoly on monetary emissions to credit economic growth and finance government spending, the monetary authorities in Russia refuse to do either for the country, resolving to print money for the acquisition of foreign currency instead. Gaining from this

policy are exporters, who exploit the low ruble rate to reap excess profits on the export of cheap natural resources, foreign investors, who buy-up Russian assets at bargain-basement prices, and the US and EU financial systems, which attract Russian currency reserves to credit their growing deficits practically free of charge.

Instead of suppressing inflation with a tough anti-monopoly policy or promoting fair competition, the government has opted to restrict the growth of money in the economy, thereby dampening final demand and limiting opportunities for production growth. As a result, depression was reinforced and sectors oriented towards the domestic market went into decline, tens of millions were robbed of the opportunity to increase their incomes, and mass poverty became a chronic problem. Only highly-monopolized industries engaged in the production of vital goods and services and export-oriented enterprises have managed to flourish. The first, insofar as – thanks to systematic price increases – consumers have been sufficient to generate constant refinancing. The second, thanks to the stable influx of currency and attraction of foreign credits. All these years, the rest of the production sphere, geared towards the domestic market, has been suffocating from the chronic lack of floating capital, deprived of the ability to refinance operations independently due to the low rate of return.

Due to the artificial tying of the ruble to the dollar and money supply to the growth in currency reserves, as well as the tight quantitative restriction of money-supply growth to abstractly-set parameters, all sectors not oriented towards exports have effectively been washed up on the “financial sandbar”. They have been deprived of long-term borrowing opportunities and suffered from a lack of mechanisms to refinance production operations.

As a result of the monetarist monetary policy pursued over the past decade and a half, we have lost a significant portion of our production and investment potential, capital exports have exceeded half a trillion US dollars, and the country’s overall economic structure has degraded, reinforcing the dominant position of raw-materials-based and highly-monopolized sectors. Today, our GDP could be doubled, our total investment volume could be trebled, and our economic structure

could be much more progressive, if the policy pursued by the Central Bank had adhered to its main objective – utilizing the state monopoly over the money supply to finance economic growth.

The main reason for the low innovational activity of Russian organizations has been, and continues to be, the acute lack of financing sources. This is evidenced by surveys in which more than 2/3 of all respondents cited this issue as the main problem they face. Following the abrupt dismantling of the centralized-planning system that used to support the R&D required for economic development, market institutions capable of providing adequate R&D financing have thus far failed to materialize.

That said, the state has abdicated its responsibility to step in and compensate for the lack of such market institutions, proving itself incapable of conducting a pro-active policy of innovational support. The current level of state support for science, education and the stimulation of socio-economic development has dipped below the average rate across Africa.

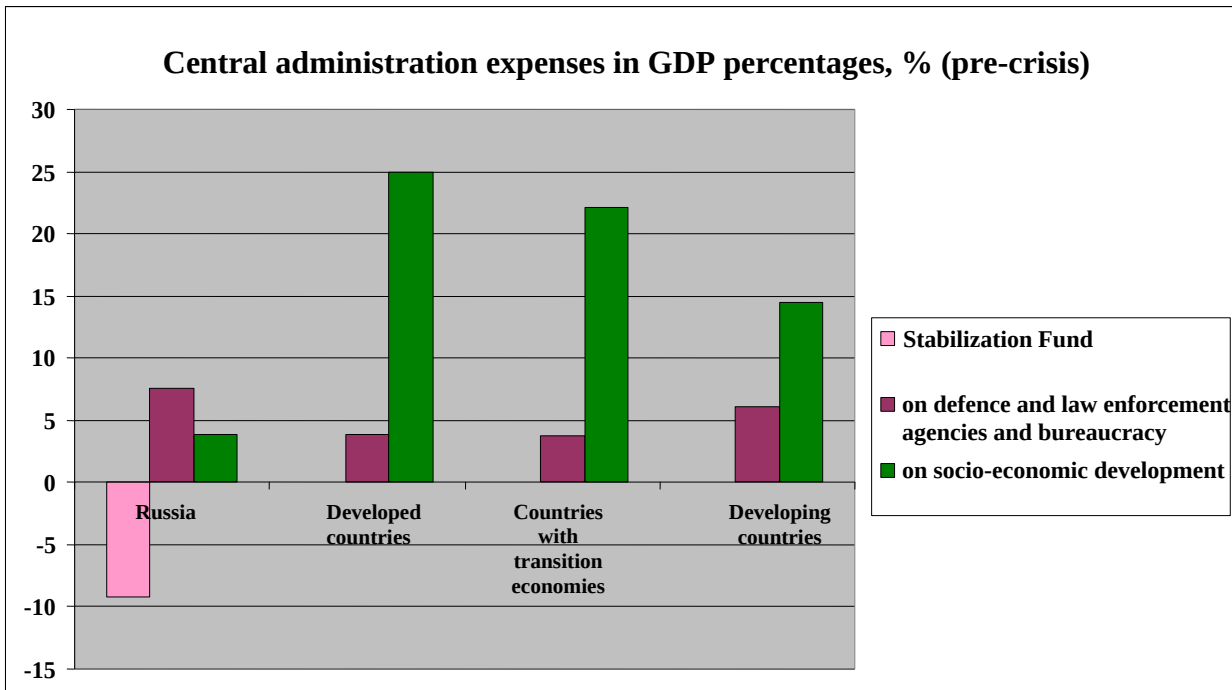
Analysis of the division of state functions conducted by S.M. Rogov² into traditional (defense, law and order, public administration) and modern (development of intellectual-human potential – expenditures on education, healthcare, science and economic development) clearly indicates that throughout the world today, state-budgetary expenditures on modern functions average 17.8% of GDP, with expenditures on traditional functions accounting for just 5.3% of GDP. The ratio between these expense items is 3.4:1. In developed countries, these indicators stand at 25.0% and 3.9%, respectively (at a ratio of 6.4:1), in countries with transition economies – at 22.1 % and 3.8% (at a ratio of 5.8:1).

Up until the beginning of the financial crisis – and in contrast to the emerging global pattern of increased government spending on modern state functions – the majority of government spending in Russia continued to go to the fulfillment of traditional functions. Federal-budget expenditures on such items exceeded 7% of GDP, exceeding the worldwide average by almost 25%. That said,

² S.M. Rogov; Functions of the Modern State: Challenges for Russia: Scientific Paper; M.: RAS USA and Canada Institute, 2005

our government has spent three-times less on modern functions (4.7% of GDP). That is, our expenditure breakdown into traditional and modern functions has stood at 2:1 – more reminiscent of a 19th century state (Diagram 22a).

Diagram 22a



Source: RAS USA and Canada Institute

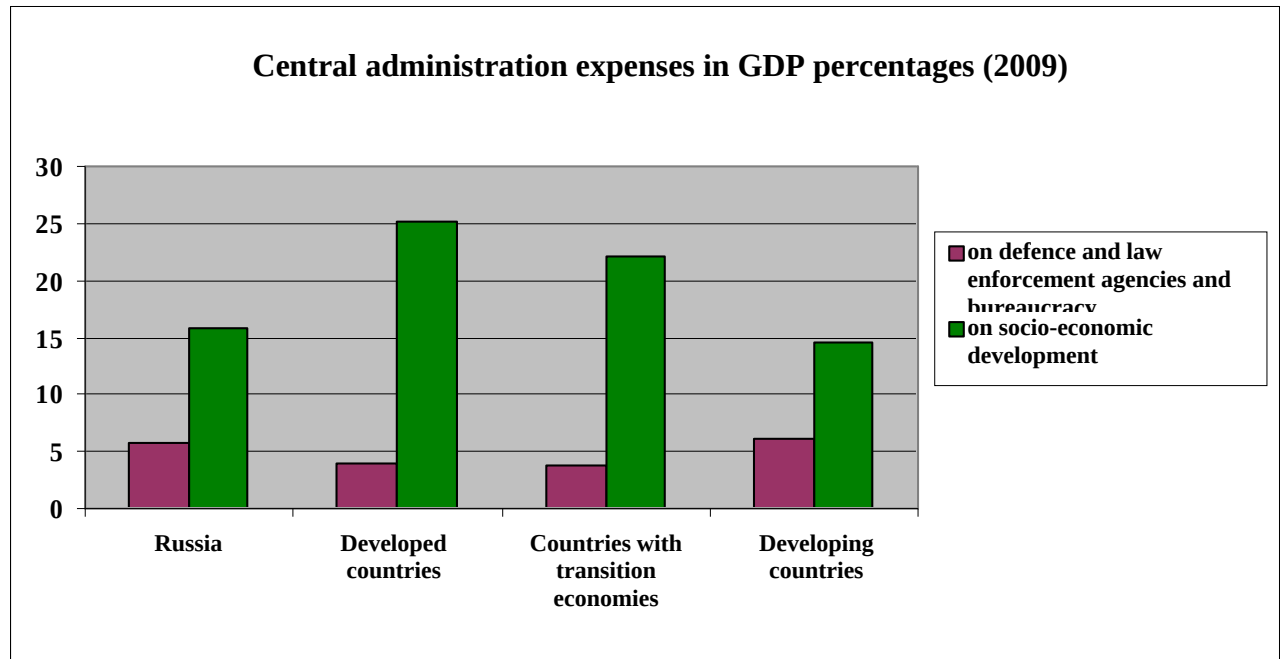
It follows from the above that throughout all of the “feast” years when the petrodollars were pouring in, Russia’s level of state spending on socio-economic development was among the lowest in the world – insufficient to meet the needs of a social-welfare state, and inadequate for the development of human potential. In order to reach the average global level of social expenditures, the Russian government would have needed to increase them by about 5% of GDP. This amount corresponds to the federal-budget surplus experienced when the foreign-economic environment was more favorable. If the excess profit on the export of hydrocarbons had not been spirited out of the country by the government, the disproportion in the Russian budgetary system could have been easily rectified by bringing the structure of government spending into line with internationally-recognized standards and objectives of socio-economic development. This would have meant a doubling of education and healthcare spending, and a trebling of expenditures on science and STP stimulation. The rate of economic development

would have been almost twice as high, and the level of vulnerability of the Russian economy to the global crisis would have been much lower if the government had not frozen one-fifth of budget revenue in the Stabilization Fund set up overseas.

In light of the patterns of long-term economic development discussed above, the best way to use the petrodollars streaming into the Russian budgetary system at the beginning of this century would have been to stimulate the faster development of the key industries of the emerging technological mode. If the hundreds of billions of dollars sent to the Stabilization Fund had been invested in its development instead, the Russian economy would be successfully expanding today on the crest of the next long-wave of economic growth. It would have been the best investment to ensure stable and rapid development.

Today, the crisis has forced the abandonment of the dogmas of deficit-free budgets and quantitative restriction of the money supply. Following the abrupt contraction of budgetary revenues during the crisis, the Russian government not only attempted to preserve its previously-planned expenditures on socio-economic development – it increased them within the scope of anti-crisis measures. Following the example set by developed countries, Russia shifted to the deficit financing of state spending. The structure of federal-budget expenditures began approaching worldwide standards, reaching the average level maintained by developing countries (Diagram 22b).

Diagram 22b



Source: RAS USA and Canada Institute, RF Federal Law No. 204-FZ “On the Federal Budget for 2009 and the Scheduled Period of 2010 and 2011”

These changes have come as the result of shrinking revenues under steady and even growing social spending and the onset of new expenditures to help stabilize failing major corporations. They do not reflect any particular shift to a pro-active development policy. On the contrary – unlike advanced countries, which have increased funding for scientific research and innovational activity as a part of anti-crisis measures, Russia has seen cutbacks in such spending.

In order to overcome the economic crisis, rapid and large-scale business activity must be mobilized in the main areas of the emerging technological mode. In the absence of developed institutions for the financing of innovational activity, only the government is in a position to provide the required concentration of resources. The comparative analysis provided below of the processes involved in the spread of the key factor of the emerging technological mode throughout Russia and other countries across the globe demonstrates the need for the dramatic activation of the respective state support.

CHAPTER 6. DEVELOPMENT OF THE NEW TECHNOLOGICAL MODE IN THE GLOBAL AND RUSSIAN ECONOMY⁶⁵

6.1. Emergence of the new technological mode

Emergence of the new technological mode begins with the origination and application of its key factor. As was indicated above, nanotechnology serves as this factor in the new – sixth – technological mode emerging today. In recent years, there has been an avalanche of new research and publication activity in the field⁶⁶. According to the now-classic definition, if a new quality is yielded under the volumetric reduction of a substance by one, two or three dimensions to nanometer scale, or if such a quality arises from a compound thereof, such formations should be classified as nanomaterials and the technology of their obtainment and further manipulation as nanotechnologies⁶⁷.

Historically, the starting point for scientific research into nanotechnologies was a discovery by the Russian theoretical physicist Georgiy Antonovich Gamov, who, in 1928, solved the Schrödinger equation. His solution describes the possibility of surmounting of an energy barrier by a particle in cases where the energy of the particle is lower than the height of the barrier. Discovery of the phenomenon known as tunneling (quantum tunneling, the tunneling effect) allowed for the explanation of the many processes in atomic and nuclear physics that lie at the heart of a number of modern technologies, including nanotechnology. Developments in the electronics field led to the application of tunneling processes almost 30 years later, with the origination in the mid 1950s of the tunnel diodes discovered by L. Esaki, who went on to win the Nobel Prize in Physics.

⁶⁵ This chapter refers to several findings under research conducted by the author and his colleagues at the Moscow Engineering Physics Institute (MEPhI) under the FTP Program “Research and Development in Priority Growth Areas for Russia’s Science-and-Technology Complex for 2007 – 2012.” The results of this research have been published in the joint study “Nanotechnology as a Key Factor of the Economy’s New Technological Mode.”

⁶⁶ Detailed overview of publications on this topic is provided in the joint study “Nanotechnology as a Key Factor of the Economy’s New Technological Mode.”

⁶⁷ Z.I. Alferov, A.L. Aseev, S.V. Gaponov, P.S. Kopyev, V.I. Panov, E.A. Poltoratskiy, N.N. Sibeldin, R.A. Suris; Nanomaterials and Nanotechnologies // Microsystems. 2003. No. 8; pp. 3–13.
<http://www.microsystems.ru/files/publ/601.htm>

The baseline invention of the sixth technological mode should be viewed as the invention in 1981 of the scanning tunneling microscope (STM), which allowed for the 3D imaging of individual atoms on the surface of conductive materials. It was created at the IBM Research Center in Zurich by physicists Gerd Binnig and Heinrich Rohrer (Nobel Laureates in 1986 together with Ernst Ruska – inventor of the electron microscope)⁶⁸. In 1986, Gerd Binnig developed the atomic scanning-probe microscope (SPM), which finally made it possible to visualize and even manipulate the atoms of any materials (not just scanned ones). Using this type of microscope allows scientists to “pick up” atoms and drag them to the desired location, i.e. manipulate atoms and assemble fundamentally-new substances from them.

Playing another important role in the emerging development of nanotechnology was the discovery in 1985–1991 of fullerene molecules, comprised of 60 carbon atoms arranged in a spherical structure. In 1991, the Japanese professor Sumio Iijima working at NEC used fullerenes to create carbon tubes (or nanotubes) measuring 0.8 nm in diameter. Today, they are being used to produce materials 100-times stronger than steel.

In 1998, Cees Dekker, the Dutch professor at the Delft University of Technology, developed a transistor on the basis of nanotubes, using them as molecules. In order to reach the achievement, he became the first in the world to measure the electrical conductivity of such molecules. In 2002, he attached the carbon tube to DNA, yielding a single nanomechanism.

Since the mid-1990s, the development trajectory of nanotechnology has been in the growth phase – we are witnessing dramatic growth in the number of publications in the field, as well as the increased industrial application of nanotechnological methods. This has become possible thanks to the development of methods and tools of linear measurement and manipulation at the nanometric level, which have essentially paved the way for the development of nano- and cellular technologies. First and foremost, this refers to the invention of the

⁶⁸ S. Bobrovskiy; From the History of Nanotechnology.
<http://www.nanotechnology.org/populyarnoonanotehnologiyah/izistoriinanotehnologiy>

scanning-electron and atomic-force microscopes, as well as to the development of the metrological systems based on their use.

It would appear that this moment should be pegged as the starting point of the technological trajectory of the sixth technological mode. The baseline factors for its formation should include the development of diffractometers and spectrometers with the respective resolutional capabilities allowing for the measurement of the physical-and-chemical parameters and properties of nanoobjects. The use of this set of instruments has made it possible to discover new properties of the matter and create new materials with the engineering-designed properties arising from the atomic manipulation of substances at the nanolevel. Other baseline inventions whose wider application marks the trajectory of the lifecycle of the sixth technological mode include the decoding of plant, animal and human genes, the invention of the cloning and genetic-modification of living organisms, the discovery of stem cells and the development of cellular technologies in medicine.

Taken together, the aforementioned baseline innovations form clusters of complementary, technologically-interconnected process flows, the extent of whose development determines the reproduction system of the new technological mode, the key factor of which is nanotechnology.

6.2. Nanotechnology as the key factor of the new technological mode

This section investigates the main application fields of nanotechnologies and nanoproducts, grouped into seven primary areas: Nanoelectronics, Medicine and Pharmaceuticals, Genetically-Modified Products, Nanoengineered and Functional Materials, Machine-Building and Energy. A more detailed discussion of nanotechnology application is available in the aforementioned study “Nanotechnology as a Key Factor of the Economy’s New Technological Mode”.

6.2.1. Nanoelectronics and nanophotonics

As the growth trajectory of the new technological mode continues to form, competition between the various technical solutions and the businesses and research groups offering them becomes fierce – and countries begin to jockey for the lead position in terms of the formation of the core of the new technological mode. A prime example of this competitive struggle is the formation of new technological trajectories in the electronics industry. Competition in today's microprocessor industry forces manufacturers to increase processor speed, boost memory capacity, shrink equipment sizes and bring product prices down. Insofar as the key performance characteristics of electronic devices depend largely on the size of their electronic components, minimizing their size has become the main thrust of the technological trajectory of microelectronics development, encompassing all of the elements of the technical process flow – lithography tools, including excimer lasers, optical image-transfer systems, positioning, scanning, and wafer-photomask alignment systems. For more than forty years now, the general trend has been defined by Moore's Law, under which the density of the components of integrated electronic systems has doubled every year and a half (with the size of system elements halving at the same rate over the same period).

As a result, this size entered the nanosphere at the beginning of the 21st century (reaching 100 nm). The tipping point in the shift of this technological trajectory to the mature phase of the sixth technological mode should be regarded as the exploration of extreme ultraviolet (EUV) in the 13-nm range.

The technological associativity between existing enterprises serves to synchronize complementary and mutually-supportive innovations. The launch of a small batch of supercomputer microcircuits, for example, paves the way for the development of computing equipment for automated systems involved in the engineering-design of aircraft and maritime vessels. This, in turn, creates opportunities for the development of more sophisticated apparatus and, consequently, increased demand for microsystems. This type of feedback with a

pronounced and positive effect forms the growth trajectory of the new technological mode. Technological renewal is accompanied by rapid improvements in performance indicators, intensified production, and the simultaneous heightening of its capital intensity.

The dynamic of the development and dissemination of nanotechnologies in the electronics industry clearly illustrates the logic behind the formation of the technological trajectory of the core of the new technological mode. During the early phase of its lifecycle, when the sphere of nanotechnology application is extremely limited and the respective technological base is still forming, the investment costs involved in the development of production capacity remain low – as the technological trajectory evolves, however, both production and investment volumes increase rapidly, resulting in sharp productivity gains and the ability to finance further development. That said, leaders move quickly to reinforce their technological pre-eminence, and the price of admission for nanotechnology newcomers to the set technological trajectory becomes more expensive and economically risky.

As a rule, production under the new technological mode is less energy- and materials-intensive than under the previous mode by an entire order. A typical example of rapidly-increasing energy efficiency as the next technological mode emerges is the spread of light-emitting-diodes in light engineering. Light-emitting-diodes (LEDs) are semiconductors that operate on the basis of the physics phenomenon in which light is emitted as an electrical current passes between the contact points of two semiconductors. Unlike incandescent lights, light-emitting-diodes emit light through a relatively-narrow spectrum. They occupy a midway-point between lasers, whose light is monochromatic (rays at a strictly-determined wavelength), and the different types of lights that emit white light (combination of varied-spectrum rays). As sources of “colored” light, LEDs have long since surpassed color-filter incandescent bulbs. Light-emitting-diodes are widely used as miniature indicators in audio-video equipment and home electronics. Aside from their high light-output ratio, low energy consumption, and ability to produce light

of any color, light-emitting-diodes offer a whole host of other marvelous properties. Their lack of a filament thanks to their non-thermal light-producing properties means that LEDs have a remarkably-high service life. Light-emitting-diode manufacturers claim that their useful life extends to 100,000 hours, or 11 years of continuous operation. The fact that they lack a glass bulb lends them a high degree of functional durability and reliability. LEDs give off little heat and feature a low supply voltage, guaranteeing a superior level of operational safety. Moreover, their laglessness makes light-emitting-diodes irreplaceable when high-speed performance is required (as in the case with stoplights, for example).

Light-emitting-diodes are finding ever-wider application: traffic lights and “active” road signs, automobiles, backlighting for mobile phones, illuminated advertisements, full-color light-emitting-diode displays, architecture and many other fields. LED dynamic-color systems, easily programmable by remote control or personal computer, are being used in architecture and landscape lighting. Looking to the future, LED lighting is evolving into the creation of colored-light environments with fully-regulated spatial, brightness and color parameters.

Light-emitting-diodes are increasingly squeezing incandescent lamps out of the marketplace – over the next few years, developed countries are planning to phase out incandescent lamps entirely, replacing them with energy-saving light-emitting-diodes. New energy-conservation standards for residential buildings are geared towards this objective, as well.

At the beginning of their lifecycle, light-emitting diodes trailed traditional light sources in terms of their efficiency indicators. Light-output ratio, expressed in terms of lumens per watt (lm/W), characterizes the efficiency of the conversion of electrical energy into light. Today, the technological trajectory of LED-development far outpaces that of other light sources in terms of the efficiency with which electricity is converted into light (Diagram 23).

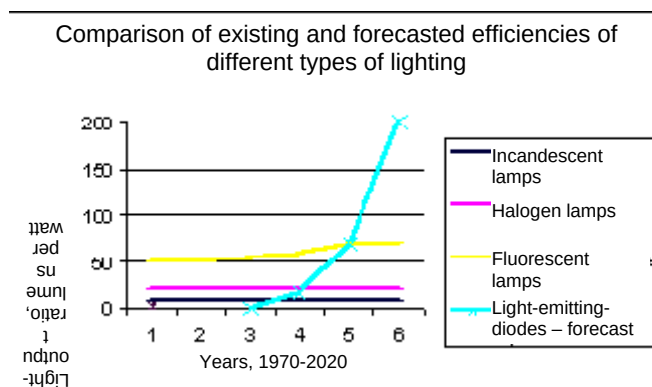
Diagram 23

Outpacing dynamic of LED-light power

[light emitting diodes (LEDs) – new technology on the lighting market.

<http://www.leds.ru/anl11.htm>]

(decades charted along the horizontal axis, beginning with the 1970s)



Over the past eight years, at growth rates exceeding 30% per annum, the global LED market has exploded, reaching USD 3-4 billion in 2007. It is anticipated that the worldwide market for light-emitting-diodes will reach USD 5.4 billion by 2013, USD 5.9 billion by 2015. According to reports published by [Strategies Unlimited](#), which conducts research in the LED market, the technology is expected to experience stable growth over the next five years – regardless of how the global economic crisis continues to unfold.

The main producers of light-emitting-diodes and related devices are companies based in Japan and the US. LED manufacturing is growing at a brisk pace in the countries of Southeast Asia – principally Taiwan, South Korea and China. The Russian LED market comprises approximately 100 million units per year, with more than half of that total volume purchased abroad. Russia is one of the few countries in the world that possess the technology to produce ultra-bright LEDs, manufactured specifically for home use. In the event of the mass-conversion to LED bulbs in all types of lighting fixtures, the global market for LED lighting products could exceed USD 60 bln annually by 2012. The Russian market alone could reach RUB 70 bln by 2012, on which domestic nanoindustry products should play a defining role.

Emerging as the fastest-growing segment of the semiconductor industry is the microelectromechanical-system (MEMS)⁶⁹ market. Over the next five years, annual growth in the sector is expected to average 15%. By 2012, the MEMS-system market is poised to exceed USD 66 billion – a full 15% of the entire semiconductor market.

Until recently, the main driver of the MEMS market has been automotive electronics. Some of the first MEMS technologies to achieve widespread application were acceleration sensors, now installed in virtually all newly-manufactured passenger vehicles to detect imminent collisions and deploy airbags. There have been a number of other highly-successful MEMS-products, such as microfluidic-printer caps, the pressure-sensors that are supplied to the medical and automotive industries by the hundreds of millions, or high-definition digital projectors. In recent years, great strides have been made in the manufacture of motors, pumps and other mechanical units of widely-ranging application, invisible to the naked eye. Demand for nanoelectromechanical systems is now spreading to the consumer sector. Their usage niches include remote controls, multimedia (smart) phones, and portable data-storage devices. MEMS-devices have now been incorporated to protect hard disks from damage in case of being dropped, and in laptops – to allow them to be switched off in case of theft. Optical-router MEMS devices are being developed for fiber optic telecommunications systems. Today, MEMS technology is the most cutting-edge and promising technology in the manufacture of UHF (microwave) devices [<http://www.chipinfo.ru>].

Developments in the telecommunications industry led to progress in microwave electronics based on the use of nanosized heterostructures, which support the creation of ultra high-speed devices, and which dominate in communications, radio-detection-and-location (radar), radiometric and navigation systems, installations used in the war on terror, and modern electronic-armament systems. Achievement of the minimal element (transistor gate) size of 30–50 nm

⁶⁹ V. Kononov; MEMS-Technology – Main Driver of the Sensors Market. http://www.3dnews.ru/news/mems_tehnologii_glavnii_lokomotiv_rinka_sensorov/; A. Borzenko, MEMS Technology. <http://www.bytemag.ru/articles/detail.php?ID=6756>

supported a qualitative leap forward – the creation of UHF (microwave) devices with a frequency range of over 1000 GHz, which could fairly be deemed the tipping point in the transition to the sixth technological mode.

The transition in microwave nanoelectronics from submicron-scale transistors to heterostructure nanotransistors led to a manifold improvement in performance speed, the shift from centimeter waves to waves in the millimeter and sub-millimeter range, and, consequently, to increases in the speed and volume of information transmitted using communications and radar systems.

The worldwide sales volume of heterostructure transistors and monolithic integrated circuits (MICs – chips) has been approaching USD 7–8 bln annually, growing by more than 30% every year⁷⁰. The broadest sphere of nanoheterostructure-technology application, by far, has been cellular communications. It accounts for approximately 57% of the entire “heterostructure” market – just about every mobile phone contains heterotransistors. About 23% of the market is occupied by rapidly-progressive high-speed fiber-optic communications, utilizing heterostructure MICs at frequencies of 60 GHz and up. Approximately 12% of the market belongs to so-called consumer electronics, dominated primarily by digital television (at frequencies of from 12 to 30–40 GHz). Moreover, the heterostructure-MIC market for automobile radar (collision-avoidance systems) and satellite communications systems is also growing rapidly. Nanostructure technology is rapidly squeezing out silicone technology wherever high operating frequencies are required, conquering a steadily-increasing share of the global telecommunications and radar market.

Thus far, Russia lacks a modern heterostructure-technology industry. The commercial market has yet to form, and the technology continues to be propelled by government defense contracts, as was the case in advanced countries in the 1980s.

One of the baseline inventions of the sixth technological mode has been the development of high-performance lasers that use nano-layered heterostructures. In Russia, the primary research in the field is being conducted at the RAS Ioffe

⁷⁰ Z.I. Alferov; Outlook for Electronics in Russia. Heterostructure- and Acoustoelectronics // Electronics. Science, Technology, Business; 2004, Issue 6

Physico-Technical Institute (PTI) (Saint Petersburg) and the Semiconductor Physics Institute (Novosibirsk). Nanotechnology use allows for the achievement of qualitative improvements and manufacturing efficiencies in the production of semiconductor lasers, light-emitting-diodes and the lighting systems based thereon.

Only the most technologically-advanced countries (US, Japan, Germany, France, South Korea, Taiwan) have at their disposal the comprehensive technological complexes necessary to produce a full range of such devices. The field of semiconductor-laser application is extremely wide-ranging, and includes optical devices for the recording, storage and reading of data, fiber-optic communications systems, and various types of sensors. Within the terahertz range, electromagnetic radiation is safe for people, which opens up a multitude of possibilities for the application of laser technologies in medicine.

Despite the obvious financing challenges, Russia has managed to preserve its scientific parity with developed countries in all of the main areas of laser-diode development. This position is reflected in its global achievements (including record-breaking successes) with devices manufactured in small lots or in the laboratory setting. The total Russian laser-diode market is valued at USD 8–12 mln per year with an average annual growth rate of 8–10%, which is in line with the worldwide trend.

The use of nanoparticles and nano-semiconductors has allowed for the development of ultra-shortwave lasers (nanolasers), which have in turn permitted a manifold increase in optical-disc density. Shortwave lasers with wavelengths of 5–50 nanometers could have tremendous applications in the emerging types of the optical microscopy and high-definition lithography required for the development of next-generation micro- and nanoelectronics. As they replace the red-light lasers used in today's CD-system recordings, nanolasers will offer increased recording density by more than a factor of one thousand.

Attempts have been made in recent years to use nanolasers as a springboard for the development of optical computers – computers that will eventually replace today's electronic computers. Optical computers, in turn, represent the first step towards the development of even more sophisticated quantum computers.

Many area specialists view molecular electronics as a real alternative to “silicone” electronics in the not-too-distant future. Over millions of years of evolution, Mother Nature has created highly-diverse molecules – molecules that carry out all of the functions necessary to the survival of complex organisms: sensory, logical-analytical, memory and motoring. They have the optimal configuration, structure and nanometric size. At present, the greatest density of electronically-addressable memory has been accomplished via the use of molecular structures [<http://www.osp.ru/cw>]. This achievement paves the way for the creation of complex microcircuits (chips) the size of a few molecules, whose further refinement will aid in the development of even smaller, faster and cheaper devices.

A promising area for electronics development – one capable of determining future progress in information and telecommunication technologies over the next 10-20 years – involves the shift from binary logic to neural-network methods of information processing in continuously-distributed molecular and biomolecular environments that use light beams as data-storage media. Bringing together achievements in nano and biomolecular technologies makes it possible to create fundamentally-new materials for the specialized hardware components of neurocomputers and intelligent robotic systems capable of automatic learning and successful functioning in the complex external environment.

6.1.2. Medicine and pharmaceuticals

An important element of the key factor of the sixth technological mode is nanobiotechnology, which unites achievements in the fields of physics, chemistry, biology and medicine. They serve as the basis for the creation of diagnostic systems, the development of micronized medications that target ailing organs, and the creation of biocompatible materials and coatings for use in medical implantation practice, reconstructive and plastic surgery. In development now is the commercial production of test-systems for the accelerated identification of the triggers for socially-significant viral and bacterial diseases, toxins and crop pests. Technology is being developed for the production of nanodiagnosticators based on encapsulated quantum dots and

metallic nanoparticles for the purposes of creating new fast and inexpensive analytical methods for decoding the sequence of nucleic acids and proteins for use in medicine, agriculture and national security. The last few years have seen rapid growth in the sale of medications developed with the aid of genetic-engineering technology.

Genetic-engineering technology allows for the synthesis of medications with previously-known properties – unlike the traditional pharmaceutical approach, in which the development of new drugs entails studying the properties of tens of thousands of different chemical agents. Thanks to new approaches to the development of medications, revolutionary breakthroughs have been made in recent years in the treatment of such diseases as cancer, multiple sclerosis, rheumatoid arthritis, diabetes, HIV and others.

New transportation nanosystems (containers) have been developed for the delivery of medicine to targeted organs. These developments have allowed for improvements in the solubility, bioavailability and therapeutic range of drugs – as well as for reductions in dosage levels and side-effects, thereby significantly lowering the body's pharmaceutical load. These technologies have found broad application in cosmetology, insofar as the liposomal cosmetic preparations formulated in this manner have tremendous transdermal-penetration properties.

The application of nanotechnologies allows for the achievement of qualitative improvements in the effectiveness of many fields of medical practice. In particular, they allow for the creation of materials with heightened biocompatibility with the blood, living tissue and physiological (saline) solution of the human body. The need for high-quality implants for cardiovascular surgical procedures alone numbers 3–4 mln units annually. The formulation of biocompatible interfaces between the material of a medical implant and the living components of the human body (blood, blood plasma, saline solution, lymph, etc.) requires the creation of a morphological implant structure featuring active surface-elements of a size compatible with that of the structure of such living components, i.e. within the nano range.

Combining nanotechnology and achievements in the field of genetic engineering opens revolutionary new horizons for tissue regeneration. The creation of

bioartificial organs and tissues features the use of cell matrices (carriers) based on nanoparticles. One promising area involves stem cell research. Stem cells are protocells that develop in specialized cells within the body as the respective tissue experiences the need to grow and regenerate. Scientists once believed that the sole source of stem cells was embryonic tissue and the bone marrow of adults. An endless supply of stem cells was subsequently discovered in the adipose tissue of humans, thereby removing the ethical and medical barriers to their broader application.

It is expected that the use of achievements in the field of genetic engineering will allow for marked improvements in the effectiveness of healthcare and the pharmaceutical industry. Over the next five years, the main thrusts of nanobioindustry research will be determined by the development of micro- and nanofluids for precision dosing, technologies for creating biochemical reactions in micro- and nanovolumes, and the technology for signal pick-up and subsequent signal conversion to the nucleic-acid sequence. According to the International Association of Nanotechnology, the mass use of nanotechnologies in medicine is poised to commence in 2011-2015.

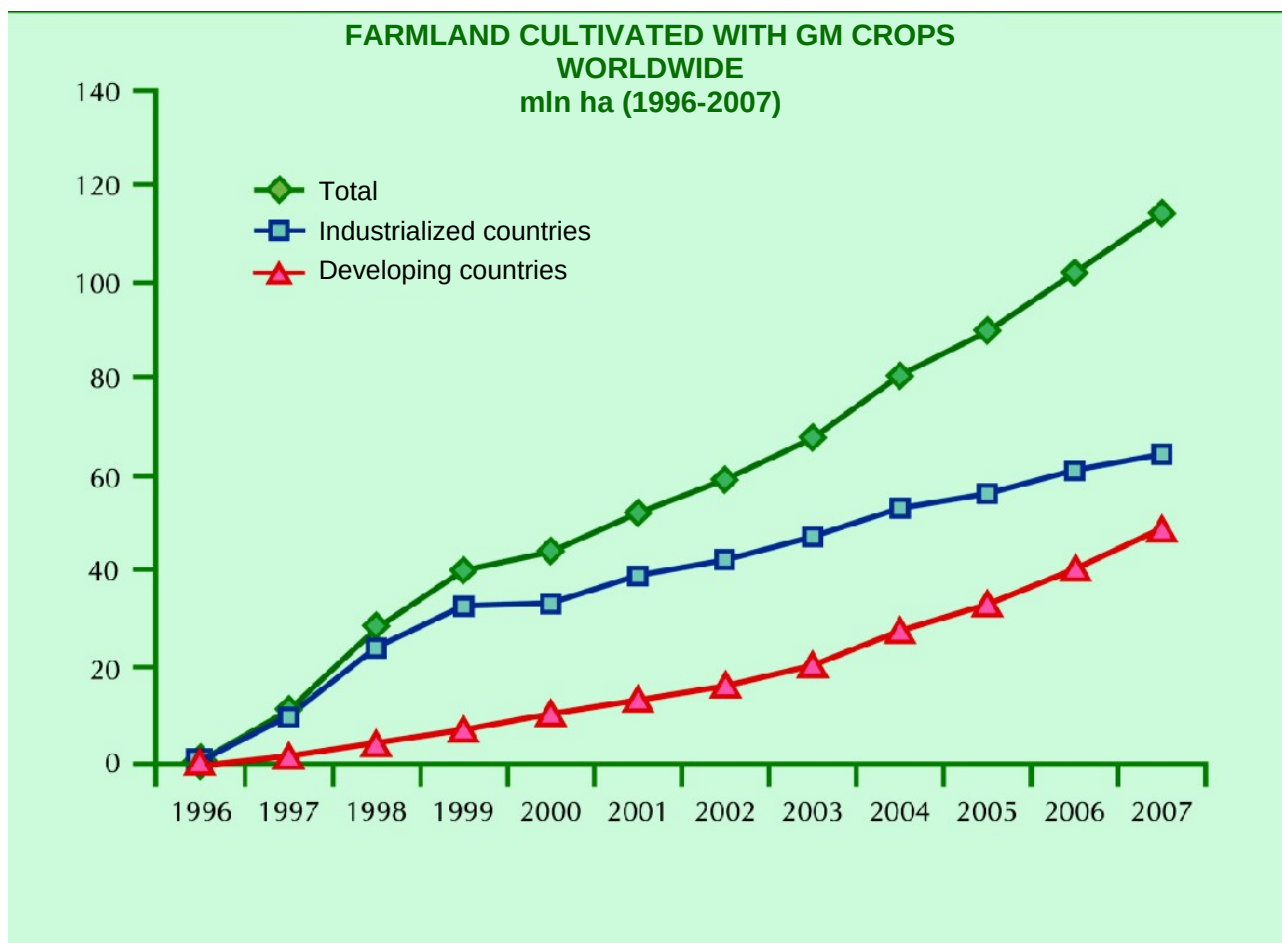
6.1.3. Genetically-modified products

Another field experiencing the rapid spread of nanotechnologies has been agriculture, which features the broad use of genetically-modified organisms created via genetic engineering on the basis of achievements in modern molecular biology. Falling under the genetically-modified (GM) definition are organisms with genome alterations incapable of being achieved by the traditional methods of selection and recombination. At present, the most common GMOs are transgenic plants, whose genomes are infused with alien genes in order to give them new properties. A potato has been developed, for example, with a soil bacterium gene that makes it resistant to the Colorado potato beetle.

The first genetically-modified (GM) agricultural crop was the “Flavr Savr” rot-resistant tomato. Since 1996, when GM crops were first commercialized, they have

been introduced in many countries, and by 2007 occupied more than 114 mln ha of farmland (Diagram 24). The greatest GM crop area is found in the US (about 50% of the global total), as well as in Argentina, Brazil, Canada and Paraguay (approximately 90% of the total farmland in these countries is occupied by GM crops).

Diagram 24. Farmland (mln ha) cultivated with genetically-modified crops worldwide



Formation of the technological trajectories for the spread of the new technological mode in crop production has entered the steady-growth phase. The market has selected the most competitive genetically-engineered plants, whose cultivation is fast approaching maximum economic effect. While the number of patented GM cultures is constantly growing (comprising approximately three dozen sorts), the vast majority of GM crops involve soy, cotton, corn and canola (oilseed rape).

The market breakdown between major GM companies is winding down. By monopolizing use of the GM cultures they develop, they capture the market for the

respective seeds – and this aggression is by no means restricted to GM cultures alone. At present, the ten biggest companies control 57% of the market, including the American company Monsanto, which holds rights to 86% of all GM plants.

The formation of an oligopolistic crop-production market is achieved through the patenting by companies of GM cultures as a form of intellectual property. As a rule, the agricultural producers concluding seed-supply contracts with them are not entitled to keep the yielded crop seeds for future use. As a result, farming enterprises lose control over reproduction conditions, insofar as they are forced to purchase new seeds every year. That said, they undertake to refrain from sending the seeds on for further testing of any kind, thereby rendering competition in the development of new products impossible and complicating product quality and safety control.

The monopolization of seed production opens opportunities to establish control over the agrichemical market as well. GM companies produce seeds for GM plants that are resistant to certain types of herbicides, giving them a clear competitive advantage in the sale of such herbicides. Monopolization of the global GM-seed market is fraught with negative consequences, including rising seed prices, falling seed variety, and worsening environmental pollution by pesticides and herbicides.

Russia possesses one of the three seed banks of global significance, allowing it to develop its own self-sufficient industry for the reproduction of genetically-modified plants. While the country has the scientific potential necessary to achieve this objective, it has thus far gone unrealized due to the excessively conservative stance taken by the regulatory authorities in terms of their opposition to the practical application of GM plants. As a result, the technological lag suffered by the domestic crop-production industry is growing, and the country's food economy is being undermined – an economy increasingly geared towards imports, a growing percentage of which is comprised of GM products.

6.1.4. Nanoengineered and functional materials

The use of nanocomposites leads to the creation of new types of materials that combine high durability with superior plasticity. The heightened performance characteristics of nanocomposite materials are predicated on the formation through sintering of the specific and constant filamentary structures that result from 3D contacts between nanoparticles at various phases. Improvements in the corrosion resistance of nanostructured coatings are achieved by lowering the specific concentration of imperfections within the surface grain by reducing the overall size thereof.

Among the most promising and widely-studied nanomaterials with a broad scope of application are fullerenes and carbon nanotubes. They form a new class of carbon nanomaterials or carbonaceous structures with properties quite distinct from other forms of carbon such as graphite and diamond.

Carbon nanotubes are finding industrial application in the storage of electrical power (hydrogen fuel cells), high-capacity condensing units, devices with elevated electronic emissions (displays, electron microscopy, scanning-probe microscopy (SPM), etc.), the production of fillers for the chafing plates used in aircraft and automobile engines, and fillers for various 3D nanocomposites (from carbon fiber-reinforced plastics (CFRP) to multicomponent ceramics). It is expected that such 3D materials will be used in the automotive industry and aviation, as well as in the capacity of special-purpose construction materials. Nanotube-based materials and coatings are currently being developed to reduce friction in electromechanical devices. Today, the main areas of application for carbon nanotubes are sporting goods, electronics and automaking. Carbon nanotechnologies can be used in radio-electronics to absorb microwave radiation and create new materials with controllable electromagnetic and even superconductive properties. Nanotubes can also serve as an element of compact integrated circuits (chips).

One promising research area involves the use of nanoceramics with enhanced properties: high strength and durability, lightness, flexibility, heightened electrical resistance and reduced thermal conductivity.

Over the past 2–3 years, the retail market for imported and domestic anti-friction products (reducing wear and restoring sliding surfaces) has posted stable 50% growth, which will continue for the foreseeable future. Market capacity totals RUB 750–900 mln annually.

Back in the 1960s-70s, researchers in many countries were already studying the new effects clearly manifested under the micronization of materials. When the particles of micronized substances reach nano size, fundamental changes are observed in their physicochemical properties (amorphization, chemical reactivity, elevated solubility, and the sudden solubility of previously-insoluble compounds, etc.).

The commercial production of most types of nanopowders (metal oxides and metal-particle powders) commenced about ten years ago. Until that point, only silica, alumina and iron oxide had been produced in industrial quantities. Only scientific-research institutes and universities were producing small lots of many of the nanopowders known today for use in nanoresearch. Despite the wide assortment of nanopowders available today, only a select number of them are produced on a commercial scale and subject to competitive price formation.

Many field-specific publications are studying the use of nanopowders in heightening material strength and durability, lending conductivity properties to dielectrics, optimizing combustion, catalysts and reagents, reducing friction, magnetic materials, protective coatings, optics, abrasive materials, radio technology, filters, galvanoplastics, electronics, pyrotechnics, cosmetics, tinted glass, medicine and forensics, etc. As yet, few nanopowder producers (let alone their potential consumers) have a clear idea of the full range of their possible use.

Industrial sectors such as electronics, optics and manufacturing currently consume more than 70% of global powder output. Medicine and the cosmetic industry consume about 7% of all nanopowders, although their use in these fields is expected to drive the bulk of nanotechnology research over the next 10–15 years.

At present, the database of nanosubstances produced worldwide contains information on more than 1400 substances, broken down into 22 application fields.

The evolution of work in the nanomaterials field and measurement devices at the nano level is capable of revolutionizing development of the machine-building complex. One of the main objectives in machine-building is the creation of a new machine-tool equipment fleet capable of fabricating parts with nano precision. Such machine tools are needed in rocket and aircraft engineering, the space industry, and the manufacture of optical details of varying purpose. The measurement devices and precision positioning developed in nanotechnology make it possible to exercise adaptive control over cutting tools on the basis of optical measurements of the detail's work surface and the tool face during the course of the process flow.

6.1.5. Energy

The emergence of the new technological mode and ongoing development of nanotechnologies is laying the groundwork for revolutionary change in many energy fields. The most promising area is solar power. The energy of the solar radiation reaching Earth is thousands of times greater than industry's total energy needs. The main obstacle to the further development of solar power on the basis of semiconductor converters is their high cost. Today, solar batteries represent the main source of electrical power on spacecraft. In order to make the mass use of solar power feasible on Earth, its cost must be brought down to 0.08–0.09 USD/kWh (while it currently stands at more than 0.2 USD /kWh).

The application of nanomaterials and nanotechnology is making it possible to achieve a manifold increase in solar-power efficiency based on the use of nanostructured photovoltaic cells (PVC). The cascade solar cells developed in recent years are driving improvements in KPI values (in space – up to 33%, in silicon KPI elements – 15%) and increased solar-battery specific power-discharge up to 300 W/m² (at a solar flux of approximately 1400 W/m²), as well as improvements to radiation resistance.

The KPI of the “Earthly” cascade solar cells created at the Ioffe PTI and other research centers is approaching 40% at concentrated exposures. PTI has

developed high-performance concentrators – Fresnel lenses made of a “silicone glass” composition characterized by its superior resistance to UV exposure and impressive thermal and mechanical properties. The use of such concentrated solar batteries allows for more than a two-fold reduction in the cost of the electrical power thusly-received, with more than a three-fold increase in specific power-discharge. Given the 25-year service life of such photovoltaic cells, the cost of solar power is poised to level-off at 0.07–0.08 USD/kWh, which is comparable to the cost of a kWh generated at atomic power plants (under 0.1 USD/kWh).

The worldwide production volume (based principally in the US) of heterostructure space batteries exceeds 1000 m²/year. In Russia, the production of heterostructure batteries has been wound-down due to the country's lack of modern technological infrastructure and the financing required to develop promising types.

No less important is the goal of using organic nanomaterials to develop cheap and effective solar-radiation converters in the form of thin flexible panels covering building walls, roofs, etc. The cheapness of the materials and technology involved has the potential to make solar power cost-efficient at a solar-power conversion rate as low as 5–7%.

The solar-power market has been developing at a brisk pace in recent years. According to Lux Research (USA), total market volume in 2008 reached USD 33 bln, or approximately 5 GW. Since 2001, the market has experienced more than an eleven-fold increase in monetary terms. In 2008, the microfilm silicone solar-module market was assessed at 0.6 GW – by 2012, this figure will increase to 2.4 GW, or from USD 3.8 bln to 8.6 bln.

Nanostructured materials can be used to increase electrode capacity, ionic conductivity and long-term electrolyte stability, as well as to improve the performance of electrochemical-reaction catalysts on electrodes. Nanostructured foil, for example, could significantly improve the performance characteristics of electric capacitors. Aside from improving the performance characteristics of existing aluminum electrolytic capacitors with liquid electrolyte, nanostructured anode foil can be used in the promising hard-aluminum capacitors, whose

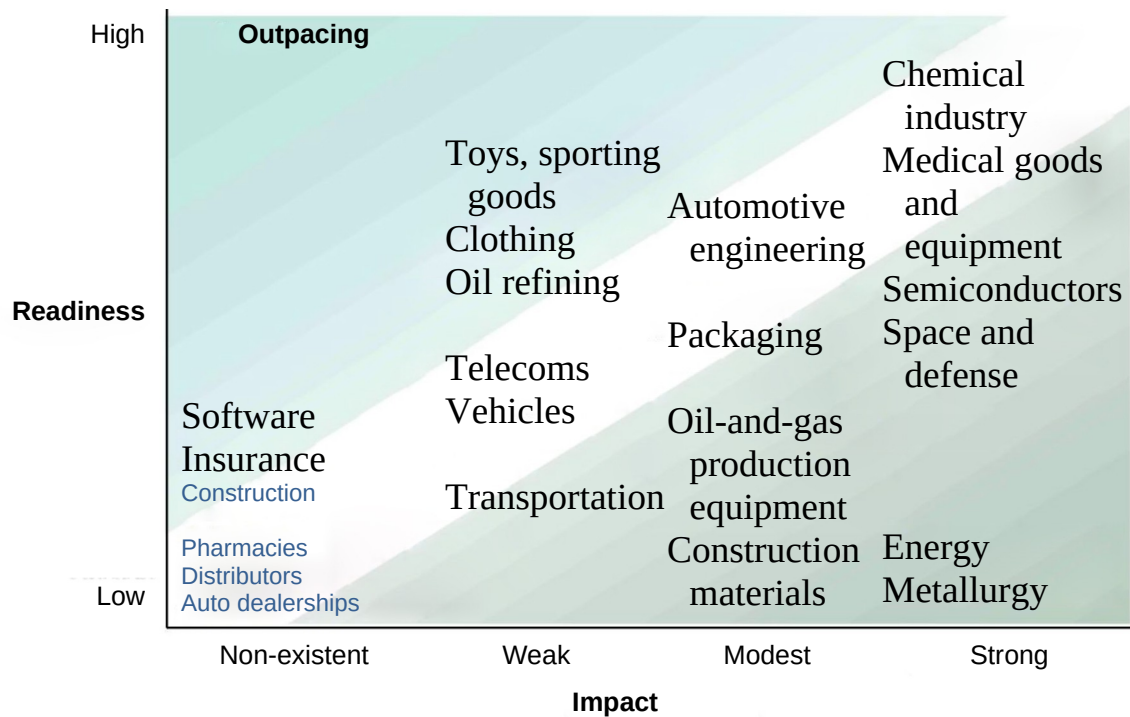
production in recent years has emerged as one of the core operational areas of the majority of the world's leading radioelectronic-component manufacturers.

One of the first sectors to embrace the use of nanotechnologies has been the atomic industry. In Russia, the application of nanotechnologies and nanomaterials in nuclear power began back in the 1950s. Nanosized metallic powders were first synthesized in the development of diffusion technologies for isotopic uranium enrichment and the various process flows of the nuclear fuel cycle. Use of the new class of radiation-proof steel, reinforced with nanosized yttrium-oxide particles, has yielded a marked (up to eight-fold) increase in heat-resistance compared to conventional steel. Today, Rosatom enterprises are developing engineered nanomaterials for nuclear power units, nanomaterials and nanotechnologies for the nuclear fuel cycle, nano-superconductors and nanoelectronics, ultra-dispersed (nano) materials and nanotechnologies, nanomembranes and nanosorbents.

It follows from the overview presented above that at present, the impact of nanotechnologies on various sectors of the national economy – and sector readiness to embrace nanotechnologies – is extremely uneven (Diagram 25).

Diagram 25. Impact level of nanotechnologies (high-medium-low-non-existent) on various sectors of the national economy (top) and sector readiness to use nanotechnologies and related products

| Impact | Sector |
|--------------|--|
| High | aerospace and defense, chemicals, electronics, semiconductors, power industry, medical products and equipment, metallurgy, pharmaceuticals |
| Medium | textiles, foodstuffs/beverages/tobacco products, construction materials, foodstuffs, industrial and agricultural equipment, automobile manufacturing |
| Low | air transport, auto sales, construction, forestry, furniture manufacturing, mining, sporting goods, waste treatment and recycling, insurance |
| Non-existent | advertising, marketing, banking, computing, software, restaurant business, publishing industry, real estate |



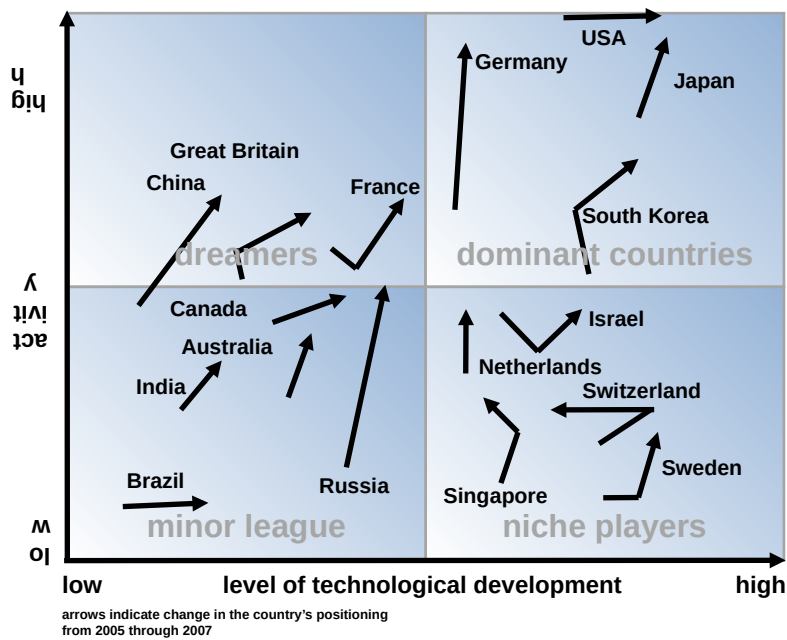
As illustrated by Diagram 25, certain economic sectors such as metallurgy and pharmaceuticals, etc. are lagging behind in the implementation of nanotechnologies, while others are ahead of the curve in terms of nanotechnology achievements (high readiness level, though nanotechnology impact remains under-investigated or ineffective). Such unevenness in the dissemination dynamic of the key factor is typical of the early development phases of an emerging technological

mode. As the various elements of its technologically-interconnected industrial complexes begin to form and the integrated contours of its expanded reproduction system begin to take shape, the spread of nanotechnologies will become more widespread and all-pervasive.

CHAPTER 7. MEASURING THE SPREAD OF NANOTECHNOLOGIES IN RUSSIA AND THE WORLD'S MOST ADVANCED COUNTRIES

Measuring the spread of nanotechnologies at the early phase of development of the new technological mode is extremely difficult given the relatively small scale involved and the lack of systematically-collected statistical data. It is only following restructuring of the economy and the substitution of the old technological mode by the new one that the constituent operating sets of the latter begin to experience brisk growth and gain reflection in government statistics, at which time their expansion indicators become key benchmarks for the management of economic development.

The world leaders in the spread of nanotechnologies are the USA, Japan, Germany and South Korea (Diagram 26). The next group of countries with high levels of nanotechnology development but low levels of government involvement include Israel, Singapore, the Netherlands, Switzerland and Sweden. The next group of “dreamer” countries is comprised of France, Great Britain and China, where “NT-activity” levels exceed actual nanotechnology-development levels. Russia has been relegated to the intermediate zone between all four quadrants.

Diagram 26. Country distribution on the nanotechnology market (source – www.luxresearchinc.com)

At the same time, the weight of nanoproducts in the gross output of all countries remains extremely small, accounting for no more than 0.1% of global GDP¹. Of course, the overall economic impact of nanotechnologies is much greater, and should be factored in to reflect the wider scope of application of such products. The process of their dissemination, just as the process for development of the new technological mode, is just now transitioning from the embryonic to the growth phase, which is characterized by exponential growth. The next few years are expected to witness the rapid spread of nanotechnologies as the key factor of the new technological mode in widely-diverging spheres of economic activity. According to Lux Research (2004), the share of nanoindustry products will account for 4% of total industrial output in 2014; that said, nanotechnologies will be featured in the manufacturing of 100% of computers, 85% of home electronics, 23% of pharmaceuticals and 21% of automobiles.

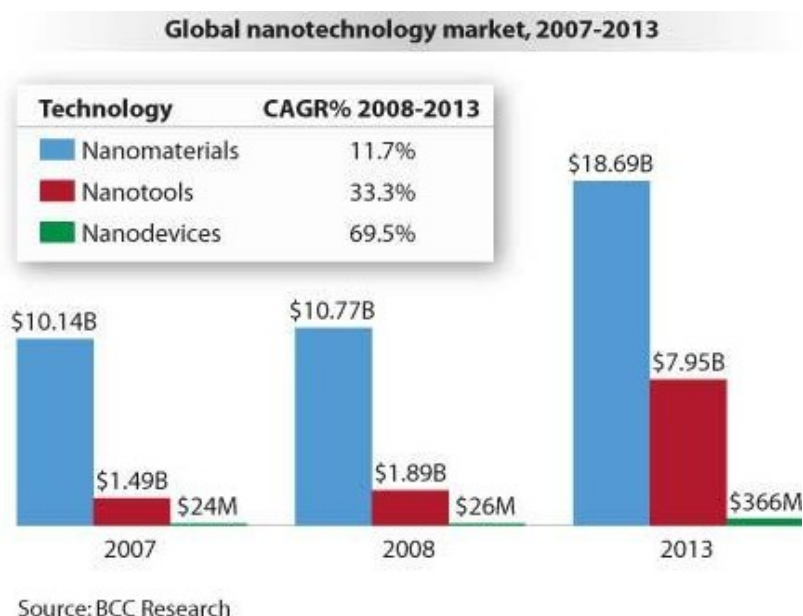
Diagram 27 illustrates the manufacturing volumes of different types of nanoproducts for the foreseeable future. The largest segment of the broader nanotechnology market is the nanomaterials market. A forecast compiled by Global Industry Analysts, Inc. assesses the global nanomaterials market at USD 10 bln by 2012. The other “billion-dollar” segment of the nanomaterials market involves carbon nanotubes, whose growth is expected to reach about 10% per annum by 2015.

¹ Lux Research.

Diagram 27

Volume of the global nanomaterials, nanotools and nanodevices market (USD bln)
over the short-term.

Here, CAGR (Compound Annual Growth Rate) is calculated according to the formula $CAGR = (W_T/W_0)^{1/T} - 1$,
where W_T – final position, W_0 – initial position, T – number of years



Source: Global Market for Nanotechnology Slated for High Growth through 2013. Nanotechnology: A Realistic Market Assessment. (www.bccresearch.com/report). www.smalltimes.com/articles

Global nanopowder production is distributed unevenly. Today, only the most industrially-developed countries have begun to produce nanomaterials in commercial quantities, approximately one-half of which are manufactured in the US.

According to available data, the global nanotech market stood at almost USD 12 bln in 2007.¹ Moving forward, the market is expected to continue expanding at an average annual rate of 16%.

The briskest growth rates are being posted by the varied nanodevice (nanomechanism) sector – 69% annually. Over the next 5 years, nanoelectronics, nanobiomedicine and consumer goods (home electronics) based on nanotechnologies are expected to demonstrate the fastest production-volume growth rates of 35, 56 and 46%, respectively. Nanoenergy (13%) and environmental-protection monitoring tools

¹ Global Market for Nanotechnology Slated for High Growth through 2013. Nanotechnology: A Realistic Market Assessment (www.bccresearch.com/report). www.smalltimes.com/articles

(1.5%) are expected to experience more modest development. The global market for nanorobotics and nanoelectromechanical devices is expected to grow from USD 40 mln to USD 830 mln in 2011, at an average annual growth rate of 83%.

The market for scanning-probe microscopes, which serve as the basis for the development of nanotechnologies, is growing at a healthy rate of approximately 13% per year, and now stands at about USD 150 mln.

According to forecasts by IMS Health, the share of biotechnological drugs formulated using genetic-engineering technologies has grown on the global pharmaceutical market from 6% in 1999 to 14% in 2009.¹ Annual sales volume has reached USD 90 bln. While the worldwide sales volume of pharmaceutical drugs is growing at an annual rate of 7% (reaching USD 602 bln in 2005), sales of biotechnological preparations are growing at a rate of more than 17%. In full conformity with the theory for this stage of formation of the new technological mode, small and heretofore-unknown companies are emerging to become the leaders of the global pharmaceutical market. Many current leaders of the pharmaceutical sector, conversely, are finding themselves in a difficult position due to the problems associated with augmenting their drug portfolios with new and promising formulations.

Today, the nanobiotechnology sector is the most attractive to venture capital and accounts for more than half of all funds invested. Biotechnology is one of the world's most high-tech industrial sectors – its research component accounts for the bulk of area investments. Thus, in the US in 2006, biotechnology companies on the open market alone invested USD 27 bln in research. According to available data¹, biotechnologies attracted more than USD 25 bln in investment financing in 2007 and collected more than USD 100 bln over the five-year period 2003–2007.

Over the foreseeable future, faster growth is expected in the use of nanotechnologies as the key factor in the development of the new technological mode. According to European Commission estimates (2006), the global nanoindustry will require a workforce of approximately two million by 2015². The

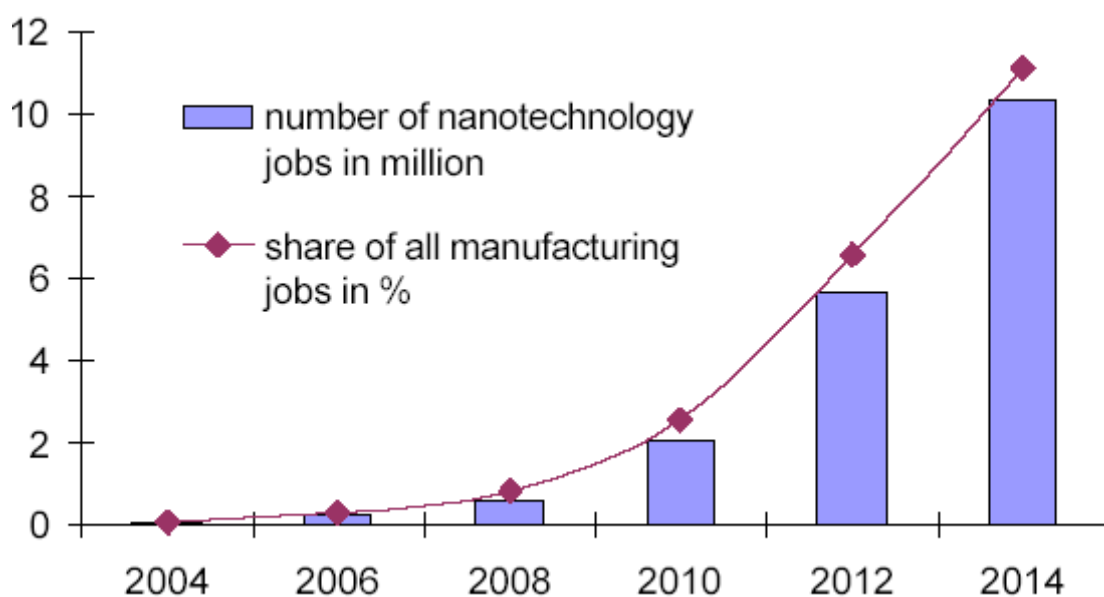
¹ Biotechnology Investments: Undue Risk or Safe Bet? www.k2kapital.com 14.09.2006.

¹ www.bioworld.com

² Angela Hullmann. The Economic Development of Nanotechnology – An Indicators-Based Analysis. European Commission, DG Research. 28 November 2006. <http://cordis.europa.eu/nanotechnology>.

regional breakdown of this workforce is expected to be as follows: up to 0.9 mln in the US, up to 0.6 mln in Japan, up to 0.4 in Europe, about 0.2 mln in the Asia-Pacific Region (excluding Japan) and about 0.1 mln in the rest of the world (including Russia). An additional 5–10 mln jobs in supporting industries will need to be created by 2014 (Diagram 28).

Diagram 28. Number of workers employed in the nanoindustry (millions) and the share (%) such workers represent in the global manufacturing industry

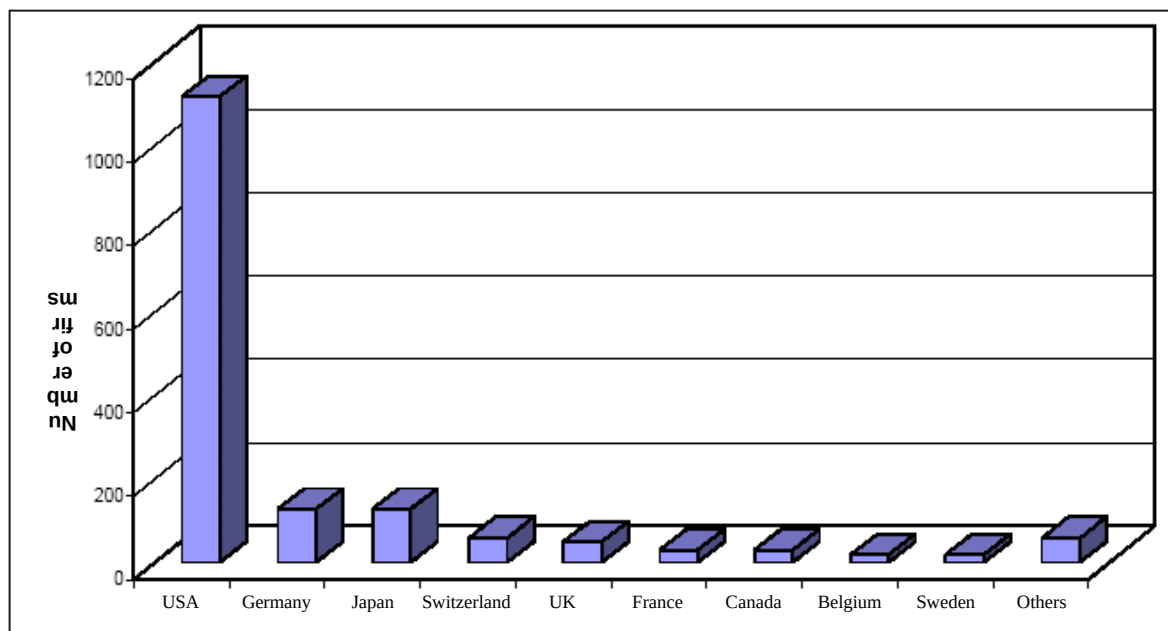


Source: Angela Hullmann. The Economic Development of Nanotechnology – An Indicators-Based Analysis. European Commission, DG Research. 28 November 2006. <http://cordis.europa.eu/nanotechnology>. http://www.cetraonline.it/file_doc/262/nanoarticle_hullmann_nov2006.pdf

On the regional markets, the US – where the majority of the world’s nanotechnology companies are headquartered – has thus far retained its lead (Diagram 29).

Diagram 29

Geographic distribution of nanotechnology companies, 2007
(Russia's rank – 18). Source: BCC – Nanotechnology: A Realistic Market Assessment



Inter alia, the American nanomaterials market was valued at more than USD one billion in 2008. The second in terms of volume has been – and remains – the EU market, accounting for approximately 30%. At the same time, the fastest-growing market is Southeast Asia, whose annual expansion rate is averaging more than 30%.

US leadership in the emergence of the new technological mode has been determined by more than just the forward positions it achieved throughout the course of the previous mode's growth. A key determinant of the rate of expansion of the new technological mode is the financing for development of its key factor. The US is the absolute leader in terms of both the volume of public and private expenditures on R&D financing and investments in nanotechnology development (Diagrams 30, 31). Financing for various nano developments has been earmarked in the budgets of 63% of the leading American corporations included in the Dow Jones Industrial Average.

In line with the recommendations provided under the modern theory of economic development, the government has been the “driving force” in advanced countries behind the development of nanotechnologies at the embryonic phase of

the new TM (Diagram 32). Thus, since 2001, the US has been implementing a federal program entitled the “National Nanotechnology Initiative” (NNI) with an annual budget of USD 1 bln and featuring the participation of 23 state agencies.

Diagram 30. Government expenditures of various countries on nanotechnology development (USD mln annually)

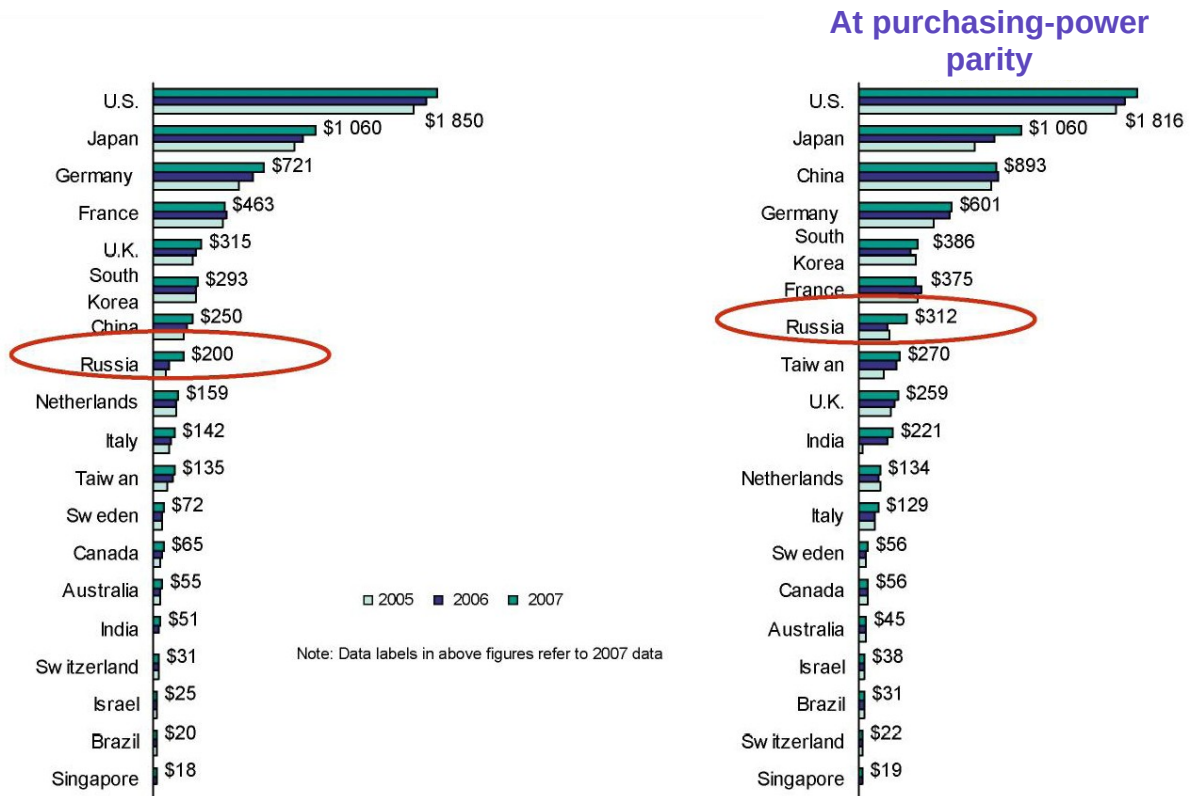
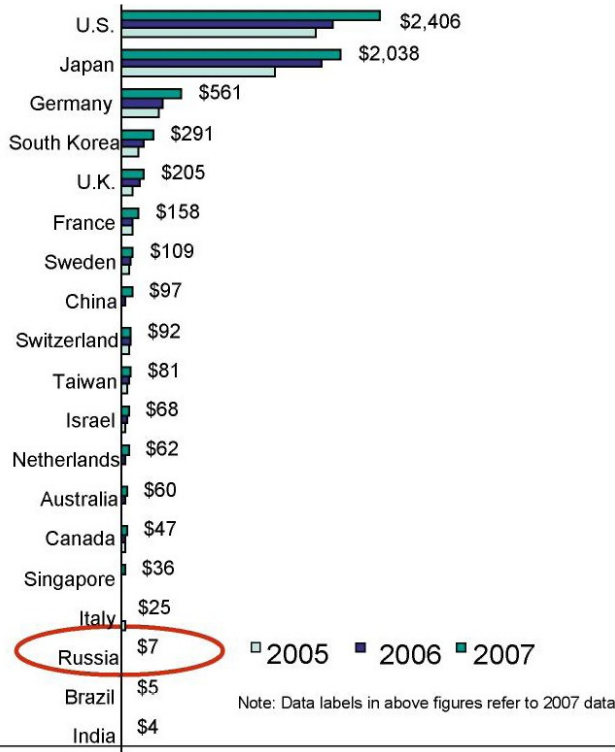


Diagram 31. Volumes of corporate (non-governmental) financing for nanosector development 2005–2007 (USD mln annually)

At the current exchange rate



At purchasing-power parity



Diagram 32. Evolution of government financing for nanotechnology research in world countries (USD mln)

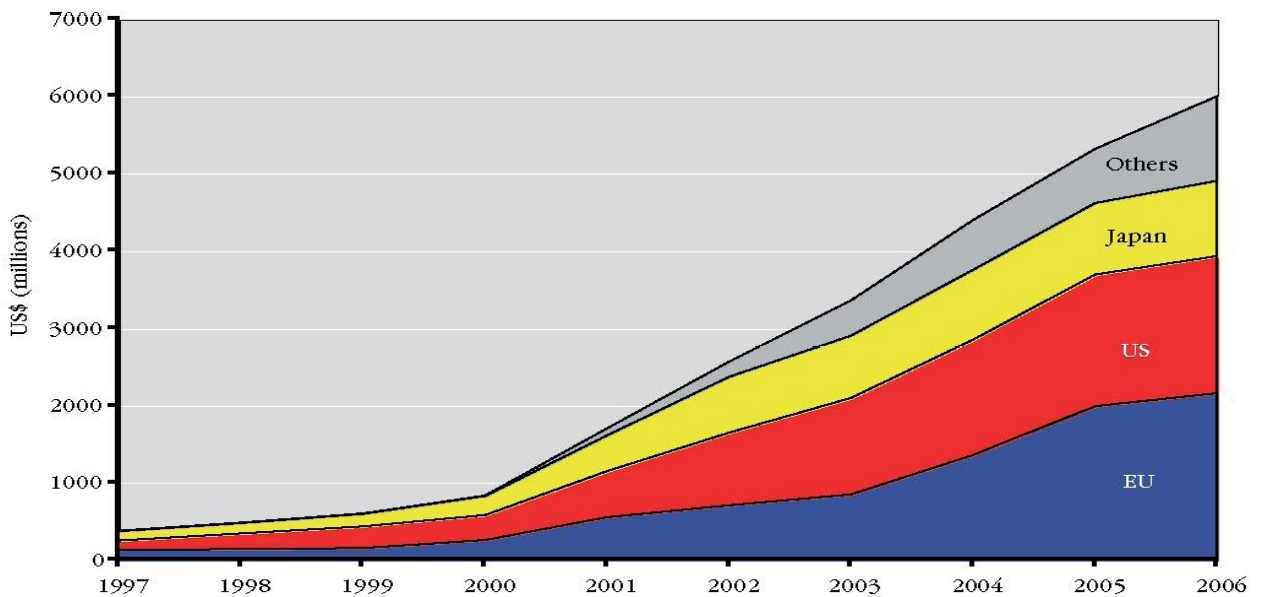
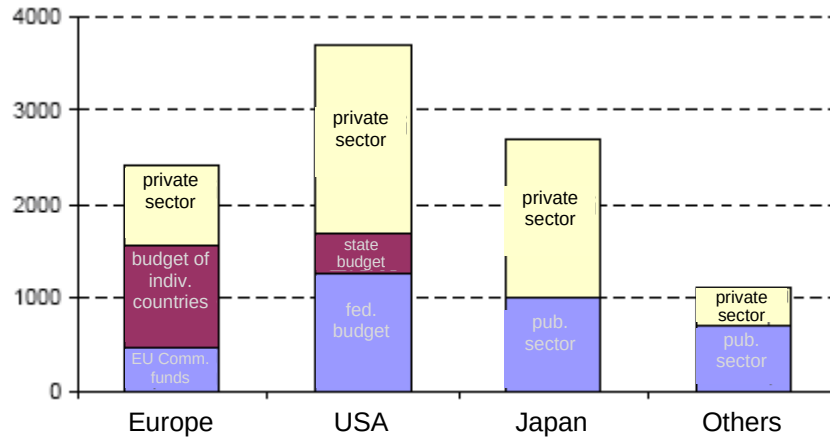


Diagram 33. Public and private nanotechnology financing in 2005 (EUR mln)

Source: European Commission, 2005 [Angela Hullmann. The Economic Development of Nanotechnology – An Indicators-Based Analysis. European Commission, DG Research. 28 November 2006. <http://cordis.europa.eu/nanotechnology>.
http://www.cetraonline.it/file_doc/262/nanoarticle_hullmann_nov2006.pdf]



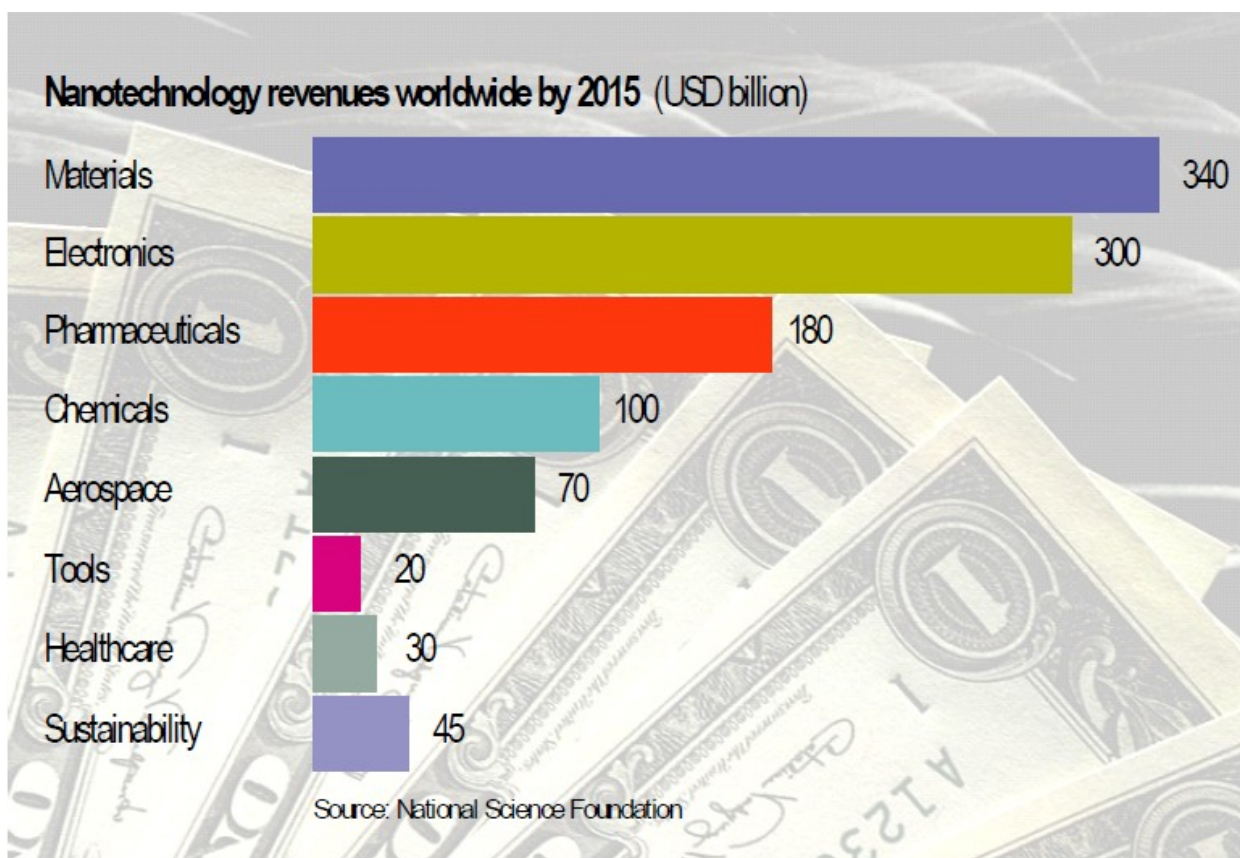
Whereas, at the embryonic phase of development of the new technological mode the government plays the main role in its emergence, the role of business activity in the private sector takes on added significance as its constituent operating sets mature and the respective markets begin to form. Today, the contribution by corporations (private business) to the financing of nanotechnology operations in the US, Europe and Asia is climbing steadily (Diagram 33). By 2005, the volume of corporate nanotechnology financing in the US and Japan had already exceeded government funding, evidencing the transition of the new technological mode from the embryonic to the growth phase.

As reflected by the data presented above, Russia held 8th–9th place in 2007 in terms of its state financing of nanotechnology development, but only the 19th–20th spot in terms of corporate financing.

According to US NanoBusiness Alliance, the aggressive division of the nanotechnology market among competing countries has already begun, and is expected to wrap up by 2015. Forecasts indicate that the US will take 30% of the nanotechnology market (3% growth over 2007), Japan – 25% (plus 1%), EU – 20% (minus 5%), dominated by Germany, Great Britain and France. The rest of

the market is poised to be divided between China, Russia, South Korea, Canada and Australia. Thus, the US and Japan are expected to retain their market leadership positions, with the specific market weights of Western Europe, Asia and a number of other countries slipping.

Diagram 34.
Global nanomarket in 2015



The anticipated volume of the nanomarket in 2015, comprised of various sector specializations, is provided in Diagram 34. Clearly, the bulk of the market is poised to be occupied by nanomaterials and nanoelectronics. On average, the annual growth rate of the entire electronics market stands at about 7%.

As was indicated above, the shift in technological modes opens up faster-growth opportunities for countries able to develop the key factor of the emerging TM first. In forming its growth trajectory, they are able to earn intellectual rent on a global scale, thereby reinforcing their competitive advantages and ensuring their position of global leadership on the next long-wave of economic growth.

The RAND Corporation identified 16 applied areas of the technological revolution determining the shift to the sixth technological mode. According to the analytical findings presented by RAND, only 7 of the 29 countries studied stand a good chance of success in all 16 applied areas: US, EU, South Korea, Japan in Asia, Australia and Israel. RAND assesses the outlook for the development of 12 technological-application areas as realistic for 4 countries: China and India in Asia, and Poland and Russia in Eastern Europe. Development opportunities in 9 technical areas are held by 7 of the 29 countries: Chile, Brazil, Columbia, Mexico, Turkey, Indonesia and South Africa. Less than one-third of the 16 total areas will be accessible to such countries as Fiji, the Dominican Republic, Georgia, Nepal, Pakistan, Egypt, Iran, Jordan, Kenya, Cameroon and Chad.

What stands out in the RAND study is that within the group of countries in which Russia is ranked, its outlook is viewed with the most skepticism. China and India are both expected to close the gap with the leaders. Russia risks joining the ranks of less technologically-developed countries (Brazil, Chile, Mexico and Turkey). The analysis points out that without a robust science-and-technology policy, our country will find it difficult to compete not just with Japan, the US and a number of other highly-advanced countries, but with China and India as well, which are vigorously ramping-up their respective R&D sectors. RAND is of the opinion that China, India, Poland and Russia trail the world leaders insofar as their weaker driving forces for technological development are further hampered by the relatively high barriers standing in the way of progress. The situation in our country is contrasted with that of China, where the highly-skilled workforce is augmented by a growing number of researchers. The focus China places on the training of highly-qualified specialists at the leading universities of the US and Canada is well known.⁷¹ Chinese citizens lead among all foreigners earning PhDs in the United States. That said, emphasis is placed on the training of Chinese specialists in the technical and natural sciences.

⁷¹ See D. Boothby, Who Goes to North America for a Degree and Why // Foresight; 2007, No. 4.

Despite the financial crisis and worsening state of government budgets, leader-countries are rapidly expanding their public funding of nanotechnology research⁷² and encouraging private investments in the field. Europe is paying no less attention to faster R&D expansion as a means to ensure global competitiveness in the future. As outlined in the respective European Commission report, Europe should not cut back on research investments in times of crisis. Just the opposite – member states should focus on preparing to make the most of the next economic recovery. From this perspective, knowledge-focused measures and structural reforms are viewed as taking on greater significance during economic slowdowns than in times of economic prosperity.⁷³

Although forecasts point to leader-countries maintaining their forward positions during the recovery offered by the next long-wave, China is emerging as an even more formidable competitor. It was back in 1986 that China adopted its National High-Tech Research & Development Program, known as Program 863, as its response to the global challenges posed by the new technological revolution and competition. Since 1997, China has been implementing its National Program of vital fundamental research, designed to lay the scientific foundation for the country's future development and command of cutting-edge technological frontiers. The concept to turn China into a scientific superpower by 2050 envisions taking a decisive step within the next 15 years. Planned for the period is reducing the country's dependence on foreign technology and achieving a level of "endogenous" innovational development in strategic high-technologies that will guarantee China's national security and ensure strong positions in global scientific and economic competition. Implementation of these plans rests on the powerful financial support of the central government and provincial administrations. In terms of total R&D expenditures, China is projected to trail only the United States by 2020 (Table 6).

⁷² Key Figures 2007. Towards a European Research Area Science, Technology and Innovation. Luxembourg: Office for Official Publications of the European Communities, 2007

⁷³ A More Research-Intensive and Integrated European Research Area. Science, Technology and Competitiveness Key Figures Report 2008/2009. Luxembourg: Office for Official Publications of the European Communities, 2008; pg. 3.

Table 6

Share of countries and regions in R&D financing, %

| | 2004 | 2005 | 2000 (estimate) | 2020 (forecast) |
|------------------------------------|------|------|--------------------|--------------------|
| Europe | 24.6 | 23.8 | 23.4 | 20.0 |
| North and South America | 37.8 | 37.5 | 37.1 | 35.0 |
| USA | 32.7 | 32.0 | 31.3 | 28.0 |
| Asia | 37.6 | 38.7 | 39.5 | 45.0 |
| China | 11.8 | 12.8 | 13.6 | 20.0 |
| Japan | 13.0 | 12.6 | 12.4 | 12.0 |

Source: A. Dynkin, N. Ivanova; *Innovation Dynamics: Global Trends and Russia // Theoretical Problems and Management Practice*; 2008, No. 5.

Under purchasing-power parity between the national currencies involved, China has already taken second place in terms of government nanotechnology expenditures, ahead of both Japan and Germany. Corporate spending on the aforementioned goals is also growing rapidly, shooting up by 68% in 2006 alone.⁷⁴

The nanotechnology research conducted in China is geared towards solving the energy and environmental problems. The initiative of the Chinese Academy of Sciences which envisions turning solar power into China's primary source of energy by 2050 appears symptomatic of the trend.

In reality, China is pursuing to a two-pronged economic-development strategy. Sectors within the previous long-wave are serving as the backbone for the implementation of a "catch-up" development strategy that utilizes China's competitive advantages in terms of labor cost. At the same time, the country's storming of brave new research frontiers is laying the foundation for a strategy of science-and-technology leadership.⁷⁵ In order to implement these strategies, the respective measures are being adopted under the country's industrial policy. With the support of central agencies, 103 enterprises have become experimental

⁷⁴ China Second to U.S. in Nano 12-03-2007 (www.nanochina.cn).

⁷⁵ A. Rei; *Competitive Strategies of the State and Individual Businesses in Export-Oriented Development // Economic Issues*; 2004, No. 8.

innovation centers, “pulling” others along with them. Within the next 3–5 years, the number of such experimental enterprises is projected to grow to 500.⁷⁶

Analysis of a dozen nanotechnology-development indicators reveals that the growth rate of almost all indicators now exceeds GDP growth rates in all countries, and is even approaching 30–50% annual growth in a number of areas. In leader-countries (US, Japan, European Union), where nanoindustry development rates are particularly high, business is shouldering a growing share of nano-development financing. That said, business financing in the US now exceeds federal and local (state) financing by a factor of almost 1.5. The high rate of expansion of nanotechnology use in the private sector of many industries in the world’s leading economies indicates that the new technological mode is entering the active-growth phase.

Despite its obvious achievements in the development of nanotechnologies, Russia is experiencing a significant gap between the high quality of its research and considerable science-and-technology capacity and the country’s underdeveloped nanotechnology infrastructure and the slow commercialization of its existing concepts. According to various indicators, Russia’s lag behind the world leaders in this area stood at anywhere from a factor of 2 to 1000 in 2007. The weak response of industry to developments in the nanotechnology field and the primitive strategies of the country’s financial structures, particularly given the shift in the global economy to an innovational development path, are the main hindrances to national progress. The favorable price environment for the raw materials exported from Russia was not utilized to spur development of the nanoindustry, which has created considerable advantages for countries where innovational-development strategies are actively supported by government and business alike. Instead of being used to restructure the economy on a fundamentally-new technological foundation, the natural-resource rent generated from the export of energy commodities and raw materials, totaling approximately USD 60 bln annually, went instead to pay down the country’s foreign debt, pad the Stabilization Fund, and found other expressions of capital export.

⁷⁶ <http://www.china.org.cn>

Accelerating resolution of the development challenges facing Russia in terms of nanotechnologies and nanomaterials and the practical application of existing concepts by industry will only be possible with wide-scale and immediate government support in the financial, organizational, human resources and regulatory arenas. That said, the incorporation of nanotechnology into the broader economy cannot be based solely on achievements in the fundamental sciences. It must be based on active and productive cooperation between business, industry, science and government. In order to reap the maximum economic reward from research findings and developments in the field of nanotechnology, their conversion into commercial production streams must be well-timed. From among the wide variety of science-and-technology achievements and promising ideas in nanotechnology, those capable of being commercially produced and brought to market relatively quickly must be carefully selected. These projects must then be given priority focus and serious research support.

CHAPTER 8. OPPORTUNITIES FOR TECHNOLOGICAL DEVELOPMENT IN THE CONTEXT OF GLOBAL ECONOMIC CRISIS⁷⁷

8.1. Opportunities for faster development under structural change

The global economic crisis unfolding today has had a profound impact on all sectors of the economy, including the high-tech sector. The high-tech industry, the bulk of which involves manufacturing under the fifth technological mode, is experiencing the worst crisis in its history. Production declines have even been suffered by such monopolists as Microsoft, which had symbolized the modern technological mode for an extended period of time. Collapsing sales have been observed in all segments of the electronics market – from microchips to mobile phones – so integral to the key factor of the fifth technological mode. The falling demand caused by the economic crisis has forced almost all leading firms within the electronics industry to cut jobs. Intel, the world's leading manufacturer of

⁷⁷ This chapter uses material by V.E. Dementiev.

microchips, has been forced to implement a business-restructuring program resulting in the closing of a number of its assembly plants.

At the same time, the crisis currently being endured by mature industrial sectors is creating additional opportunities for those lagging behind. In and of itself, the onset of the mature phase makes it possible to lower entry barriers to sector newcomers and open windows of opportunity for imitators.⁷⁸ Furthermore, an economic crisis results in the lower capitalization of firms with access to the most advanced technologies. As a result, exposure to the technologies used by such firms via the acquisition of controlling stakes becomes more realistic. Moreover, leaders-countries' reduced need for high-tech equipment increases its accessibility to countries playing "catch-up" development. Thus, in the 1970s, South Korea took full advantage of the opportunity to acquire the equipment and technologies involved in the Japanese shipbuilding industry when the latter was presented with a reduction in its excess capacity.

Our own national history is rich with vivid examples of the timely borrowing of new technologies. The USSR made good use of its chance to acquire the technologies necessary to industrialize the country during the Great Depression of the 1930s. Western companies were experiencing an acute need for orders at the time, and the USSR gained the opportunity to acquire high technologies and cutting-edge manufacturing skills in record time. Under the agreements concluded at the time, foreign companies were obligated to prepare construction or technological design plans that featured a comprehensive description of equipment, machine tools and mechanisms, as well as their specifications; transfer their industrial know-how (technological secrets, patents, etc.) to the respective Soviet client; dispatch highly-qualified specialists to the USSR to oversee the construction and operational commissioning of the respective facility; and permit Soviet engineers and workers to learn Western companies' production methods during on-site training programs and business trips to the companies' enterprises located abroad.

⁷⁸ C. Perez and L. Soete; *Catching up in Technology: Entry Barriers and Windows of Opportunity / Technical Change and Economic Theory*. New York: Pinter Publishers, 1988.

According to available data, USSR heavy industry concluded 170 agreements on technical assistance in 1923–1933: 73 with German companies, 59 with American firms, 11 with French companies, 9 with Swedish businesses and 18 with firms based in other countries. Such major European enterprises as DneproGES (Dnieper Hydroelectric Station), the Stalingrad and a number of other tractor-manufacturing plants, the Magnitogorsk Metallurgical Combine, and the Nizhegorod (Gorky) Auto-Manufacturing Plant were all built with the active participation of American companies. In terms of equipment supplies, 1st place was held by Germany, 2nd place by the US, and 3rd place by Great Britain. International General Electric, Ford Motor Company, International Harvester, and Dupont de Nemours became the USSR's leading foreign partners.⁷⁹

Of course, even in a crisis environment, gaining access to advanced technologies remains a challenging proposition.⁸⁰ Foreign firms rid themselves of their least efficient divisions. The crisis notwithstanding, leading firms are concerned with strengthening their position in terms of innovation-based competition. Thus, despite the ongoing crisis, IBM plans to continue allocating up to 10% of its earnings for research.⁸¹ Yet, despite firms' best intentions to preserve their innovational potential, cutbacks inevitably have an impact on divisions involved in research and development. Attracting foreign technology specialists as a catch-up development measure becomes easier in a crisis, accompanied as it is by economic depression in the world's leading countries.

At early development stages of the new technological mode, countries playing catch-up gain real chances to take lead positions. In growing sectors, the fact that pursuers are less burdened by outdated production facilities gives them a

⁷⁹ B.M. Shpotov; Policy of Using Western Technologies as a Factor in the Development of Heavy Industry in the USSR // Issues of Management Theory and Practice; 2003, No. 4; B.M. Shpotov; "History Has Not Given Us the Easy Path" (Western Technical Assistance in Soviet Industrialization) // World of History; 2002, No. 3.

⁸⁰ As noted by D. Livanov and A. Ponomarev; "a consensus persisted among the late-Soviet and post-Soviet elite that any required and highly-advantageous high technologies could – and should – be purchased on the basis of primary-resource sales. Yet, it must be acknowledged that there are certain technologies no one will share with us, simply because they constitute a factor of global competitiveness. Thus, simultaneously with our pursuit of a modernization and mass technology-borrowing strategy, we need to think, moving forward, about how we can: a) support our existing competitiveness, and b) organize a breakthrough towards leading positions." ["Expert" No. 5 \(644\)](#) /9 February 2009.

⁸¹ <http://dailyhitech.ru/123.html>

comparative advantage. In order to make a successful technological leap, trailing countries must correctly gage the promising development areas for the new technological mode and move faster to launch their production on a commercial scale. Success is more likely when a lead is secured during the embryonic development stage of the new technological mode.

To a large extent, the art of taking the lead depends on identifying growing opportunities before the markets start making signals about them. Betting on industries already absorbed by the market to the exclusion of other possibilities eviscerates any strategy to move to the head of the pack. Experience with technological revolutions indicates that the accelerated transformation of new knowledge into commercial production is the key to Russia's competitive success on dynamic markets. In this connection, V.E. Dementiev is justified in suggesting that determining the international-competition strategies for dynamic markets should highlight one of the two specific approaches he distinguishes: science-and-technology leadership or dynamic catch-up. The first strategy was pursued by the US during the post-war years, while an example of the second involves development of the aviation industry in Brazil.

According to V.E. Dementiev, our country's significant losses in terms of capitalizing on its science-and-technology potential – against the backdrop of its swift development by leaders in the global scientific arena – give rise to doubts as to the country's ability to concentrate its efforts and break ahead. At the same time, Russia's current science-and-technology potential is sufficient – not just to assimilate foreign technologies, but to secure a leadership position in certain development areas of the new technological mode.

In the current environment, Russia would be wise to pursue a mixed strategy that contemplates opportunities to utilize the science-and-technology achievements of other countries. The commercialization of inventions need not be rigidly linked to the location of their inception. The main factor of commercialization is the

availability of properly-trained scientific personnel capable of getting to the heart of a technological breakthrough and sending it in a practical direction.⁸²

Pursuer opportunities are not limited to a strategy of playing dynamic catch-up. The aforementioned tendency of R&D leader-countries towards inertia in new-sector development results in the leader being held hostage by its previous successes. As new scientific results in the field are achieved, the flip side of leadership is revealed – developing the respective manufacturing facilities is hindered by the difficulties associated with modernizing existing assets. This inertia slows the commercialization of discoveries already in the pipeline, rendering development uneven despite the regularity of scientific-knowledge acquisition. Thus, winning a chance at success are pursuer-countries with, firstly, a sufficient scientific base to raise such results to the level of applied developments, and secondly, the technological and financial base to introduce such developments into production. Such an approach to competition on dynamic markets can fairly be termed a strategy of the outpacing commercialization of supplementary innovations.

A recent example of this type of approach involves the development of technologies for stem-cell use. In the US, their commercialization took the costly route of establishing umbilical-cord blood banks. The subsequent discovery of stem cells in adipose tissue rendered such expenditures pointless, just as investments in the extraction of stem cells from bone marrow were made fruitless. Russia has been unable to capitalize on this advantage due to bureaucratic opposition from oversight agencies, though Russian researchers were some of the first to patent the technology involved in growing stem cells from a person's own tissue.

Overall, bureaucratic barriers notwithstanding, Russia has the conditions necessary to make such a strategy successful:

- existence of scientists capable of moving to the commercial sector for the utilization of fundamental discoveries;
- participation of Russian researchers in international science-and-technology cooperation, thereby increasing their access to cutting-edge research

⁸² A. Rei; Competitive Strategies of the State and Individual Businesses in Export-Oriented Development // Economic Issues; 2004, No. 8.

discoveries;

- emergence of companies with significant financial potential interested in diversifying their operations and winning a monopoly on the global market for new goods and services;
- presence of stable professional teams with comprehensive experience in the development of products with complex engineering systems and their refinement to the necessary level of quality.

The only thing missing is a pro-active science-and-technology policy by the government, which is critical at this stage of development. The fact that Russia's fundamental sciences are well-developed is key to its ability to absorb external discoveries, expand internal capacities in the respective fields of knowledge, and develop the human-resource potential for applied R&D. All of this facilitates the combining of foreign and domestic inventions, which could play a critical role in commercialization of the latter by augmenting them with unique qualities.

The strategy for the faster commercialization of scientific discoveries combines various elements of the science-and-technology leadership strategy and the dynamic catch-up strategy. The availability of domestic R&D results opens the door to real technological cooperation with foreign companies, up to and including the joint commercialization of separately-owned but complementary discoveries. According to V.E. Dementiev, this strategy is the surest route to gaining exposure to the promising technological developments of leader-countries. There are other consequences associated with the attraction of foreign direct investments (FDI) under a dynamic catch-up strategy. Under the latter scenario, technologies already reflected in commercialized discoveries are more likely to flow into the country.

A key element of the strategy for the faster commercialization of scientific discoveries is conducting independent R&D programs. If the country's development programs are conducted at research centers owned by foreign companies, they cannot form the basis for the exchange of discoveries with domestic companies. As a rule, such centers are preoccupied with fragmented developments, whereas the integration of R&D findings takes place in countries

where the centralized management offices of transnational companies are headquartered. A strategy for the faster commercialization of scientific discoveries requires not just the respective R&D base, but powerful industrial and financial infrastructure as well.

In order to conduct a successful development policy for the national economy, individual sector strategies must be clearly defined. Factoring in available resources and the development level of science-and-technology potential, either a leadership strategy or a catch-up development (dynamic catch-up) strategy must be chosen for each sector, or, in the event that the necessary capacity is lacking, a strategy of faster commercialization.

During the emerging phase of the new technological mode, priority attention should be paid to the development of industries with a positive sales outlook for new products, including on state-controlled markets (government procurements and state-corporation contracts). This can serve as a driving force for achieving economies of scale, with cheaper product prices spurring development of the technological mode forming on its own basis. Russia has competitive sectors capable of creating demand for the products of the new technological mode: the atomic industry, aircraft engineering, shipbuilding, the rocket-and-space industry, electronics, etc.

For example, the directional scope of nanotechnology application in aerospace equipment includes: nanomaterials (nanocomposites, nanostructured alloys); nanocoatings (nanofilms) and nanomembranes; carbon-nanotube fibers; nanocatalysts, nanogels, high-temperature superconductors, nanoelectronics; nanophotonics; nanomanipulators.

Wide-scale demand for the products of the new technological mode is also capable of being generated by such pillars of the domestic economy as chemistry, metallurgy, fuel-and-energy, railway transport, and agriculture.

In metallurgy, one example of nanotechnology use involves development of the mass production of unique-to-Russia brands of steel featuring a two-fold improvement in performance characteristics (weldability and cold-resistance).

These materials are designed for the construction of installations involved in development of the oil-and-gas fields of the arctic shelf under extreme climactic conditions (up to -50°C), as well as for use in the shipbuilding, oil-and-gas and machine-building industries.

In the oil-and-gas industry, one promising area is nanocatalysis. New components allow crude oil to be refined much more efficiently, quickly and cheaply. With the aid of nanotechnologies, the oil-and-gas industry will also gain a number of sensors and self-healing materials capable of protecting the surrounding environment from potential oil spills.

New technologies involved in the refining of light hydrocarbons (special reactors with nanoporous catalytic membranes) will assist in Russia's ability to meet the obligations assumed under the Kyoto Protocol. According to available estimates, such technologies are capable of supporting the processing of up to one-third of all associated gas released into Russia's atmosphere (i.e. approximately 10 billion m^3/year), thereby securing an added volume of goods and services of up to RUB 200 billion annually.

An example of yet another priority direction for the emergence of the new technological mode in which Russian industry has promising capacities and competitive advantages involves manufacturing of the ultra-bright light-emitting-diodes (LEDs) used in residential lighting. In order to ensure its full implementation, it would be wise to introduce legislation designed to promote the replacement of incandescent bulbs with LED lights, thanks to which the Russian market for LED lighting could reach RUB 70 bln by 2012.⁸³

An important element of implementing a leadership strategy across the broad range of emerging areas of the new technological mode involves capturing and holding forward positions in the production of the instrument-making base for the nanoindustry. Despite existing capacities and commercial successes in the field, the technology for creating nanosystem equipment is still lacking within the current range of critical technologies. At the same time, Russia's production of the

⁸³ Remarks by Minister A. Fursenko at the RF Government Meeting on Scientific and Organizational Support for Development of the Nanoindustry in the Russian Federation; Moscow, 17 January 2008.

unique equipment required by the nanoindustry is well-organized, including ultra-high vacuum complexes, probe nanolaboratories, and scanning-probe microscopes. It must become a goal to reinforce Russia's forward positions in the field, and to classify the production of nanotechnology equipment as a priority of the government's science-and-technology policy.

The patent system surrounding nanosystem equipment should be analyzed for the purposes of ensuring the timely acquisition of certain foreign licenses. The government should offer to cover the full costs incurred by domestic creators (individual inventors and small research organizations) in the patenting of their promising domestic developments, provided the creators agree with the state on the subsequent sale of licenses thereto.⁸⁴

Particular attention should be paid to the instrument-making involved in nanometrology.⁸⁵ Bear in mind that the development of each successively-new technological level in micro- and nanoelectronics entails the respective modifications to the metrological support needed for production. The loss of domestic specialized-technology machine-building drives the need to acquire the entire range of technological and control equipment abroad. This equipment is extremely expensive, with costs of about USD 1 mln per unit and up to USD 8–10 mln for certain types of equipment (photolithographic systems).⁸⁶

Naturally, the aforementioned examples of promising directions for development of the new technological mode do not exhaust the entire spectrum of promising sectors and industries. They deal solely with the key factor of the new technological mode – nanotechnologies – and must be combined within a unified strategy for faster technical-economic development that includes the other priority development areas at the core of the new technological mode (cellular technologies, genetic engineering in crop production and pharmaceuticals,

⁸⁴ According to various assessments, the cost of a European patent now approaches EUR 115–120 thousand (<http://www.smoney.ru/article.shtml?2007/07/16/3356>).

⁸⁵ For more information on the state of metrological support for nanotechnology, including the device-manufacturing involved in nanometrology, see Metrological Support, Standardization and Compliance Assessment for Nanotechnologies and Nanoproducts (Analytical Overview). M.: Russian Technological Regulation; November, 2007.

⁸⁶ Development Strategy for the Electronics Industry in Russia Through 2025 // Industrial Growth Weekly; No. 31, 24–30.09.2007.

information technologies, etc.) and its carrier sectors (healthcare, education, high-tech machine-building, etc.).

8.2. Formation of the development institutions of the new technological mode

The main obstacle to the growth of the new technological mode is the disconnect between the existing institutional structure and opportunities for its development. Current institutions, from the human-resources training system to the planning methods under the government's science-and-technology policy, rest on the reproduction of the previous technological mode and are ill-suited to the requirements and development opportunities of the new one.

For example, a fundamental requirement for the institutional system of the new technological mode is ensuring continuous innovation process, which entails incorporating technologies for the simultaneous project-engineering of all phases of the R&D-manufacturing product cycle into management practice. Close ties between the manufacturers of high-tech equipment and its consumers play an important role in the implementation of such technologies. The persistent weakness of inter-industry innovation coordination in Russia hinders the use of technology-convergence mechanisms⁸⁷ and the respective management methods.

As was previously mentioned, emergence of the new technological mode occurs via the formation of clusters of technologically-complementary industries evolving along the dissemination trajectories of its key factor. The lead role in the coordination of innovational processes within clusters of technologically-complementary industries is played by big companies and business groups. They constitute the system-integrators of the innovational process unfolding within different elements of the innovational system. Big high-tech companies are in a position to assume the major financial and technological risks associated with the development of new technologies. These companies control sales channels and

⁸⁷ V.E. Lepskiy; Improving the National Innovational System (A Subject-Oriented Approach) / Conference Materials of the IX International Forum "High Technologies of the XXI Century" 22–25 April, 2008; Moscow, Russia, "Expocenter" Central Exhibition Complex.

own formats and standards, which becomes an important competitive advantage on high-tech markets. Moreover, they create and develop technological platforms. The underdevelopment of such companies is a key strategic weakness of Russia's national innovation system.⁸⁸

The deficit of integrating companies, the narrowness of the circle of private investors strategically-oriented towards technological development, the weakness of the financial system, and the lack of government funding for wide-scale modernization projects – these are but some of the challenges hindering the production streamlining of sophisticated domestic machine-building products that have prompted the rise of state corporations, which cover the key elements of the R&D-manufacturing-sales cycle of product production. The approaches to the coordination of economic activity typical of state corporations, which are geared towards the production of relatively-standardized products, can be combined with less-rigid approaches to integration in the form of different network structures.

According to V.E. Dementiev, leadership in systemic integration may serve as the basis for the implementation of a strategy for the faster commercialization of scientific achievements. Temporary participation in innovational cooperation under the direction of foreign leaders may be a justified means of gaining access to systemic-integration experience. In order to avoid being chronically relegated to secondary roles, however, domestic research-and-development in cutting-edge areas is needed. Illustrative in this context is the experience of Japanese keiretsu or Korean chaebols, which facilitate the decision-making involved in expansion of the planning horizon of market agents and the concentration of resources in cutting-edge STP areas, based on indicative state planning and the dominance of strategic investors (suppliers, consumers, banks) within their shareholder structures.

In a competitive environment, modernization of the sectors of domestic industry transitioning from the fifth to the sixth technological mode prompts the sectors themselves to search out promising science-and-technology developments

⁸⁸ A. Dynkin; The Global Crisis – Trigger for Innovational Development // Issues of Management Theory and Practice; 2009, No. 4.

and support scientific research. At the stage of fundamental research into new technologies, however, the state continues to play a critical role for an extended period of time. In fact, it does not withdraw from supporting research and applied R&D even in countries that have attained lead positions.

The system of state institutions within the national innovation system should ensure the following conditions for faster emergence of the new technological mode:

- subsidizing the costs involved in protecting the intellectual-property rights to domestic inventions and developments abroad;
- permitting insurance companies and pension funds to participate in venture projects;
- maintaining the information infrastructure for scientific-research work, supporting the network of science-and-technology libraries, and subsidizing the rendering of services thereby involving informational-network/database use and scientific-literature procurements;
- supporting the operation of test units, experimental installations and pilot-plant runs, creating a network of technological centers and collective-use parks;
- accounting for all enterprise expenditures on R&D activity, production modernization and new-technology implementation as tax-exempt operating costs;
- actively encouraging CIS science-and-technology potential participation in the realization of priority areas of development.

An important element of tailoring the institutional system to the requirements of faster development of the new technological mode is the stimulation of R&D activity via the tax instruments applied so successfully in many developed countries.⁸⁹ Since 2008, Russian enterprises have been allowed to account for R&D investments as operating costs. While this is viewed as a massive breakthrough, much more aggressive tax incentives have been used throughout the world for more than ten years now, some of which allow for 120–150% of total R&D

⁸⁹ See, for example, E.V. Sokolov, N.Y. Yurchenko; Tax Stimulation as a Critical Factor in the Innovational Development of High-Tech Enterprises Abroad / Conference Materials of the IX International Forum “High Technologies of the 21st Century”, 22–25 April, 2008; Moscow, Russia, “Expocenter” Central Exhibition Complex.

investments to be written off as operating costs. Moreover, these incentives are differentiated across the economic sectors most critical to the country in question.⁹⁰ Above and beyond such indirect methods (i.e. tax incentives), the direct co-financing by the government of corporate research in priority areas is also justified.

At the commercialization stage of new technologies, public-private partnership (PPP) gains particular significance. Simply augmenting the range of critical technologies with a clear list of the sectors that utilize them and the innovational enterprises within which are entitled to count on state support is capable of significantly lowering the risk of private investments in cutting-edge industries. One of the key areas of public-private-partnership support for new technologies involves state procurements.

The tremendous attention paid to development institutions in recent years has been conditioned by the need to renew and strengthen ties between the scientific community and industry. Yet, the return on such endeavors has been much lower than anticipated. Thus, the Russian Venture Company, a significant portion of whose money was deposited at banks as opposed to invested in innovational projects, found itself on the verge of liquidation.⁹¹ Mandatory reserves for improving the performance of development institutions should encompass support for projects envisioning domestic leadership in systemic integration.

It is widely recognized that one of the weakest spots in the domestic innovation system is its anaemic involvement in the commercialization of scientific developments. The training of specialists in the commercialization of scientific developments could contribute greatly to changing this situation, and should be identified as a separate thrust of science-and-technology policy. Such a specialist corps can only be formed under close ties between educational institutions, the scientific community and business, in dialogue with the proponents of systemic integration and commercialization and familiarization with their mentality and values.

⁹⁰ A. Dynkin; *The Global Crisis – Trigger for Innovational Development // Issues of Management Theory and Practice*; 2009, No. 4.

⁹¹ RBC, 23 March 2009.

Adapting the system of higher education to the requirements of the new technological mode presupposes the training of managers and engineers with a broad range of STP knowledge capable of supporting constant innovational processes. This entails supplementing state support for the development of fundamental research at universities with the stimulation of teaching activities by employees at research institutions and industrial-firm research departments. Given the ongoing deficit of domestic engineering competencies, it would be prudent to bolster the instructor corps via a hiring drive for foreign specialists in the respective fields with information on the cutting-edge foreign technologies not yet applied in our country.

Our long historical experience with the formation of educational centers in science cities should incorporate the on-site development of technological zones, technoparks and techno-hubs.

An organic form of science-and-production integration is the research conducted by manufacturing companies themselves. Although innovational competition promotes the implementation of such research, many advanced countries take additional stimulation measures. In 2005, for example, the Government of Belgium decided to stimulate private-sector activity in the field by lowering taxes on researcher salaries. Companies engaged in R&D or cooperating with research organizations are allowed to retain 50% of the respective payroll tax. Similar measures are implemented in Italy: receiving a tax subsidy since 2003 enterprises are spending at least 10% of their profits on financing research-personnel costs. Research workers returning to Italy from permanent residence abroad receive a 10% subsidy on their personal income taxes (for a period of five years following their repatriation).⁹² Such measures are entirely justified in our country.

In order to escape from this dead-end, the government's economic policy needs to undergo radical change. It should be based on the development of national competitive advantages and the main thrusts of formation of the new technological

⁹² Innovational Development – Foundation for Modernization of the Russian Economy: National Paper – M.: RAS Institute of World Economy and International Relations (IMEMO), SU-HSE, 2008.

mode. This will require the respective concentration of the country's available financial, informational and intellectual resources.

CHAPTER 9. ANTI-CRISIS POLICY IN RUSSIA

9.1. Consequences of misguided macroeconomic policy

In planning their anti-crisis measures, most countries made three strategic mistakes. First, the initial diagnosis was incorrect – the crisis was viewed as financial and short-term in nature, whereas it proved to be structural and long-term. Second, the principal target of anti-crisis measures – the banking system and the financial market – was erroneously selected. Measures aimed at saving the banking system should have been viewed in the context of a broader program to prevent the slide into economic depression. Third, instead of implementing a well-considered strategy of long-term development, emphasis was placed on short-term “fire-extinguishing” measures which, in the absence of a strategic plan, turned out to be ineffective and wasteful. Furthermore, there has been a persistent lack of insight into the causes of the global crisis, the possible scenarios for its further development, and the available paths to recovery.

Unfortunately, despite the admonitions and recommendations of a number of scholars and specialists, the same mistakes were made in Russia. We are being forced to continue playing by the rules of the Washington Consensus, which has already cost the country approximately USD one trillion in capital and a significant portion of its R&D-manufacturing potential. This is leading to the loss of faster-development opportunities, the acquisition of Russian assets by foreign capital and deterioration of the country’s position at every turn of the global crisis.

We need an independent anti-crisis strategy that proceeds from a long-term vision for our development potential. Taking a wait-and-see stance and following the example of countries at the core of the global financial system is dooming us to a position of dependence, which is highly dangerous in a situation characterized by abrupt structural changes to the global financial system and intensifying international jockeying for position in the post-crisis world.

During the first stage of the global crisis alone, Russia lost one-third of its reserves, suffered industrial-production declines in excess of 10%, experienced a 15% investment contraction and a three-fold collapse of the stock market, with

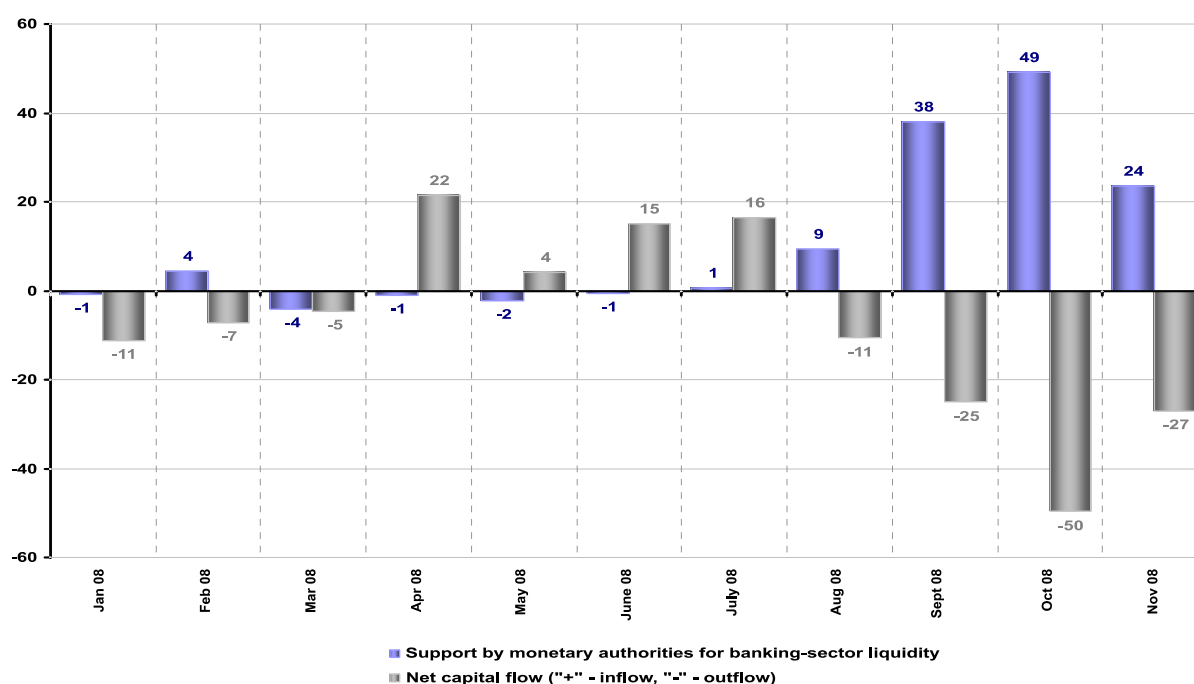
faith in the national currency undermined and the inflation rate climbing to 18%. Hundreds of thousands of private citizens who took out consumer and mortgage loans in foreign currency have gone broke, with forced unemployment on the rise. The financial performance of individual enterprises has suffered a three-fold collapse, with corporate solvency falling off sharply. The servicing and paying-down of the external debt of Russian banks and corporations continues to be a serious problem. This year, they are facing payments of USD 136.1 bln; in 2010 – another USD 86.7 bln; and after 2010 – USD 274.8 bln¹.

In Russia, the relative weight of government expenditures on the first stage of anti-crisis measures has been estimated at 15% of GDP – one of the highest rates in the world. Yet, the results of such measures have fallen short due to the misguided macroeconomic strategy resulting in severe turbulence on the financial market, which remained inaccessible to enterprises within the real sector. What has evolved is a ***vicious circle***: the issuance by the Central Bank of cheap loans to a group of commercial banks – their conversion into dollars and euros (Diagram 35) – the contraction of currency reserves – devaluation of the ruble – growing inflation – rising refinancing rates (as a countermeasure) – loan appreciation – production declines – and the specter of continuing devaluation –

¹ V.I. Maevskiy; Real Sector and the Banking System – <http://www.econorus.org>

Diagram 35

**Net capital flow (in USD blns) and support for bank liquidity
by monetary authorities (USD blns)**



Source: Center for Macroeconomic Analysis and Short-Term Forecasting

This circle could be broken by locking-in the currency position of commercial banks. The export of capital abroad could be significantly reduced and complicated by the reinstatement of basic currency-control regulations. As A.D. Nekipelov fairly writes, “clearly, restrictions on capital exports, a return to the practice of the hundred-percent sale of hard-currency proceeds by exporters, and pegging of the ruble exchange rate would stabilize the situation in the monetary arena at a minimum currency-reserve cost. This would avoid the necessity of implementing a policy of high interest rates.”¹

According to estimates by A.D. Nekipelov, “a policy of soft ruble devaluation has cost the government USD 210 bln, which is equivalent to the value of 800 mln tons of oil it takes our country more than 1.5 years to produce. Establishing an exchange-rate corridor is fraught with the potential for constant speculative attacks on the ruble and the spending of tens of billions of new dollars

¹ A.D. Nekipelov; Crisis in Russia: Development Logic and Economic-Policy Options – <http://www.econorus.org>

in currency reserves.”¹ As I.S. Korolev notes, “a soft reduction in the ruble rate doesn’t give domestic industry any of the price advantages offered by a sharp and instantaneous devaluation, while simultaneously leading to a gradual increase in operating costs. Such a policy also results in a re-dollarization of the economy, artificial import stimulation and capital flight, and deteriorating borrowing terms for the real sector.”² Moreover, commercial banks would be forced to pass the credits emitted by the CB onto enterprises in the real sector if they were secured by their promissory notes rather than unsecured.

Today, continuation of the monetary-policy approach to fighting inflation is provoking formation of the *next vicious circle*: the slashing of federal and regional budgets – reductions in final demand – further production declines – growing arrearages – surging inflation – shrinking real earnings – reduced demand

The Russian economy experienced such a spiral of production contraction and demonetization of the economy as a result of monetary methods of battling inflation in the first half of the 1990s – with disastrous results. Today, we risk repeating them if we follow the path of reduced government spending. After pumping the banking system with more than RUB 3 trillion in credits, attempting to save RUB 1–2 trillion by cutting back on critical government spending is clearly irrational. Particularly given the fact that monetary emissions to finance budgetary expenditures designed to revive the economy are more effective than spending to support banks.

Unlike the behavior of commercial banks, budgetary expenditures are tightly controlled by the treasury and cannot be used for unintended purposes. They remain in commercial circulation, thereby facilitating monetization of the economy and support for production. That said, as indicated by the experience of the 1990s, every RUB 1 in government-spending cutbacks leads to RUB 5–6 in new arrears, provoking the destruction of engineering-and-manufacturing ties and production declines³.

¹ A.D. Nekipelov; Crisis in Russia: Development Logic and Economic-Policy Options – <http://www.econorus.org>

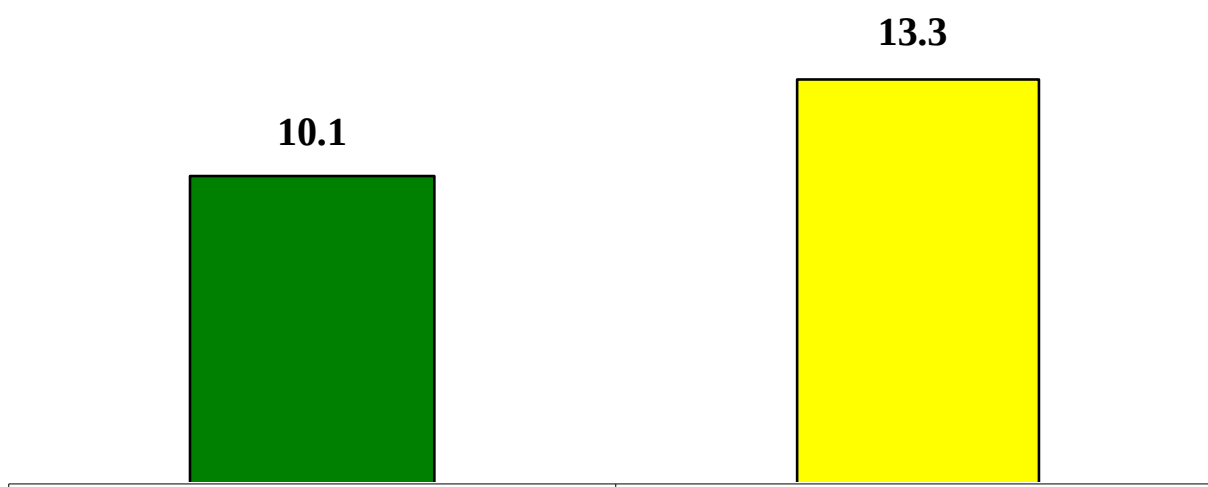
² I.S. Korolev; Is Russia Suffering Most of All from the Global Crisis? – <http://www.econorus.org>

³ V.E. Dementiev; Long-Waves of Economic Development and Financial Bubbles / Pre-Print #WP/2009/252 – M.: RAS CEMI, 2009.

It should be noted that the vicious circles of anti-crisis policy are the logical continuation of the vicious circles outlined above that formed at the previous stage of macroeconomic policy. The most consequential of these was the vicious circle of foreign borrowing, which emerged as a result of the strict pegging of ruble emissions to the purchase of dollars and euros in the currency reserve under the quantitative restriction of money-supply growth: excess supply of petrodollars – emission of rubles for their acquisition at a reduced ruble rate on top of established restrictions – sterilization of the money supply – overstatement of the refinancing rate – switching of Russian organizations to foreign sources of cheap credits – increased supply of foreign currency – ...

One consequence of this vicious circle was the pegging of ruble emissions to foreign credit sources, which rendered the Russian financial system heavily dependent on external conditions and made us extremely vulnerable to the serious consequences of the global financial crisis. Suffice it to say that by the onset of the crisis, more than half of the money supply in the Russian economy had been formed under foreign credits (Diagram 36). Thus, their outflow led to the automatic collapse of the Russian financial market. A combination of ruble devaluation and climbing refinancing rates is renewing this vicious circle and dragging the Russian economy into a new spiral of unequal exchange (in which the net loss to the Russian economy totaled approximately RUB 50 bln annually in the pre-crisis period)¹.

¹ S.Y. Glazev; Anti-Crisis Measures: Missteps, Conclusions, Proposals. // Economics of Modern Russia; No. 2, 2009.

Diagram 36**Corporate external debt and M2, RUB trillions****Corporate external debt**

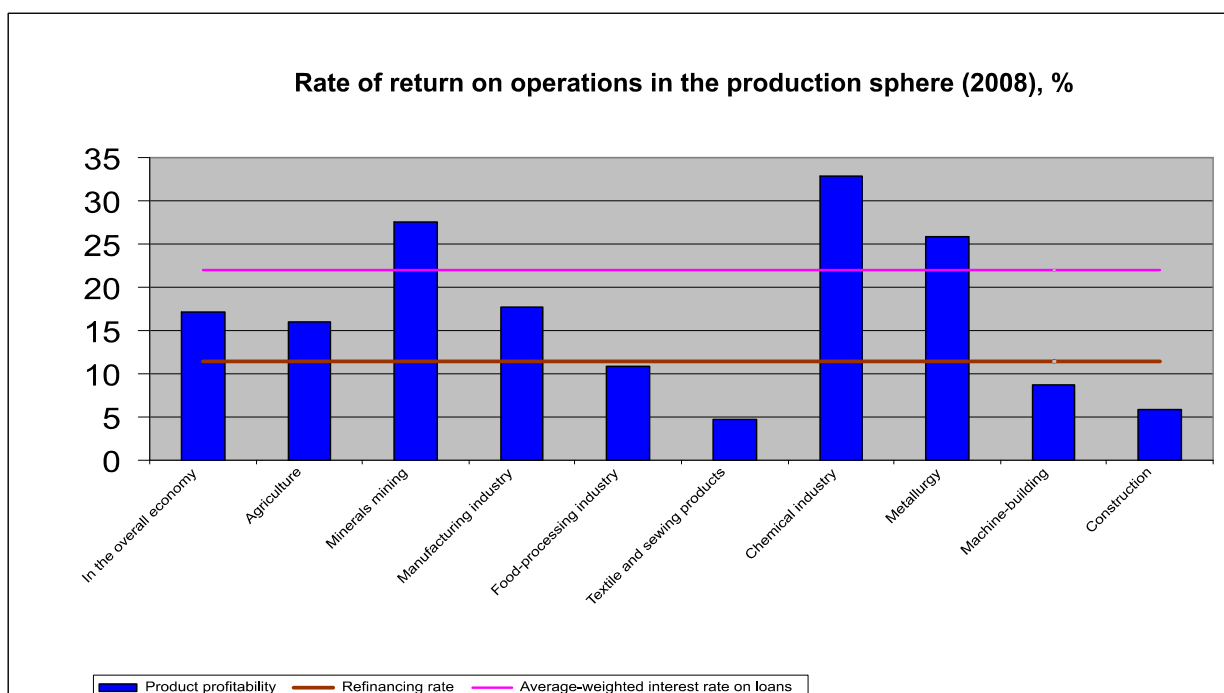
Source: M. Ershov; Financial Mechanisms of Economic Growth. Materials based on remarks at a meeting of the SUM (State University of Management) Academic Council, 2008.

As many experts warned, liberalization of the capital account in 2004 under conditions of the ultra-high profitability of financial assets and fixing of the ruble rate led to expansion of the speculative component of the financial market and its increased susceptibility to systemic risks². The excessive openness of the Russian economy and the pegging of domestic sources of monetary supply to the acquisition of foreign currency led to its extreme vulnerability to fluctuations in the foreign-economic environment. As was previously mentioned, countries unlike Russia that managed to preserve currency control – China, India etc. – were in a position to protect their financial systems from the blows of the financial crisis. They continue to expand production and actively beef-up investments and spending to stimulate innovational activity, implementing a strategy of faster development.

² V.M. Polterovich; Mechanism of the Global Economic Crisis and Problems of Technological Modernization; A.D. Nekipelov; Crisis in Russia: Development Logic and Economic-Policy Options; Y.M. Mirkin; Post-Crisis Development Strategy for Russia's Financial Sector – <http://www.econorus.org>.

Unlike the practice found in developed countries of regulating the money supply by pegging the refinancing rate to the economy's credit requirements, the money supply in the Russian economy is determined by net capital inflow and the strategy of building-up gold and foreign-currency reserves, while credit demand is largely satisfied by foreign borrowing. For Russia's existing currency-and-financial system, which has resulted from the country's monetary policy, more typical are climbing interest rates, which cut enterprises in most industries of the real sector off from access to credit (Diagram 37). Under its continuation, falling world prices for raw materials lead to reduced economic activity and the contraction of investment sources. In the absence of domestic sources of refinancing, the banking system contracts and Russian enterprises deprived of loans become insolvent, with the exception of enterprises within the mining industry and chemico-metallurgical complex. The logical result of such a monetary policy is primitivization of the economy and its raw-materials specialization.

Diagram 37



Under the crisis-driven contraction of the total book value of the Russian stock market to USD 300 bln, the threat of the transfer of the pledged assets of Russian companies into the ownership of foreign creditors arises: of the USD 450 bln in total medium-term debt, no more than half has been secured via the capitalization of pledged assets². This threat is intensified with respect to the entire Russian economy due to the growing monetization of the financial pyramid of American debt securities, accompanied by the simultaneous sharp growth in the emission and export of dollars beyond the US for the acquisition of tangible assets. In the absence of measures to insulate its financial system, the Russian economy will be absorbed by foreign capital and robbed of its capacity for independent development, condemning it to a deteriorating position under any scenario for the continued unfolding of the global crisis.

These were precisely the results produced by following such a policy, as urged by the IMF, during previous financial crises. Under conditions in which monetary emissions are pegged to the acquisition of foreign currency, the outflow of foreign capital paralyzes the financial system, leads to arrears between enterprises and to the budget, uncontrolled devaluation of the national currency, loss of the liquid portion of currency reserves, production declines and runaway inflation. Greatly-undervalued assets are then scooped up by foreign capital, and the national economy loses its independence and falls under the sway of transnational corporations linked to foreign emission centers.

As D. Mityaev rightly points out, there is no doubt that reintroduction of the policy of macroeconomic stabilization by monetary methods (fighting inflation by “sterilizing” the money supply and cutting back on government spending) will lead to the consequences already seen on a regular basis in dozens of other countries: worsening of the economic slide, paralysis of the banking system, and reducing the range of opportunities to the “mail slot” of foreign-debt expansion¹.

² D.A. Mityaev; Implosion Dynamics of the Global Financial System (Scenarios and Strategies). Adaptation Opportunities and Strategy Choice for Russia. Mock-Scenario Presentation. M.: 2009.

¹ D.A. Mityaev; Implosion Dynamics of the Global Financial System (Scenarios and Strategies). Adaptation Opportunities and Strategy Choice for Russia. Mock-Scenario Presentation. M.: 2009.

Particularly detrimental to the outlook for the country's future development are spending cutbacks on science and innovation support. While the US, China and the world's other advanced countries are busy organizing their long-term strategic-planning systems and ramping up spending on scientific research in the key areas of the emerging technological mode, Russia is cutting back on such spending and therefore missing opportunities to achieve faster development.

9.2. Management issues

Unlike the liberal doctrine, which demands nothing from officials other than lofty phrases and obtrusive PR campaigns, conducting a development policy is impossible without scientifically-grounded decisions, highly-qualified management and a responsible and creatively-active civil service. It must be acknowledged that the inefficiency of Russia's current system for management of the national economy and the corruption of its civil service are incompatible with the requirements of an innovational economy. The latter requires high-quality and transparent regulation, which demands that civil servants and managers take a creative and highly responsible approach to the task at hand.

Conducting an effective anti-crisis strategy presupposes beefing-up the demands placed on the management corps, and introducing rigid mechanisms of responsibility for the achievement of target indicators and competition for the attainment of objective results. The wide-scale replacement of enterprise directors occurring in recent years in both the private and public sectors has not led to an overall improvement in management quality – the new directors trail their predecessors in terms of their understanding of production technologies and ability to organize the manufacture of high-tech products. Hired on the strength of personal ties, many top-managers at Russian enterprises bear no personal responsibility for the results of their performance.

A separate problem is the excessive bureaucratization of the government-regulation system, coupled by its extreme inefficiency. For example, the tax-collection rate per tax-service employee, customs-declaration processing speed, and GDP volume per civil servant are all much lower in Russia than in the US or

the EU. Transition to a path of innovational development is being hindered by impassable administrative barriers to the expansion of new technologies, based on the unprofessional application and arbitrary interpretation of the provisions of technical and tax regulation, export and customs control.

A prime example of this phenomenon is the longstanding disregard by the Federal Public-Health Oversight Service for the many applications filed by Russian researchers to conduct clinical testing on the use of a person's own stem cells, collected from adipose tissue, in regenerative medicine. As a result of the incompetence of bureaucrats, Russia is losing an opportunity for faster development of one of the most promising areas of medical progress, poised to create tremendous advancements in the efficacy of the treatment of many diseases.

Clearly, Russia's administrative system is ill-suited to modern requirements. Its fatal flaw, incompatible with the culture of innovational management, is the corporate-clan principle of staffing policy at every level of the chain of authority. Bureaucrats hired according to the principle of personal loyalty and insulated by the code of silence are geared towards observing subordination, maintaining the status quo, and minimizing career risks. They are averse to assuming responsibility for their decision-making and unmotivated to tackle the complex challenges of economic recovery and development. The challenges are massive, and require high qualifications, extensive knowledge and exceptional organizational skills. Among them: modernization and outpacing development of the Russian economy based on the new technological mode; transition to a knowledge-based society; restoration of a single economic space within the CIS and improving the competitiveness of domestic enterprises to international standards; creation of an attractive image for Russia as a world power with its own vision for the new world order. The experience of recent years has raised doubt as to the ability of today's ruling elite – not only to address these challenges, but simply to frame them properly.

A prime example of this problem is the utter failure of all attempts to revive the domestic civil aircraft-engineering industry, which is a critical element of the emerging technological mode. Russia inherited everything it needed for success

from the Soviet aviation industry: a modern engineering-and-manufacturing complex, an advanced science-and-technology base, a well-organized specialist-training system, and broad, state-regulated demand for ready-to-go and highly-competitive new aircraft models of every type. Yet, in the past decade and a half, it has proven impossible even to implement the basic development of this R&D-manufacturing potential. Our current models are not in demand, and state-run Aeroflot has taken to leasing imported planes, in gross violation of the government's own directive to acquire domestic equipment. That said, discredited directors continue to manage the sector and earn astronomical salaries, without bearing any personal responsibility whatsoever for their failure to meet government-set goals.

In order to assess the relative competence of today's directors of the Russian aviation industry, let us imagine for a minute that the Chinese had acquired such going concerns as Aviastar, the Tupolev Engineering Center, and the aircraft-manufacturing plants in Voronezh and Kazan back in 1992. Would the Chinese have flown on imported planes if they had had anything like the Tu-204, Tu-334 or Il-96? Would the US or the EU have been unable to launch the commercial production of already-certified and ready-to-fly advanced models in a decade and a half? Would the managers in charge of such failures still be in their jobs and raking in astronomical salaries? We've seen how the EU leadership reacts to even a six-month delay in the production-launch of new models...

Unfortunately, the collapse of the civil aircraft-engineering industry is typical of Russia's current business-management practices, in both the public and private sectors. An analogous situation exists in machine-tooling, shipbuilding, automaking, the atomic industry, electrical engineering and other sectors within the high-tech industry. Inefficient management in the gas, oil, metallurgy and other raw-material economic sectors prior to the crisis was masked by the exceedingly-favorable pricing environment. Incompetent "top-managers," appointed to their positions on the basis of personal loyalty, bear no personal responsibility for their inevitable work failures. Thus, even in the best case scenario, they prefer to do

nothing at all, in the worst – to exploit their professional positions for personal gain. It's sufficient simply to recall some glaring examples of the disastrous consequences of incompetent management decisions: the bankrupting of the state's financial system in 1998, the fraud involved in developing the infrastructure for the Moscow-St. Petersburg high-speed railway (of which only the excavation pit in St. Petersburg remains), and the restructuring of RAO UES, after which electric and heating bills underwent a five-fold increase, a series of manmade disasters ensued, and the economy began to suffocate from a lack of power capacity. The "top-managers" responsible for these colossal failures not only went unpunished for the damages they inflicted on the state and the entire country – they were treated with tremendous consideration and received substantial promotions.

Under this style of management, the country is doomed to further degradation. The signals sent out by the country's leadership are lost in the maze of the power vertical, while initiatives wane in the bureaucratic swamp of incompetent and irresponsible – but personally-loyal – top management. One can hardly count on successful investments in a knowledge-based economy under a neo-feudal system of management. The foundation of staffing policy should rest not on personal loyalty but competence, not on the code of silence but personal responsibility, not on family-clan relations but on business and professional reputation. The brilliant Prokhorov study of the Russian management culture indicates that when bureaucratic-clan, familial, mafia or other relations excluding managerial competition have dominated power structures, the country's economy has devolved. Conversely, periods of economic growth have always been associated with the creation of a highly-competitive managerial environment at every level of administration.

The management system must be updated with a mechanism for competition among – and the selection of – executive staff based on their achievement of objective results. There can be no responsible, competent management without it. But such a mechanism is unlikely to evolve given the current political order. Without true choice, without real opposition, and without parliamentary control

over executive power, it remains impossible to create a competitive managerial environment or build an effective 21st century system of national administration.

The main obstacle to improving the current system of administration is its inability to objectively evaluate the consequences of its decision-making and thus to correct its mistakes. The sheer number and consequences of the latter create threats to the country's economic security that are plainly obvious to all specialists other than the senior officials involved in the decision-making. A typical example of misguided decision-making with monumental negative ramifications is the abolition of currency control two years following the bankrupting of the state in 1998, leading to legalization of the export of hundreds of millions of dollars, just as Russian enterprises desperate for loans to modernize were left without access to credit or forced to borrow abroad. As a result, Russia was left highly susceptible to speculative foreign-capital attacks and suffered more than other countries during the global financial crisis.

Under the right monetary policy, the Russian economy wouldn't be so vulnerable to the foreign-economic environment. If the Central Bank were to normalize the refinancing of commercial banks, at least under the promissory notes of export-oriented enterprises secured by reliable hard-currency contracts for the supply of energy commodities and raw materials, said enterprises wouldn't need foreign loans – they would be able to access cheap credit resources from domestic sources. Moreover, there would be no need to pay interest to foreign banks and there would be no crisis stemming from the depreciation of security values and withdrawal of foreign loans. Our economy would have been in a position to shield itself from the global financial crisis and retain more of the foreign-currency reserves it had amassed.

Just before the crisis broke out, ambitious plans to elevate Russia to the European standard of living by 2020 were announced. By that point, the Russian economy was to have been thoroughly modernized, resting on a foundation of advanced technology, and be competitive across a whole range of sectors in the high-tech industry. A concept and outlook for the country's socio-economic

development had been formulated, geared towards the achievement of the aforementioned goals. Yet, these plans fell by the wayside under the adoption of anti-crisis measures, insofar as they would entail restructuring the entire system of state administration on the principles of personal responsibility, competitiveness and objectivity.

Under the right economic policy, it remains possible to assume a trajectory of faster growth and achieve the timely development of the country's science-and-technology advantages in the key emerging areas of the new technological mode. But there's no time left for wavering. In the past decade and a half of economic destruction and popular demoralization, the country has suffered greater total human and material losses than the damage sustained during the Great Patriotic War. Degradation of the Russian economy and destruction of the spiritual matrix of Russian civilization have simply gone too far. Russia's successful development in the context of the restructuring of the global economy on the basis of the new technological mode will require rebuilding the entire system of national administration: abandoning the cozy neo-feudal staffing policy, ridding the corridors of power of corruption and incompetence, opening them to new, highly-qualified personnel, and introducing mechanisms of direct personal responsibility and competitiveness among administrators at every level of the power vertical.

The societal consolidation necessary for the mobilization of forces will require a dramatic transformation of the state's attitude towards society. The country's citizens must be allowed to participate in governance and given the opportunity to exercise control over the power of the authorities. This will require not only the restoration of genuine voting rights, but also the introduction of a feedback mechanism that allows common citizens to demand the ouster of any unscrupulous bureaucrat. The administratively-corrupt coalescence between bureaucracy and business must be dismantled by calling the latter to open and responsible cooperation in the goal-setting and implementation of government policy. The participation of authoritative scholars in the adoption of strategic decisions must be radically increased. Obeisant government analysts who have

been lured by foreign funds should be replaced with recognized academics and specialists, with the Russian Academy of Sciences assuming the role of the primary institution for scientific inquiry and decision-making support in the system of government administration.

9.3. Prospects for growth

Although Russia has suffered more than most countries from the global crisis, and despite its shrinking resources (currency, manufacturing, administrative) and reductions in earnings and economic activity, it is objectively much less dependent on the world financial market than the proponents of international capital would have us believe. By natural-resource, military-political, engineering-and-manufacturing and other material indicators, Russia's weight in the global economy appears much more imposing than it does according to financial parameters. Thus, it is objectively much less vulnerable to the financial crisis than countries with well-developed financial markets. That said, these advantages are becoming more evident as the crisis deepens.

Existing capacities in the atomic, rocket-and-space, aviation and other high-tech industrial sectors, as well as in molecular biology, genetic engineering, nano-, bio-, and information technologies give Russia significant competitive advantages for faster development of the new technological mode and decent chances to take the lead in a number of areas under the emergence of the next long-wave of economic growth. Utilizing these chances, however, will entail the vigorous ramping-up of investments in the respective fields.

It must be stressed that no real anti-crisis strategy can be developed within the framework of the previous liberal and monetary macroeconomic policy. International practice indicates that the goals associated with overcoming the crisis cannot be achieved solely via the free capital market – particularly such a marginal market as ours. As Y.M. Mirkin notes,² the Russian capital markets are simply too

² Y.M. Mirkin; Post-Crisis Development Strategy for Russia's Financial Sector – <http://www.econorus.org>.

small, speculative, dependent on funding by non-residents, volatile and inaccessible to the majority of manufacturing enterprises. The domestic market, pressured by foreign competition, is unable to address the challenges of modernizing the economy and bolstering its high-tech sectors without a targeted government development policy. Commercial banks cannot independently raise their capital to a level that adequately addresses the needs of the real sector. Thus, the objective need arises for government programs of financial support for high-priority sectors, regions and small business, and for the state stimulation of demand for domestically-produced goods.³ As was previously mentioned, a system for the refinancing of commercial banks secured by the credit instruments of manufacturing enterprises is also needed.

In order to reach a trajectory of faster innovational development, the government needs to create conditions under which:

every enterprise with the capacity to develop new technologies in promising areas of economic growth has access to long-term credit;

any scientific-research group developing new technologies can receive financing for projects envisioning their practical implementation;

scientists working in the key areas of the new technological mode and institutions of higher education training specialists in the respective field receive sufficient financing for the full realization of their creative and educational potential;

every firm developing new technologies has access to loans for the necessary R&D activities and to state-regulated sales markets for their products;

consumers are interested in acquiring new domestically-manufactured high-tech products;

business entities have convenient access to science-and-technology information and are in a position to assess the development outlook in their field of operations and absorb cutting-edge technologies in a timely fashion.

³ *ibid.*

Under the right policy, Russia could use the crisis to significantly improve its standing in the global economy, having achieved:

- 1) outpacing development of the new technological mode and economic recovery on the long-wave of growth it produces;
- 2) a manifold capacity expansion of the domestic banking-and-investment system;
- 3) economic stabilization and creation of sustainable-development zones within the EAEC (Eurasian Economic Community) and, given the right political conditions, the CIS.

Under all of the scenarios for the global crisis, the opportunities for development of the Russian economy will depend more on domestic economic policy than on external factors. In order to formulate an effective anti-crisis strategy geared towards achieving these three goals and setting the Russian economy on a trajectory of faster growth, the opportunities, restrictions, and patterns for the development of Russian engineering-and-manufacturing potential must be clearly understood.

CHAPTER 10. MAIN THRUSTS OF THE ANTI-CRISIS STRATEGY FOR DEVELOPMENT OF THE RUSSIAN ECONOMY

In order to achieve faster emergence of the new technological mode and economic recovery on the long-wave of its growth, mechanisms must be envisioned that direct state-issued credit resources towards the financing of economic modernization on the basis of the new technological mode. This means that measures designed to overcome the crisis must be aimed at ensuring formation of the domestic innovational system and a rapid intensification of innovational activity. Anti-crisis measures must be combined with a strategy for long-term socio-economic development, for whose implementation the government has never had enough money.

When planning anti-crisis policy, it must never be forgotten that the main factor for modern economic growth is science-and-technology progress (STP),

which, in turn, is determined by society's intellectual potential. Taking an innovational path to development and transitioning to the knowledge-based economy characteristic of the new technological mode assumes top-quality human capital – capital advanced countries spend the bulk of their national income to develop. An important element of labor and human resources is the national spiritual culture, which is of tremendous significance to labor motivation and largely determines the effectiveness with which national manufacturing potential is utilized.

10.1. Aligning economic management with Russian cultural values as a condition of economic recovery

Despite the severe destruction of R&D-manufacturing potential, the Russian cultural matrix contains favorable prerequisites for intensifying innovational activity and making a technological leap on the next long-wave of economic growth. Its characteristic values fit nicely with the management paradigm of the 21st century. This is evidenced by the scholarly and spiritual legacy of Russian philosophical thought.

In contrast to the Western rationalism of the late 19th-early 20th centuries, the works of Russian scholars (V. Vernadsky, N. Fedorov, L. Chizhevsky, etc.) laid the foundation for the idea of noospheric global development, which experts view today as the key to formulating a strategy for the future socio-economic development of humanity. According to the conclusions drawn by A.S. Panarin, “along with a system of instrumental knowledge, humanity needs a corrective and guiding system of rule-forming knowledge, whose purpose is to keep mankind from engaging in destructive types of activity or prevent productive activism from becoming destructive.”¹ This conclusion is affirmed by other researchers, “The future civilization of the world is humanitarian-technical, with a development vector that points towards spirituality and humanism. Right before our eyes, suffering is giving rise to a new paradigm of social development, in which the goal

¹ Theory and Practice of Knowledge-Based Economics and Sociology / Science Council under the Fundamental Research Program, Presidium of the Russian Academy of Sciences “Economics and Sociology of Knowledge”; – M.: Science, 2007, pg. 56.

of human existence is the creative development of each and every individual and the full self-realization of their essential strengths. This is precisely where the new sources of social progress lie – the keys to development of the global community as a whole and each individual state choosing the concept of spirituality and knowledge over the concept of consumption for its development...”¹

Unfortunately, the comparative advantages of Russian cultural values were disregarded by reformers, who directed social energy towards destroying the “old world” and looting state property instead. Running counter to Russian cultural and spiritual traditions, reformation of the Russian economy and society was based on principles of market fundamentalism that provoked anti-social forms of entrepreneurial behavior. Instead of creative initiative and socially-beneficial activity, the road to riches was laid through the asset-grabbing of state enterprises in which criminals, corrupt officials and mafia structures came out on top. Honest work, qualifications and manufacturing experience lost all value.

The reasons for the acute degradation of the Russian economy lie entirely within the business-management structure that evolved as a result of reforms. The objective state of the Russian economy’s R&D-manufacturing, human and natural-resource potential did not foreshadow such a precipitous decline in economic activity and investment, whose level remains well-below pre-reform indicators. The export of a trillion dollars in capital and the emigration of several million qualified workers evidence the inability of the country’s system of economic management, as put in place by reformers, to capitalize on existing opportunities for economic growth. Instead of formulating creative motives for socially-beneficial economic activity, government policy prompted entrepreneurs to appropriate what wasn’t theirs – not to create new wealth but to redistribute that already created. This excluded the opportunity to formulate an intellectual style of management and thus the transition to an innovational path of development.

Under the initial capital accumulation that occurred in Russia via the bureaucratic asset-grabbing of state property, people unburdened by moral

¹ V.N. Ivanov, A.V. Ivanov, A.O. Doronin; Management Paradigm of the 21st century – Volume 1; M.: Moscow State Industrial University; 2002, pp. 117, 120.

principles emerged with a competitive advantage: capable of bribing officials, terrorizing directors, putting staff in its place and, where necessary, destroying the competitors. The commercially-successful (and therefore dominating throughout the course of reforms) examples of entrepreneurial behavior were determined more by criminal experience than by creative motives.

The traditional Russian business culture and examples of pre-revolutionary entrepreneurship were not just disregarded but discredited by liberal reformers. Being honest, responsible, law-abiding, fair and conscientious became not just disadvantageous but absolutely unacceptable from the standpoint of running a successful business. Coming out on top were unprincipled, greedy, and, as a rule, ignorant opportunists who bought-off bureaucrats, cheated the government, “shafted” their partners, blackmailed enterprise directors, spurned workforces – and ultimately proved themselves incapable of managing high-tech production. In the end, economic management was highly criminalized, with the positive qualities of Russian business culture squeezed out of the bureaucratic-camp criminal landscape. According to Plato’s classic classification, the management style emerging in Russia should be regarded as a timocracy (rule of the inferior and mercenary). Transitioning from such a structure to democracy, understood in the Russian tradition of political science as rule by the people, is now much more difficult than before, insofar as it will entail overcoming the opposition of the criminalized and cynical ruling elite that runs counter to the interests of the people.

The fundamental reasons for the sharp decline in the competitiveness of the Russian economy lie in the criminalization and degradation of the business culture. So long as excess profit leads not to improved manufacturing efficiencies and the qualitative satisfaction of societal needs but to the looting of enterprises, conning of partners and liquidation of competitors, economic development will remain out of the question. Not surprisingly then, what we’ve been witnessing for a decade and a half now instead of such development has been deepening degradation, capital exports, the emigration of those who see no outlet for their talents at home, the merciless exploitation of the country’s natural-resource and human potential,

and the appropriation of national wealth by criminal structures.

Thus, the policy implemented in the Russian economy has led to the emergence of a highly-inefficient business system thoroughly ill-suited to the modern patterns of economic growth and the values-based motives and stereotyped behaviors of the vast majority of the population. It is a business system that gears entrepreneurs not towards creative, socially-beneficial activity but towards embezzlement, provoking an endless “war of all against all”. It discredits traditional moral values and spurs the criminalization of economic activity. It suppresses the creative energy of citizens, drives their alienation from the state, leads to destruction of the country's R&D-manufacturing potential and degradation of its human potential, and undermines the competitiveness of the national economy.

The stage of the parasitic appropriation of the socialist heritage is coming to a close, raising a question critical to the formulation of anti-crisis policy: which spiritual ethos will emerge to guide people’s economic behavior? The cult of the Golden Calf is unlikely to become the new religion of our people, most of whom embrace the Orthodox Faith, now experiencing a renaissance, or communist doctrine. If we proceed from the trend towards Orthodox self-identification by a growing percentage of the Russian population, modeling of compatible economic behavior should feature an analysis of the influence of the Orthodox worldview on the motives and limitations of such behavior. A suitable foundation would be the Code of the Ethical Principles and Rules of Economic Management developed by a group of scholars and theologians under the auspices of the Moscow Patriarchy of the Russian Orthodox Church (ROC) and approved by the World Russian People’s Council.⁹³ In due consideration of the fundamental importance of the principles it contains, we shall delve into the extracts therefrom of greatest significance to the present study.

⁹³ “Code of the Ethical Principles and Rules of Economic Management” – Concluding Document of the VIII World Russian People’s Council; Adopted at the Final Plenary Session of the Council.

As the authors state, the Code of Ethical Principles and Rules outlines the ideal business model – one which does not currently exist, but one towards whose materialization we can and should strive in our daily lives...

The spiritual underpinning of economic behavior that coincides with the distinctly-Russian worldview differs from both liberal doctrine and its criminalized manifestation existing in the contemporary Russian reality. This goes a long way to explaining the rejection by most Russians of the ultra-liberal reforms that legalized amoral and largely-criminal forms of enrichment via embezzlement. The vast majority of Russian citizens turned down their ticket to “market paradise,” selling their privatization vouchers for a pittance and refusing to be seduced by promises of “popular” capitalism. They did so not by folly, but by their rejection of the methods of personal enrichment via the embezzlement of state property proposed by liberal reformers.

The Russian spiritual tradition is filled with profound meaning, a key element of which is creative activity for the common good and manifestation of the principles of truth and justice. The doctrine of vulgar liberalism, imposed from without and enthusiastically co-opted by oligarchs and corrupt officials alike, thoroughly contradicts this tradition. Our society does not tolerate criminal methods of personal enrichment, insultingly low wages, or the oligarchical bacchanal of those elbowing their way to power in the face of the mass poverty of the working population. A consequence of the discord between the spiritual tradition rooted in popular consciousness and daily practice has been the epidemic of socially-driven diseases, the sharp decline in life expectancies, and the anomalously-high levels of crime and psychiatric disorders.

The contradiction between spiritual tradition and practice can be resolved one of two ways. Either the spiritual tradition will be broken by the dominant economic practice, or the latter will be brought into conformity with spiritual tradition.

The first scenario would necessarily entail the final replacement of the ethical principles of economic management listed above with the cult of the Golden Calf, with its characteristic war of all against all, social irresponsibility and

the dominance of amoral and criminal methods of personal enrichment through embezzlement. Examples of such stereotypical economic behavior are provided by the underdeveloped countries of Africa and Latin America, with their characteristically-inefficient market mechanisms and corrupted institutions of state regulation. Under this scenario, Russia can anticipate worsening popular demoralization and decay, the further degradation of its manufacturing potential, and having its economy relegated to the role of a raw-materials colony for more advanced countries.

Under the second scenario, it would be possible to build an efficient economic system driven by the creative motivation of tens of millions of well-educated and employable citizens. Moreover, in the context of the shift of the global economy to an innovational development path dominated by STP as the main engine of economic growth, the specific features of the Russian spiritual tradition give the country fundamental competitive advantages. First and foremost, this entails the Russian culture's tendency towards the dominance of the spiritual over the material, the eternal search for truth, the drive to create and the capacity for collective intellectual labor. These qualities are ideally suited to the challenges of the modern knowledge-based economy, in which the key to success is the ability to create and develop cutting-edge technologies. The country's remaining scientific and intellectual potential could serve as the basis for the swift recovery of the Russian economy – provided favorable conditions for its activation are created. This would require implementation of the respective socio-economic policy, geared towards activation of the national economy's remaining comparative advantages.

The disconnect between today's dominant style of management and generally-accepted moral values is leading to reduced management efficiency – in both the public and private sectors. In order to build an efficient economic system driven by the creative motivation of tens of millions of well-educated, employable citizens, dominant economic practice must be brought into line with the country's spiritual traditions.

As was repeatedly indicated above, assuming a trajectory of stable economic growth and social welfare is only possible on the basis of a manifold increase in

innovational and investment activity, a radical improvement in the quality of government regulation, and a fostering of people's occupational, creative and entrepreneurial energy. To this end, Russia's socio-economic policy must have a spiritual core that reflects national cultural traditions. At the very least, the policy must be well-formulated and well-understood by citizens, and geared towards achievement of the socially-important goals they share. Activation of the country's intellectual potential assumes creation of the respective moral climate. Of fundamental importance to the average Russian is the sense that the social order is just – that it coincides with his concepts of fairness, rationality and practicality. Without restoring fairness in the distribution of national wealth and income, overcoming the corruption of state power, and purging the economy of organized crime, securing a new economic recovery will remain elusive.

In order to build an effective system of economic management consistent with the spiritual traditions and moral values accepted in Russian culture, the fundamental principles of state socio-economic policy must be thoroughly reconsidered. Inter alia, economic policy must reject market fundamentalism, staffing policy must reject the code of silence and nepotism, and management practice must reject the cult of all-permissiveness and self-enrichment. The key Russian cultural norms of social justice in the distribution of national income and wealth must be reinstated. In particular, this means:

- reviewing the outcome of privatization, entailing the voiding of illegal transactions and payment of a progressive compensating tax commensurate with the increase in the market capitalization of privatized property at the moment of its transfer on the secondary market;
- restoring citizens' pre-reform savings;
- switching to a flexible monetary policy geared towards the economy's need for long-term loans to develop production and support a high level of innovational and investment activity;
- conducting a strict anti-monopoly policy and radically improving the performance of state-run natural monopolies;

- o reintroducing the progressive income-tax scale;
- o bringing the minimum wage into line with the actual subsistence rate;
- o transitioning to the regulated planning of social spending based on the standards commonly-accepted in advanced countries and national traditions;
- o ensuring citizens' right to a free higher education;
- o returning to the public ownership of natural resources;
- o introducing a mechanism for efficient natural-resource use featuring a scientifically-grounded system of fines for environmental pollution and the state collection of natural-resource rent;
 - o instituting the personal responsibility of civil servants for the proper performance of their official duties, including the right of citizens to force the ouster of unscrupulous bureaucrats in court;
 - o introducing the political responsibility of the federal executive branch for the people's standard of living.

Clearly, implementation of these principles will entail the necessary political will and a consistent policy of pursuing public interests, which the oligarchy – long used to getting away with anything – will oppose. Overcoming this opposition will not be possible without the involvement of citizens in the processes of economic and state management, the restoration of their voting rights, the implementation of democratic forms of political order, and the creation of mechanisms for the government's responsibility to society.

As a result of the disconnect between the government's chosen policy and the fundamental Russian cultural values of fairness, rationality and practicality, the people's reaction to the looting of the country and the monstrous unfairness of the socio-economic system emerging from "liberal" reforms was an epidemic of drunkenness and drug-addicted youth, as well as sharp increases in the crime and suicide rates. People would prefer to drink themselves to death rather than agree to work for miserable wages just to enrich the "new Russians" embezzling the country's public assets. Tens of millions of well-educated and highly-qualified people found themselves at the "social bottom," having lost the meaning of their own existence.

Russia's current system of economic management has no future. Preserving it will only condemn the country to constant internal strife and external dependence, the country – to degradation, and the people – to extinction. In order to avoid this fate, radical changes to the entire system of economic relations and the government's economic policy are needed. These changes must bring the system of economic management into alignment with both traditional moral values, by activating the “human factor”, and with the patterns of modern economic growth, by activating the country's R&D-manufacturing and intellectual potential. The opportunity to address this challenge is rooted in the fact that the moral values and stereotypes of entrepreneurial activity traditionally characteristic of the Russian business culture are ideally-suited to the requirements and conditions of modern economic growth. The country's remaining scientific and intellectual potential could serve as the basis for the swift recovery of the Russian economy, provided favorable conditions for its activation are created.

10.2. Pre-conditions for recovery of the Russian economy on the next long-wave of economic growth

As was previously mentioned, only Russia's outpacing development of the industries at the core of the new technological mode will permit the country to achieve high and stable rates of economic growth over the long-term. Among the pre-conditions Russia currently enjoys to implement this strategy, of particular significance are:

- high level of public education;
- well-developed R&D-manufacturing potential;
- mature engineering-and-manufacturing structures across a range of industries within the current and approaching technological modes, domestic schools of science and unique cutting-edge technologies;
- wealth of natural resources satisfying the bulk of the country's domestic raw-material and energy-commodity consumption needs, as well as a stable inflow of foreign-exchange receipts;
- vast territory and a receptive internal market, supporting a wide variety of daily activities and public needs;
- corps of scientific researchers capable of switching to the commercial sector under the implementation of fundamental discoveries;
- participation of Russian researchers in international science-and-technology cooperation, thereby heightening their access to the results of advanced research;
- emergence of companies with significant financial potential interested in diversifying their operations and winning monopolies on the global market for new goods and services;
- presence of stable professional teams with comprehensive experience in the development of products with complex engineering systems and their refinement to the necessary level of quality.

Activation of these pre-conditions will be shaped by the government's dynamic science-and-technology, institutional, financial, informational and structural policy. Science-and-technology policy encompasses priority selection, as well as the development and implementation of targeted programs aimed at priority achievement. Institutional policy boils down to creation of the legal, organizational and value structures necessary to support pioneering work and foster a favorable environment for broad-based innovations.

Organizing Russia's R&D-manufacturing potential into competitive structures presupposes a pro-active government strategy to cultivate successful high-tech business enterprises. The extended process flows involved in the development and manufacturing of high-tech products must be restored. This will entail, on the one hand, reintegration of the technologically-interconnected industries torn apart by privatization, and on the other, stimulation of the development of new high-tech companies demonstrating competitiveness. In order to accomplish the first task, the government can use asset-value increases, including title to intellectual property and land estate not accounted for at the time of privatization. Achievement of the second task entails utilizing various instruments of industrial policy: preferential loans, state procurements, R&D subsidies, etc.

Financial conditions for activation of the country's R&D-manufacturing potential include: the creation of institutions for long-term production-development lending and mechanisms for the project financing of promising but risky science-and-technology developments, the tax exemption of innovational activity, the robust government stimulation of breakthrough STP areas, including the financing of fundamental research, the co-financing of engineering concepts, and the venture financing of promising innovations via a broad network of diverse financial institutions.

Informational pre-conditions for activation of the country's R&D-manufacturing and intellectual potential consist of forming an open and user-friendly informational infrastructure that ensures access to contemporary scientific

knowledge and technical achievements, and encompass the functioning of a system for the assessment and selection of priority STP areas. This system must help the state, private organizations and members of the public correctly identify promising areas of development in order to ensure that available resources are utilized with maximum efficiency.

An important pre-condition for “catching” the next long-wave of economic growth is the existence of a scientifically-grounded development strategy for the new technological mode in the Russian economy, which must combine: a leadership strategy in those areas in which the Russian research-and-production complex enjoys technological superiority, a strategy of catch-up development in badly-trailing areas, and a strategy of outpacing commercialization in the remaining areas.

A necessary pre-condition for the swift emergence of the new technological mode is a mechanism for government-issued special-purpose loans designed to support long-term investments. Measures to overcome the financial crisis should be linked to the strategic aims for the country’s long-term socio-economic development and envision broad application of the key technologies of the new technological mode.

10.3. Faster-development policy – the best way to recover from the crisis

Goal-setting under the Russian government’s economic policy has undergone dramatic change in recent years. Instead of liberalization of the economy or its pointless restructuring, the objectives of government policy have been announced as transitioning to an innovational development path, improving social welfare, and building a highly-efficient socially-oriented economy. The Concept for Russia’s Long-Term Development Through 2020 correctly asserts that the country’s sluggish energy-commodity-based development scenario, which has relegated Russia to a mere raw-exports role, has hit a dead end. Thus, pursuant to recommendations from the academic community, the Concept outlines the new priorities of government strategy: investments in human capital, boosting

education, science and healthcare, building a national innovation system, modernizing the economy, developing new competitive sectors in the high-tech realms of the knowledge-based economy, and reconstructing and expanding the country's manufacturing, social and financial infrastructure.¹

The Concept and Outlook for the Country's Long-Term Socio-Economic Development through 2020 discuss the transition of the Russian economy from a raw-export role to innovational development. This will necessarily entail a marked improvement in innovational activity, a 2–3-fold enhancement of economic performance, and a ten-fold increase in the share of Russian high-tech products on the global market. According to the Concept, this will permit a tripling of salaries and allow Russia to join the ranks of highly-advanced countries in terms of socio-economic development by taking lead positions in a number of key growth areas of the global economy. The Concept encompasses the goals of achieving international standards of financing for research, education and healthcare, and increasing the savings rate to that of the most-rapidly developing countries.

The correct formulation of tasks and determination of parameters is a necessary but insufficient condition for the achievement of established goals. No less important is planning economic-policy measures, moving swiftly to concentrate resources in promising areas, and ensuring their effective utilization. Anti-crisis measures have not been geared towards the outpacing technological development of the economy, which is associated with prospects for economic recovery, and have failed to halt the decline in industrial production, including the collapse of domestic machine-building. As a consequence of this misguided strategy, anti-crisis measures have resulted in the enrichment of commercial banks finding themselves closest to the printing press as manufacturing enterprises went bust.

Unlike the Russian monetary authorities, who directed the vast majority of the money issued to overcome the crisis towards the support of commercial banks

¹ Concept for the Long-Term Socio-Economic Development of the Russian Federation / RF MEDT Draft, 2007. Outlook for the Socio-Economic Development of the Russian Federation for the Period 2020-2030 / RF MEDT Draft, 2008.

while requiring no obligations therefrom whatsoever, the majority of developed countries focused their primary attention on the targeted spending of anti-crisis funds on support for economic modernization and innovational activity. Thus, the share of expenditures on the development of cutting-edge technologies for the purposes of modernizing energy, transportation and housing-public-utility infrastructure under the anti-crisis program in Korea was 80.5%, in the EU – 58.7%, and in China – 37.8%, while the share of such expenditures in Russia has not exceeded 1.5% at a worldwide average rate of 15.6%.¹

Proceeding from the above, measures to overcome the crisis should be geared towards outpacing development of the new technological mode and the formation of a domestic investment system. These, in turn, should be linked to the goals of sustainable development, including those established under the Concept for Russia's Socio-Economic Development through 2020. The latter correctly identifies the key factor of the new technological mode – nano-, bio- and information technologies – and sets the goals for the faster emergence of its core and carrier sectors. In some of them (the aerospace, atomic, electrical-engineering and a number of other high-tech industrial sectors), Russia has managed to preserve considerable production potential. The country has good R&D-manufacturing capacities in electronic instrumentation, molecular biology and genetic engineering, nanophotonics and laser technologies, nanomaterials-fabrication and electron microscopes. Russia has also preserved its lead positions in mathematics and programming.

A necessary condition for conducting a successful anti-crisis policy involves the creation of a strategic-planning system, including adoption of the RF Federal Law “On Strategic Planning”, which should envision standards of planning and oversight for development institutions and state corporations, as well as requirements for federal special-purpose programs based on the priority ascribed to faster development of the new technological mode.

¹ www.hsbc.research.com

The distribution of funds under anti-crisis measures should be commensurate with these priorities. In particular, resorting to the sequestration of the federal budget for science and education and the financing of special-purpose programs geared towards development of the new technological mode should be excluded. Just the opposite – spending on these goals should be ramped-up, just as it should for the import of cutting-edge technologies and the vigorous defense of the intellectual property rights of Russians abroad. The share of Russia's state expenditures on science and education should be brought into line with the standards in advanced countries, increasing them by a factor of at least 1.5.

It would also be expedient to implement legislative stimulation for the development of energy-saving and environmentally-friendly technology (light emitting diodes, solar batteries, nanopowders, electric cars, automated systems for heating-consumption control in housing and public utilities, etc.) by introducing regulations on the prohibition against using energy-wasteful and polluting technologies and incentives for the use of cutting-edge technologies.

10.4. Anti-crisis strategy

The *key idea* guiding the formulation of anti-crisis strategy is ensuring the outpacing emergence of the baseline industries of the new technological mode and the rapid positioning of the Russian economy on the next long-wave of growth associated therewith. This entails the concentrated investment of resources in development of the promising research-and-production complexes of the new technological mode, which is impossible without a system for the targeted management of financial flows. The creation of such a system, encompassing mechanisms of monetary, fiscal and currency policy geared towards emergence of the core of the new technological mode, must become the lynchpin of anti-crisis strategy. A necessary condition for its success entails the achievement of a synergistic effect, which assumes the comprehensive formation of complementary manufacturing clusters within the new TM and the coordination of macroeconomic policy with the priorities of long-term technical-and-economic development.

For this purpose, the formation of anti-crisis strategy should envision:

- creation of a strategic-planning system, capable of identifying promising areas of economic growth and directing the activities of state development institutions towards their implementation;
- formation of financing channels for projects associated with the creation and expansion of research-and-production complexes within the new technological mode and the consumption marketplace for related products;
- adjustment of macroeconomic policy to foster favorable conditions for innovation activity.

The ***strategic-planning system*** should include: selection of priorities for technical-and-economic development; instruments and mechanisms for their implementation; institutions for organization of the respective activity and methods for exercising control over the achievement of required results.¹ Certain elements of it have been created within the past few years – the Concept for Russia’s Long-Term Development through 2020 has been adopted, which establishes development priorities coinciding with the promising emerging areas of the new technological mode, federal special-purpose programs for the implementation of several thereof are currently in operation, and development institutions have been founded. On the whole, however, the system isn’t functioning properly and makes strategic mistakes, as a result of which Russia is missing opportunities for outpacing development of the domestic nano-, bio-, atomic, aviation, rocket-and-space, laser, cellular and other technologies at the core of the new technological mode in which the country enjoys considerable competitiveness on the global-market scale.

Further construction of the strategic-planning system will require the introduction of rules governing responsibility for the achievement of planned results and its linkage to the instruments of macroeconomic policy. Solving the first task will necessarily entail the establishment of legal provisions for the economic responsibility of organizations and the administrative responsibility of

¹ Foreign Experience with Government Forecasting, Strategic Planning and Programming. Edited by S.Y. Glazev and Y.V. Yakovets – M.: State University of Management (SUM), 2008.

executives for the achievement of government-set target-development indicators. This will require adopting the RF Federal Law “On Strategic Planning”² and giving the aforementioned Concept for Long-Term Development the status of a planning document that must be taken into consideration when planning budgetary and monetary policy and making other administrative decisions, including the program of anti-crisis measures.

Solving the second task assumes the formation of government-regulated control networks for fiscal, monetary and tax policy.

Gearing fiscal policy towards development goals assumes lifting the tax burden on all types of innovational and high-tech activity, as well as prioritizing budgetary appropriations to support state spending critical to the emergence of the new TM. Based on the technological mode’s structure and the experience of advanced countries, state spending on healthcare and education – carrier sectors of the new technological mode – should undergo at least a 1.5-fold increase, with science appropriations doubled. That said, financing increases should be concentrated in the promising developmental areas of the new technological mode in which Russia has competitive advantages. In particular, the financing of scientific developments in molecular biology, genetic engineering, cellular technologies, and the fabrication of nanotechnological equipment, laser technologies, helio-energy, nanopowders and new materials must be dramatically increased. Gearing state procurements towards the acquisition of domestically-manufactured high-tech products should become a central element of budgetary policy.

An obvious focus of anti-crisis budgetary expenditures is the modernization of transportation, telecommunications, energy and housing-public-utility infrastructure for the purposes of ensuring favorable conditions for enhancing economic performance and expanding business activity. That said, it is important that appropriations for these purposes be directed primarily towards the procurement of advanced domestic equipment. Examples of such surefire projects may include proposals to outfit gas compressor stations with generating equipment

² Foreign Experience with Government Forecasting, Strategic Planning and Programming. Edited by S.Y. Glazev and Y.V. Yakovets – M.: State University of Management (SUM), 2008.

(giving Russian power-generating capacity a 1.5-fold increase) or expand the low-orbit satellite-communications network.

Outlined above was the preferability of the budgetary channel for monetary emissions over the banking channel. Although basic Keynesian methods for the stimulation of demand via massive monetary infusions can soften a slump, they cannot ensure recovery from a recession¹. This requires a vigorous activation of science-and-technology and innovation policy. Under these conditions, monetary emissions should be targeted and channeled by the government into the priority growth areas of economic activity. Many expenditures critical to the emergence of the new technological mode, including financing for fundamental research, the creation of telecommunications infrastructure, and the testing of new technologies, etc. can only be implemented with budgetary support.

During the implementation of anti-crisis policy, it is not advisable to restrict the budget deficit by financing it through domestic sources and covering the growth in state borrowing via the equivalent emission of money to refinance commercial banks secured by government bonds. That said, the rate of return on the latter should not exceed the average profit rate in the manufacturing industry. In order to expand the state-borrowing market, the practice of using the bonds and deposits of the Bank of Russia must be stopped by offering their holders the option of converting them into the bonds of the Government of Russia. Simultaneously, the policy of exporting “excess” liquidity should be abandoned, with free budgetary resources directed towards investments, inter alia, debt securities on the open market.²

The *instruments of monetary policy* should ensure a sufficient money supply for expanded reproduction and faster economic growth in the promising areas of the new technological mode. As widely-accepted in developed countries, an emission mechanism must be created for the refinancing by the Bank of Russia of commercial banks under increased requirements for their crediting of enterprises in the real sector and paced with the rising financial requirements of the growing

¹ V.M. Polterovich; Mechanism of the Global Economic Crisis and Issues of Technological Modernization – <http://www.econorus.org>

² Y.M. Mirkin; Post-Crisis Development Strategy for Russia’s Financial Sector – <http://www.econorus.org>

economy. Our own and global experience allows us to construct the optimum mechanisms for money supply, ultimately dependent on real-sector lending and priority areas of economic development. To this end, the terms for commercial-bank access to Central Bank refinancing should be linked to the obligation to use the credit resources received from the government for the targeted financing of manufacturing enterprises and priority areas of economic activity. This could be achieved through a combination of indirect (refinancing secured by the bonds and promissory notes of solvent enterprises) and direct (co-financing of government programs, issuance of state guarantees) methods of money supply. Via the CB Lombard List and state-guarantee limits, the government could selectively influence monetary flows, thereby supporting the expanded reproduction of strategic enterprises, fostering favorable conditions for growth in economic activity, and attracting investments towards priority development areas. Simply put, the Central Bank should issue loans to refinance commercial banks *after* their re-issuance to end-borrowers, not before. In that case, in order to receive a loan at the Central Bank, the commercial bank would have to issue an enterprise loan first. Only then, under the enterprise's obligation (promissory note) would the bank receive the respective loan from the Central Bank.

In the conditions of the global crisis, development of Russia's financial sector is only possible based on the ***faster growth of internal actual demand over external***. In this connection, restructuring of the financial sector should not be geared towards the stock market but focus instead on banking-system growth with restrictions on financial speculation and the stimulation of long-term investments, by development institutions and venture financing.¹ That said, government support for commercial banks should be strictly limited to the issuance of special-purpose loans that adhere to the following principles: equal access to state aid, time and scale restrictions on support, participation of the banks themselves in anti-crisis measures, and the prohibition against shareholders profiting from state aid. In exceptional cases, government support for the banking sector's own capital could

¹ Y.M. Mirkin; Post-Crisis Development Strategy for Russia's Financial Sector – <http://www.econorus.org>

be implemented via the Bank of Russia's acquisition of the preferred shares of commercial banks.²

An important condition for the implementation of domestic anti-crisis strategy is abandoning the practice of using foreign rating agencies to assess the reliability of borrowers. The Bank of Russia should only use ratings established by Russian agencies and the results of its own monitoring.

Concentrating monetary emissions to refinance commercial banks under the obligations of manufacturing enterprises creates competition among banks for clients in the manufacturing sector in order to gain access to refinancing by the Central Bank. As a result, the credit market evolves from a seller's market monopolized by the major commercial banks into a buyer's market on which competition leads to lower interest rates. That said, the refinancing rate should not exceed the average rate of return in the manufacturing industry (per international practice, it should float between 4–6%¹), while the loan term should be commensurate with the typical duration of the R&D-manufacturing cycle for machine-building products (2–5 years).

Along with lowering of the refinancing rate, normalization of the price of money necessarily entails an active policy of limiting profitability on the government-debt market controlled by the Bank of Russia and major banks with state participation, the application of low-interest special-purpose loans (for mortgage loans, education loans, loans issued by development institutions), and the temporary administrative regulation of interest rates and the banking margin. It would also be expedient to significantly increase the resource potential of existing development institutions and the creation of new ones, including the ones issuing education loans and offering microfinancing.

A necessary condition for the transition to a policy of long and cheap money for the real economic sector is the **restoration of currency control**, envisioning the introduction of a regulatory-approval system for operations of capital nature while

² V.I. Maevskiy; Real Sector and Banking System – <http://www.econorus.org>

¹ G.G. Fetisov; Measures to Overcome the Global Crisis and Form a Stable Financial-and-Economic System (proposals for the “Group of Twenty” for Financial Markets and the Global Economy) // Economic Issues; No. 4, 2009.

preserving the ruble's free-convertibility under current operations. Without this, it will be impossible to lower interest rates and expand lending to the real sector to the degree necessary (a 2–3-fold increase).

In the absence of currency controls, commercial banks direct the credit resources received from monetary authorities towards the acquisition of foreign currency, thereby undermining ruble stability and rendering government lending policy and banking-system support pointless. An important element of this policy could emerge as stabilization of the ruble exchange rate during the period of anti-crisis measures and introduction of the mandatory sale of currency receipts. This would eliminate the need for major interventions by the Central Bank on the currency market and save currency reserves for more important purposes. Mechanisms for the dollarization of the economy would halt, and the need to maintain high interest rates would disappear.³

In order to enhance the appeal of ruble operations, it would be expedient to fix and then gradually lower the currency position of commercial banks, increase the reserve regulations for their currency operations, restrict the state-guarantee system for bank deposits to those denominated in rubles, and reintroduce the tax on currency-exchange operations. The expediency of these measures is grounded in the need to fight capital exports, as well as to neutralize destabilizing threats to the financial market and national security in connection with the anticipated expansion of foreign speculative capital due to the growing avalanche of dollar emissions under derivative-monetization to save American financial institutions. As was previously mentioned, a growing chunk of these emissions is being exported and kept in tangible assets in the face of the dollar's anticipated continued decline.

Among the measures to *protect the Russian financial market* from destabilizing threats from abroad, it would be prudent to maximize use of the recommendations formulated by the international anti-crisis forums in which Russia participated, including: interdicting operations with offshore zones; ensuring the transparency and regulation of the off-balance-sheet operations of

³ A.D. Nekipelov; Crisis and the Outlook for the Russian Economy – <http://www.econorus.org>

banks and companies, eliminating dependence on partisan rating agencies; creating a public system for the disclosure of market information (on issuers and professional participants), owned by the government and free for users.

Given the growing destabilization of the global monetary-and-financial system, we should, on the one hand, protect the domestic market from incursions by rapidly-growing masses of foreign speculative capital, and, on the other, increase the usage domain of the domestic currency by supporting the expansion of national financial institutions on markets associated with Russia. In order to ***expand the usage domain of the ruble in international settlements***, we must shift to price-setting and foreign trade in natural gas, oil, metals and military equipment in rubles, support ruble lending for the export of Russian goods, and minimize the cost of currency-exchange operations with nations integrated with Russia. The latter task could be accomplished with the support of the CIS Interstate Bank, which, with its correspondent relations with the central banks of all Commonwealth nations, could dramatically lower the transaction costs of currency-exchange operations. The “currency swap” mechanism widely used by the US FRS and China to support demand for domestic currency and expand opportunities for trade lending could also be used.

In an environment of unstable currency rates, it is important to conduct a ***policy of currency-reserve optimization*** envisioning reserve diversification by country and instrument. Excess (compared to the demand for annual imports) currency reserves could be invested in the acquisition of assets that provide access to the promising technologies of the new technological mode and the participation of Russian enterprises in the production cooperation based thereon.

Along with measures to form a national credit-and-investment system, measures should be taken to ***protect financial institutions from the destructive fluctuations of the financial market***. They could include additional forms of insuring credit risks, expanding the range of the respective control regulations,

changing the rules of pledge valuation, restricting margin calls, and introducing asset-valuation methodologies envisioning cost stabilization.¹

Following the adoption of all of the measures listed above, it will be possible to **ramp-up the money supply** as a necessary condition for supporting domestic demand and increasing investment and innovational activity. Unlike the case with the issuers of global currencies, the crisis in Russia was triggered not by excess money supply and its associated financial bubbles, but by the chronic undermonetization of the economy, which operated flat-out for an extended period of time due to the acute shortage of credits and investments. The Russian economy requires a significant expansion of money supply to restore the domestic market and increase innovational and investment activity for the purposes of modernization and faster development.

Forming a finance-and-investment system sustained by domestic sources will allow for the expansion and maximum utilization of savings, more than a third of which was exported abroad throughout the entire post-Soviet period. This, in turn, will create the conditions necessary to increase the savings rate.

As indicated by our own and foreign experience, the savings rate must stand at at least one-third of GDP in order to achieve faster development.² In order to reach the respective savings-rate increase, it would be expedient to apply measures to discourage wasteful and conspicuous consumption (introducing progressive excess-profit taxes, individual property taxes, and excise taxes on the sale of luxury items, etc.) and encourage savings. In particular, the premium on the funded part of pension savings could be boosted and use them to finance long-term investment projects backed by government guarantees.

Aside from an appropriate monetary policy, anti-crisis strategy must also include a dynamic **industrial policy** that stimulates “growth points” in the generally-depressive environment. That said, of greatest relevance are the growth points with a high multiplier that stimulate economic activity across a wide range of technologically-

¹ Y.M. Mirkin; Post-Crisis Development Strategy for Russia’s Financial Sector – <http://www.econorus.org>

² V.M. Polterovich; Mechanism of the Global Economic Crisis and Issues of Technological Modernization – <http://www.econorus.org>

interconnected industries: the launch of fully-fledged domestic aircraft (IL-96, TU-204, TU-334, AN-140, AN-148), residential construction, space communication systems, and the modernization of transportation and energy infrastructure.

Above and beyond the formation of state-supported major integrated corporations, a key emerging element of industrial policy should be stimulating demand for domestic equipment via the respective regulation of state procurements and procurements by state-run and government-backed enterprises (first and foremost, Aeroflot, Gazprom, Rosneft, Russian Railways, etc.). Tough administrative measures stipulating the responsibility borne by executives to honor the priority purchase of domestic equipment must also be introduced. This is of particular importance to the carrier sectors of the new TM (healthcare, aviation, telecommunications), the mining industry, and infrastructure sectors with a guaranteed sales market.

An important thrust of anti-crisis strategy is ***expansion of the economic arena*** via creation of the Customs Union and subsequently, formation of the EAEC (Eurasian Economic Community) common economic space. The creation of integrational associations expands development opportunities for the Russian economy, enhances its resistance to external shocks, and increases the scale of operations and competitive advantages of Russian enterprises. By implementing a common anti-crisis strategy, EAEC nations gain more opportunities to recover from the crisis and assume a trajectory of outpacing development.

The significant money-supply increase envisioned under the anti-crisis strategy demands that the effectiveness of ***antimonopoly policy*** be dramatically improved for the purposes of fighting inflation. Above and beyond the intensified application of its standard measures for interdicting price collusion, a comprehensive policy of ***price regulation*** must also be conducted. Subject to codification should be the concept of standard profitability, including the costs entailed in innovation, quality improvements and product-cost reductions, and

envisioning the progressive taxation of above-level profits.¹ In order to better align the rates of return in different economic sectors, a restrictive price policy must be applied to natural monopolies – up to and including the freezing of their service tariffs during the anti-crisis strategy implementation period, and the adoption of measures to lower the interest-rate component of production costs. A federal law establishing the forms, limits and procedures of price regulation must also be adopted.

Maintaining price ratios conducive to economic modernization and development requires adjusting the export tariffs on raw materials and import tariffs on finished goods, as well as introducing measures to protect the domestic market from unfair competition from outside. The profitability of raw-material deliveries to the foreign market should not exceed the rate of return on its domestic processing, while earnings on investments in the development of promising economic sectors should be sufficient for their expanded reproduction.

In order to ensure competitive price-formation in the raw materials sector, a **major exchange center** should be established for the price formation of export goods – one that unites all segments of the commodity and financial markets.¹

The **social component** of anti-crisis strategy should focus on supporting social infrastructure at an acceptable level, as well as on expanding opportunities for the self-realization of members of the public (for example, giving the unemployed modern IT training, ramping-up the micro-lending system).

Increasing social security benefits should be subordinated to the performance by the government of its social obligations, including the protection of citizens' property rights and the restitution of their pre-reform savings. Based on the need for the government to discharge its debt obligations and other economic considerations, monetary emissions for such purposes are preferable to emissions aimed at unsecured lending to commercial banks. They are capable of

¹ N.Y. Petrakov; Opportunities to Minimize the Impact of the Global Financial Crisis on the Russian Economy – <http://www.econorus.org>

¹ Y.M. Mirkin; Post-Crisis Development Strategy for Russia's Financial Sector – <http://www.econorus.org>

simultaneously resolving the issue of adding liquidity to the banking system and stimulating final demand. Moreover, the targeted use of restored deposits could be limited to the acquisition of domestic durable goods, the construction and/or acquisition of housing, and the payment of utility, educational or medical services, while only interest would be permitted to be freely spent. Under this scenario, all of the money issued to restore savings would work towards expanding the production of domestic goods and services, unlike in the case of the credit infusion of banks, which, in conditions of crisis, are guided by a strategy of risk minimization and hold on to the resources obtained from the government rather than channel them towards the real sector.

Technically, public savings could be restored via the creation of a special fund, managed by Sberbank, providing the credit resources necessary for their servicing and amortization. The amount of money issued for this purpose must be determined annually on the basis of interest-payment requirements and depositor claims seeking the market replenishment of amortized deposits consolidated under extended programs whose implementation could be centralized in accordance with the procurement procedure for state needs.

Given the growing chaos and volatility on the global markets, the creation of a system of ***protection from economic-security threats*** must be envisioned, which, along with the currency-control instruments outlined above, should have the protective features of the financial, distribution and property systems.²

The protective feature of the financial system should guarantee payments and credits to the real sector in the event of a banking-system emergency. The CB should be prepared to “take up the slack” in the settlement system via cash-processing centers and state banks in the event of a chain reaction of bankruptcies among commercial banks. Under conditions of possible banking-system paralysis, support programs for strategic enterprises, regions and sectors should be run through the treasury, which could also assume servicing functions for state enterprises.

² D.A. Mityaev; Implosion Dynamics of the Global Financial System (Scenarios and Strategies). Adaptation Opportunities and Strategy Choice for Russia. Mock-Scenario Presentation. M.: 2009..

In order to protect the economy's strategic assets and ensure the output of vital products (foodstuffs, energy, transportation, etc.), the government should be prepared to nationalize the respective strategic enterprises and infrastructure bundles (power stations, grain elevators, ports, warehouses) or to place them under rigid antimonopoly control. Enterprises classified as strategic should only receive financial assistance under the respective business plans and share- (asset-) stake transfer to the government as security for their obligation to produce products and repay funds. That said, the purchase of strategic assets with foreign capital (or the conversion of debts into property) should be prohibited, with the exception of cases of joint-venture formation or asset-consolidation under partnership.

Protection of the "human capital" reproduction system should be guaranteed under the respective budgetary items shielded against budget-revenue fluctuations. Strategic reserves of primary commodities, foodstuffs and medications should also be created for the purposes of supporting the production and importation of vital goods.

Under any scenario for the continued unfolding of the global crisis, Russia should preserve its ability to conduct independent policy and influence the global situation. Our stable natural-resource/raw-material and defense potential gives us objective opportunities towards that end. Even under the catastrophic scenario for further development of the global crisis, Russia has the resources necessary – not just for independent survival, but for faster development. Thus, within the scope of international initiatives, we should be guided solely by our own interests and permanently reject the old policy of crediting the US and other NATO countries and letting them lead us around by the nose. Even under the worst-case scenarios for the global crisis, conducting a policy in its own best interests will allow Russia to improve its standing in the global economy.

Instead of an afterword...

A LIST OF MEASURES FOR THE IMPLEMENTATION OF
THE ANTI-CRISIS STRATEGY

I. Creating a system for strategic planning and management-quality improvements

1. Adopting the RF Federal Law “On Strategic Planning,” which envisions procedures for setting the goals and priorities of long-term, mid-term and annual socio-economic development and formulating the concepts and programs for their implementation, and introduces regulations governing the planning and oversight of work conducted by development institutions, state corporations and government agencies, as well as the requirements imposed on those implementing government special-purpose programs.

2. Giving the Concept for the Long-Term Socio-Economic Development of the Russian Federation Through 2020 the legal status of a planning document that must be taken into consideration when drafting the federal budget and developing special-purpose programs and the operating plans of state corporations, government agencies and executive authorities, including anti-crisis-measure plans, and entitling the initiators of such programs and plans to attract off-budget funds and issue state guarantees for credits to implement program objectives.

3. Developing a 5-year plan for economic modernization on the basis of the new technological mode that envisions measures for the outpacing development of its constituent engineering-and-manufacturing complexes, the emergence of competitive integrated structures, the fostering of a favorable socio-economic environment for said purposes and the formation of the respective management institutions and networks.

4. Setting target indicators for the performance of state development institutions, corporations and agencies in their core areas envisioning the creation of globally-competitive industries within the new technological mode and the introduction of mechanisms of responsibility for their timely achievement.

5. Legislatively-stimulating the development of domestic energy-saving, material-saving and environmentally-friendly technologies of the new mode (LEDs, solar batteries, nanopowders, electric cars, automated systems for heating-consumption control in housing and public utilities, etc.) through the introduction of regulations prohibiting the use of energy-wasteful and polluting technologies, as well as of incentives for the use of cutting-edge technologies.

6. Modernizing the education system, including: bringing secondary and post-secondary education systems into line with the requirements of the knowledge-based economy and innovational development (incorporating methods of creativeness training, including inventive activity, reintroducing advanced mathematics and IT instruction, expanding the network of specialized schools and children's technical-creativity institutions, holding broad-based academic olympics for school children, etc.); reintroducing the system of free secondary professional education, ensuring opportunities for free post-secondary education by restoring the competitive procedure for subsidized enrolment and ramping-up the system of education loans accessible to any citizen; stimulating the integration of higher schools with business and science; creating innovational infrastructure at institutions of higher education; introducing state support for the export of educational services.

7. Cultivating a management culture responsive to the demands of innovational development: introducing principles of competitiveness, professionalism and objectivity to the system for the selection and assignment of senior officials within the public sector, expanding the rights of the workforce to participate in the management of joint-stock companies, applying objective criteria to evaluate the job performance of the heads of government departments, entitling members of the public to file a court complaint seeking the termination of any unscrupulous or incompetent bureaucrat's appointment, engaging the public in the fight against corruption via the automatic rendering of required state services in the event of the discovery of instances of bribe-solicitation by civil servants.

8. Stimulating the spread of cutting-edge management technologies at enterprises (computer-aided design and management of product lifecycles, quality-control systems, process flows of inventive activity, and electronic document management, etc.) by extending tax credits for the costs associated with their introduction, switching the tax, customs, antimonopoly and other oversight agencies to electronic document management, introducing the respective business training courses, implementing the government's employee retraining programs, and reviving public organizations for inventors and innovators.

9. Accelerating the incorporation of information technologies in the work of government departments, thereby raising the labor productivity of oversight-agency employees to advanced-country levels and cutting the respective workforce by a factor of 3–5.

10. Introducing rigid timelines for the consideration of applications by Russian enterprises to undergo certification, conduct clinical testing, and complete the other mandatory procedures associated with the receipt of permits to use new technologies.

II. Bringing fiscal policy into line with the goals of faster development

1. Maintaining planned federal-budget expenditures, financing the budget deficit via the Reserve Fund and the placement of long-term low-interest government bonds included on the Central Bank's Lombard List. Effecting a simultaneous monetary emission in the corresponding amount.

2. Beginning in 2010, bringing the federal-budget expense-structure into line with internationally-accepted rates of development-expenditure financing, inter alia, doubling the share of expenditures on science and the stimulation of innovational activity and increasing the percentage of expenditures on healthcare and education by a factor of 1.5. Maintaining non-interest budgetary expenditures at a level no lower than this year's.

3. Ensuring the timely financing of planned federal and multinational special-purpose programs and investment projects subject to financing by government agencies, banks, funds and corporations. Introducing the hundred-percent advancement of expenses to meet state defense contracts and reviving the practice of product delivery to military representatives directly at the manufacturer.

4. Implementing the full-scale utilization of development-institution funds to finance promising investment projects. Simplifying the rules and shortening the timeframes for the consideration of investment projects, introducing a mechanism envisioning the responsibility of senior executives for the timely and effective utilization of allocated funds.

5. Re-starting operation of the Russian Fund for Technological Development, increasing the Science-and-Technology Small Enterprise Development Fund, Russian Venture Company (RVC), other state R&D financing funds, and creating seed-investment funds to support new innovational enterprises.

6. Expanding the sources of budget revenues using: Bank of Russia profits, including those accumulated as a result of converting non-market government obligations into market obligations for the previous period; increasing excise taxes on alcohol, tobacco, high-end vehicles and introducing excise taxes on luxury goods; resurrecting the progressive income tax scale and payments for environmental pollution in accordance with EU standards.

7. Adopting comprehensive measures for the tax stimulation of innovational and economic activity, including a reduction in the tax base under profit tax by the amount of R&D expenditures, capital investments, the implementation and production of high-tech products, the acquisition of new equipment, and the reconstruction, modernization and upgrading of technical equipment; extending enterprises a three-year tax exemption from property tax with respect to equipment acquired within the scope of innovational-project implementation.

8. Permitting enterprises to form investment funds or transfer money to existing extra-budgetary R&D funds and claim related expenditures as up to 2% of the cost of production.

9. Giving enterprises the opportunity to reevaluate their capital assets based on replacement cost.

10. Abolishing the VAT with the possible recovery of lost budget revenue by bringing export duties and taxes on mining operations for natural gas into line with the taxation of oil based on a calculation of energy-equivalent units, introducing taxes on currency-exchange operations and the sale of consumer goods while simultaneously adopting measures to expand the non-cash settlement domain.

11. Tax-exempting newly-established small enterprises and individual entrepreneurs engaged in innovational activity

12. Simplifying the reporting system and achieving a manifold increase in the labor productivity of employees at fiscal-control agencies: switching to electronic document management, standardizing and dramatically reducing the number of accounting and reporting forms, abolishing VAT charges on advances, simplifying customs procedures and switching to automated forms of customs processing and control in accordance with the Kyoto Convention, and standardizing statistical-reporting forms.

13. Introducing a moratorium on the auditing of enterprises for the tax payments of past years.

III. Forming a national finance and investment system

1. Supplementing the objectives of the government's monetary policy and those of the Bank of Russia with the goals of securing economic growth, employment, and the stability of the national financial system.

2. Shifting to the indirect regulation of money supply by regulating the refinancing rate and abandoning the administrative planning of money quantity. Gearing monetary emissions primarily towards the refinancing of commercial banks under manufacturing-enterprise lending requirements, obligations of the treasury and development institutions, as well as towards the acquisition of gold,

and restricting emissions for foreign-currency purchases within the currency reserve by the need to maintain the ruble rate at the established level.

3. Radically extending the Central Bank's Lombard List to include the promissory notes of solvent strategic enterprises and enterprises operating in the priority areas of the new technological mode, per the list approved by the Russian Government. Aside from the securities on the Lombard List, using the sureties issued by the initiating-organizations of federal target programs and the bonds of development institutions and state corporations as security under the refinancing of commercial banks.

4. Lowering the refinancing rate to a level commensurate with the average rate of return in the manufacturing industry (between 4–6%). Moving forward, linking changes in the refinancing rate to the goal of maintaining economic activity at the optimum level.

5. Increasing the effective term of credits issued by the Bank of Russia to refinance commercial banks under manufacturing-enterprise credit instruments and government obligations by an average of 3–4 years.

6. Creating a government agency to insure the loans extended by Russian credit organizations in order to stimulate bank lending to the real sector and foster trust between banks and enterprises.

7. Introducing a 100% guarantee on the ruble-denominated deposits of citizens at all banks within the deposit-insurance system, coupled with the simultaneous abolishment of insurance for foreign-currency deposits.

8. Abandoning the use of ratings assigned by foreign rating agencies and obligating the Bank of Russia to monitor the solvency of major enterprises, set rating-valuation standards and stimulate the development of domestic rating agencies.

IV. Measures to stabilize the financial market

1. Re-establishing currency control. Introducing a regulatory-approval system for capital operations while preserving the unrestricted acquisition of foreign currency to finance current operations and reserving funds for doubtful foreign-economic operations. Fixing and subsequently lowering the foreign-currency position of commercial banks. Introducing regulations prohibiting the export of foreign speculative capital for up to one year for the purposes of neutralizing speculative attacks against the ruble.

2. Reintroducing rules establishing the mandatory sale of currency receipts on the domestic market.

3. Pegging the ruble exchange rate to the euro throughout the period of anti-crisis-measure implementation. Moving forward, allowing the rate to discretely fluctuate in cases of changes in the balance-of-payments dynamic and foreign-exchange rate ratios.

4. Allowing banks to transfer trading securities (shares and bonds) to investment portfolios at acquisition price, rejecting margin calls by the Bank of Russia, banks with state participation, and the receivers of subordinated loans.

5. Establishing a moratorium on applying sanctions against credit organizations for violating borrower-risk threshold regulations. Prohibiting commercial banks from unilaterally-revising loan agreements.

6. Introducing the temporary linkage of interest rates on loans and deposits to the refinancing rate. Limiting the maximum bank margin to 1.5 %.

7. Expanding the range of securities that can be accepted to cover insurers' policy reserves. Permitting insurance organizations to account for financial investments according to their book value.

8. Regulating the financial market, including: lowering excessive authorities and administrative barriers; completing the creation of a super-regulator; expanding the sphere of self-regulation; beefing-up the oversight of the financial condition of professional participants and the comprehensiveness of price-formation and market-risk level; creating a national depository and settlement-

clearing corporation; introducing the prudential monitoring and regulation of risk-management systems and systems for the public disclosure of information concerning securities-market participants; creating compensation funds for professional participants covering the risks associated with their non-performance of obligations to clients; and regulating the activities of financial conglomerates and their aggregated risks.

V. Stabilizing prices and encouraging competition

1. Establishing a moratorium on the growth of natural-monopoly tariffs that factors in the need to cut-back on natural-monopoly expenditures on non-core assets and lower the implementation cost of their investment programs thanks to falling natural-resource and raw-material prices. Introducing a prohibition against the charging by natural monopolies of penalties for shortfalls in capacities or resources, as well as requirements envisioning the pre- (advance) payment by consumers for electricity, heating and natural gas.

2. Conducting a restrictive price policy in sectors featuring major companies with state participation, utility, transportation and other infrastructure services.

3. Temporarily expanding the range of administrative prices, establishing diminishing trigger prices for key goods and services typified by artificially-high rates of return.

4. Using state procurements with low trigger prices to influence the pricing environment.

5. Introducing international price reconciliation to the practice of antimonopoly regulation and state procurements.

6. Lowering regulatory costs and expanding the operational capabilities of antimonopoly agencies.

7. Tightening antimonopoly regulations, conducting an antimonopoly policy that punishes enterprises exploiting their monopoly position by overcharging.

8. Adopting a law on price regulation and pricing policy establishing the forms, methods and scopes of state price regulation, as well as procedures to determine the standard rate of return and penalties for its overshooting.

9. Introducing a register of recommended prices for food staples, fuel and raw materials. Applying penalty sanctions for setting prices above the standard rate of return.

10. Abolishing the indexation of the leasing rates for non-residential properties leased by executive and local self-government agencies.

11. Adopting a federal law on the regulation of commercial activity envisioning: a restriction on the maximum commercial mark-up on food staples of vital social importance, a prohibition against establishing payments for the right to sell goods, a restriction on the term for settlements with foodstuff suppliers, and the obligation of retailers to agree the retail mark-up on supplied goods with their producers.

VI. Measures to protect and expand the domestic market and retain production potential

1. Conducting state procurements, as well as procurements by state-controlled enterprises (first and foremost, Gazprom, Rosneft, Aeroflot, Russian Railways (RZD)) primarily with domestic manufacturers. Temporarily introducing a regulation prohibiting state customers and enterprises from placing orders for the supply of goods, performance of works and/or rendering of services with foreign suppliers when the opportunity exists to satisfy the respective need with goods (works, services) produced by Russian enterprises.

2. Abolishing all customs-duty and VAT payment concessions for importers. In exceptional circumstances, processing concession amounts as the debt obligations of their receivers to the treasury. Forcing Aeroflot to fulfill the obligations it assumed to acquire domestic planes in return for the concessions it received to import foreign aircraft.

3. Concluding the formation of a Customs Union with Belarus and Kazakhstan with an agreed import tariff and common system for the application of protective measures. Accelerating the formation of a multinational free-trade zone within the CIS envisioning the application of a coordinated trade policy to third countries.

4. Refraining from dropping export duties on primary goods below the adjusted profit level of export deliveries against deliveries to the domestic market.

5. Tightening controls on the quality of imported goods and assigning product-compliance-testing functions to the Russian certification authorities.

6. Developing and implementing a comprehensive set of measures to protect the domestic market for promising types of products under the new technological mode.

7. Extending financial resources to major companies experiencing difficulties by purchasing their preferred shares on condition of a moratorium on the payment of dividends, bonuses, conducting M&A transactions, and the use of state funds to acquire foreign currency or imported goods.

8. Nationalizing insolvent strategic enterprises and transferring their debt liabilities to a specially-created institution.

VII. Measures for infrastructure development

1. Developing and implementing programs to modernize transportation, housing-public-utility and energy infrastructure on the basis of Russian technology using the innovations of the new technological mode.

2. Implementing a large-scale project to outfit gas compressor stations with generating equipment.

3. Expanding the low-orbit satellite-communications network for the purposes of creating a modern telecommunications system.

4. Developing and implementing the multinational EAEC (Eurasian Economic Community) program to modernize infrastructure on the foodstuff market.

5. Implementing measures for the state support of housing construction envisioning the allocation of land plots to all citizens in need, free of charge, and the provision of land plots for the construction of municipal housing on a tender basis to developers offering the lowest property-construction costs. Establishing a simplified procedure (without auction and free of charge) for the provision of land plots for individual residential-home builders, housing-construction cooperatives and other developer associations.

6. Developing and implementing comprehensive programs for reconstruction of the housing-public-utilities sector on the basis of domestic energy- and material-saving technologies.

VIII. Measures to protect the interests and stimulate the business activity of citizens

1. Implementing a program to restore the pre-reform savings of citizens envisioning the targeted use of restored deposits for investment purposes, expenditures on education, medical assistance and utility services and a possibility of unrestricted disposal of interest. Forming the credit resources needed to accomplish this task by creating a special Sberbank-managed fund.

2. Creating a Federal Small-Enterprise Support Fund and transferring it into CCI trust management. Including the Fund's obligations on the Central Bank's Lombard List. Centralizing all the undistributed loans issued by the government for such purposes within the Fund.

3. Obligating Sberbank, VTB, and the Russian Development Bank to allocate a certain amount of credit resources for lending to small enterprises.

4. Rolling-out a large-scale program to provide IT training to unemployed citizens.

5. Entitling the workforces of bankrupt enterprises to reincorporate them as public enterprises, issuing government subsidies for their financial recovery.

6. Entitling workforces to representation on the boards of directors and participation in the management structures of large limited liability companies.

7. Entitling the interest-holders in unfinished residential properties to demand transfer of the title to the property and the respective land plot into their joint participatory ownership and transfer developer functions to the homeowners association formed thereby, a housing-construction cooperative or other specialized consumer cooperative.

IX. Measures to protect Russian assets

1. Creating a centralized depository in which the recording of title to all the stock of Russian enterprises is organized. Obliging the ultimate owners of Russian-enterprise stock to register their title thereto with Russian registrars. Legislatively introducing the compulsory registration of title to Russian assets in Russia, having arranged their transfer from offshore jurisdictions by the end of the year.

2. Regulating mandatory character of IPOs on Russian trading floors.

3. Introducing a regulatory-approval system for the acquisition by foreign investors of controlling stakes in strategic enterprises. Augmenting the list of sectors in which foreign-investor activity is prohibited or restricted with the mining and defense industries, natural monopolies, and agriculture. Prohibiting the acquisition by non-residents of title to land plots, permitting land leases thereto for terms of no more than 30 years.

4. Keeping all unprivatized land in state and municipal ownership, repealing Land Code provisions concerning its spontaneous privatization. Allowing the use or lease of such land for construction purposes in accordance with the general development plans of the respective population centers.

5. Seizing wells and other natural-resource deposits laying idle for more than three years from oil companies and enterprises in the other sectors of the mining industry for the purposes of their subsequent transfer to interested lessees for operation.

6. Seizing agricultural land left uncultivated for more than three years into government ownership for the purposes of its subsequent use by interested parties.
7. Activating work to return illegally-skimmed assets to the state.

XI. Measures to expand the ruble segment of the global market

1. Promoting a shift to mutual settlements in the CIS in rubles and other national currencies, settlements in the EU – in rubles and euros, settlements with China – in rubles and yuans.

2. Shifting to ruble settlements for Russian exports of hydrocarbons, metals, chemical fertilizers, timber and other raw materials, as well as defense and military equipment. That said, where necessary, allocating stabilization ruble credits to the state-importers of Russian products should be considered in order to support trade flows.

3. Organizing the exchange-trading of oil, petroleum products, timber, mineral fertilizer, metals and other primary commodities in rubles. Obliging the producers of exchange-traded goods to sell no less than one-half of their products, including those exported, via exchanges registered by the Russian Government.

4. Denominating prices for Russian-exported gas, oil, timber, mineral fertilizer, metals, and other exchange commodities in rubles.

5. Substituting the foreign-currency loans of state companies with ruble credits through state commercial banks.

6. Making ruble use preferable to foreign-currency operations by increasing Russian banks' reserve requirements for foreign-currency assets, which must be kept higher than the requirements imposed on ruble assets.

7. Organizing, with the support of the CIS Interstate Bank, the creation of an EAEC settlement-and-payment system.

8. Ensuring unrestricted currency operations by EAEC member-nation banks within Community territory, provided compliance with currency control regulations.

XII. On behalf of Russia, it should be proposed to include the following measures in plans to reform international currency-and-finance relations:

1. Strengthening control over operations by financial institutions involving the use of balance-sheet and off-balance instruments and the quality-control of their assets and liabilities. Implementing the mutual write-down of unsecured off-balance liabilities and prohibiting operations with off-balance instruments.

2. Introducing restrictions on financial operations with offshore zones that evade generally-accepted standards of information transparency and control.

3. Proposing that all state-issuers of the world's reserve currencies (US, EU, Japan) ensure that their national budgets and balances of trade consistently avoid running a deficit, as well as the unrestricted acquisition of their assets. Under the formulation of plans to introduce a global currency, proceeding from the position that its creation cannot be based on the national currencies of countries with chronic budget deficits or excess government debt.

4. Introducing international standards for the activities of rating agencies and related operational requirements. Acknowledging the incompetence of rating agencies that committed gross errors and systematic deviations in their assessment of country risks and refusing to use their ratings in evaluating the creditworthiness of borrowers.

5. Changing the appraisal standards for pledge valuations by using average-weighted market prices over the mid-term and limiting the use of margin calls.

6. For the purposes of creating a stable financial foundation for the activities of international institutions and stabilizing the financial market, introducing a worldwide tax on currency speculation set at 0.1% of transaction amount and using the funds received to address global challenges (preventing and assisting in the relief of global disasters, fighting hunger and disease, funding education, etc.).