ORIGINAL SCIENTIFIC PAPER
UDK: 330.357:005.591.6
Date of Receipt: February 18, 2013

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AVOIDING MIDDLE INCOME GROWTH TRAP THROUGH INNOVATION*

Izbegavanje zamke usporenog rasta na srednjem nivou dohotka podržavanjem inovacija

Abstract

The previous paper presented the analysis of binding constraints on growth [22]. In this paper we extend diagnostics to problems of long-run growth slowdown and Middle Income Growth Trap (MIGT). Countries caught in the MIGT are unable to compete with low-income, low-wage economies in manufactured exports and also unable to compete with advanced economies in high-skill innovation goods. The root cause of the MIGT is failure to shift out of lower middle (LMI) income to upper middle income (UMI) growth strategy. The former is designed to support supply-oriented capital accumulation and labor relocation from agriculture to higher productivity industry, while the latter seeks to support skill (knowledge) intensive manufacturing activities ("moving up the value chain") and business services. LMI strategies embrace diversification and simple export expansion, while UMI strategies foster specialization and export growth based on innovations (new processes, new products, new markets) and highly-educated labor force; they also promote a blend of competition and public support in guiding the "discovery process" that leads to "smart specialization" and innovation based growth. Hence, MIGT can best be avoided through strong research and innovation systems, which critically depend on: (i) Research excellence, including scientific collaboration, involvement of diaspora, and merit based financing and incentive systems; (ii) Modern research infrastructure and other innovation inputs; (iii) Closer collaboration between research organizations and enterprises, better technology transfer offices, protection of patents, trademarks and other industrial property rights (IPR); (iv) Better financing at all stages of the innovation process, especially early stages where existing financial markets have limited knowledge and instruments; and (v) Better governance of the R&I process and financing.

Key words: *middle income growth trap, innovation, research and innovation, GDP per capita in PPP terms, patents, IPR– Industrial Property Right, centers and networks of excellence, TTO –Technology Transfer Offices, brain drain, brain gain*

Sažetak

U prethodnom radu izložena je analiza efektivnih ograničenja rasta [22]. Dijagnoza se u ovom radu proširuje na probleme usporavanja dugoročnog rasta i zamke usporenog rasta na srednjem nivou dohotka. Zemlje padaju u zamku rasta kada ne mogu da konkurišu privredama sa niskim dohotkom i niskim platama u izvozu industrijskih proizvoda, i istovremeno ne mogu da konkurišu naprednim privredama visoko-stručnim inovacijama. Koren zamke rasta je propust da se na vreme pređe sa strategije rasta pravljene za zemlje sa nižim srednjim nivoom dohotka (NSND) na strategiju rasta za zemlje sa višim srednjim nivoom dohotka (VSND). Prva podržava stranu ponude, akumulaciju kapitala i seljenje radne snage iz poljoprivrede u industriju sa višim nivoom produktivnosti. Druga podržava industriju zasnovanu na znanju ("moving up the value chain") i poslovne usluge. NSND strategije podržavaju diversifikaciju i jednostavno širenje izvoza, dok VSND strategije podržavaju specijalizaciju i izvoz baziran na inovacijama (novim procesima, novim proizvodima, novim tržištima) i visoko obrazovanom radu; one takođe promovišu mešavinu konkurencije i podrške javnog sektora u vođenju "procesa otkrivanja" oblasti "pametne specijalizacije" i rasta zasnovanog na inovacijama. Dakle, ovu zamku rasta najlakše je izbeći preko snažnog sistema istraživanja i inovacija, koji kritično zavisi od: (i) izvrsnosti u istraživanju uključujući naučnu saradnju, privlačenje dijaspore, i sisteme finansiranja i nagrađivanja zasnovane na rezultatima; (ii) moderne istraživačke infrastrukture i drugih inovacionih inputa; (iii) bliže saradnje između istraživačkih organizacija i preduzeća, rada centara za transfer tehnologije, zaštite patenata, trgovinskih maraka i drugih oblika intelektualne svojine (IS); (iv) boljeg finansiranja svih faza inovacionog procesa, posebno ranih faza gde postojeća finansijska tržišta imaju ograničena znanja i instrumente; i (v) kvalitetnijeg upravljanja procesom istraživanja i inovacija, i finansiranja.

Ključne reči: *zamka usporenog rasta na srednjem nivou dohotka, inovacije, istraživanje i inovacije, BDP per capita po PPP kursu, patenti, intelektualna svojina, centri i mreže izuzetnosti, CTT –centar za transfer tehnologije, odliv mozgova, priliv mozgova*

* This article was produced in the framework of the project 47028 "Enhancing Serbia's Competitiveness in the Process of EU Accession" supported by the Ministry of Education and Science of the Republic of Serbia for 2011-2014 period.

Introduction

Serbian growth is slowing down and medium term prospects do not look good. Following an estimated 0.5 percent GDP decline in 2012, the official growth projection used for 2013 budget was set at 2.0 percent. Medium term growth projections used in the latest IMF World Economic Outlook are also revised downwards, declining from 2.5 percent in 2014, to 2.2 percent in 2015, and only 2.0 percent thereafter.

This puts Serbia on a significantly slower growth path than most of the comparator countries in the upper middle income group and substantially delays its permanent transition to high income status accomplished by dozens of countries in the past decades. More importantly, the slower growth path now projected for Serbia is not sustainable in the medium and long run from at least six important angles.

First, it generates unsustainable levels of external indebtedness. Given that the cost of external financing is greater than the projected medium-to-long term 2 percent GDP growth rate, and the primary budget balance is not likely to have a surplus any time soon, debt to GDP ratio is bound to increase until it reaches externally imposed external debt limits. We already observed such developments since 2008 as the debt to GDP ratio quickly increased from comfortable 30 percent levels to legally set 45 percent limit and beyond. Sale of public sector (physical and financial) assets have been used in the past to lower the level of foreign debt, but little has been done to change behaviors, i.e. the propensity to generate deficits on the current account and, hence, the need to borrow internationally.

Second, it puts pressure on the balance of payments and makes it more difficult to finance the savings-investment gap. Growing indebtedness erodes credit worthiness, increases the cost of external financing, and limits the amount of available external borrowing. Obviously, more expensive foreign financing further exacerbates the debt situation, while more limited ability to use foreign savings directly constrains and even undermines the ongoing investment effort needed to sustain and boost economic growth. The impact of these constraints on gross capital formation (investment) is sized by the policy responses affecting consumer demand, trade and service balances, and exogenously driven dynamics of remittances and foreign direct and portfolio investment.

Third, it significantly constrains the budget and fiscal side given the need to accommodate the unusually high level of past (political) commitments and (social) expectations in pensions and social expenditures, on the one side, and gradually tames the large government and excessive public sector, on the other.

Fourth, it is not sustainable from the macroeconomic point of view as it requires continuation of restrictive monetary and fiscal policies, which are both likely to constrain further the growth prospects.

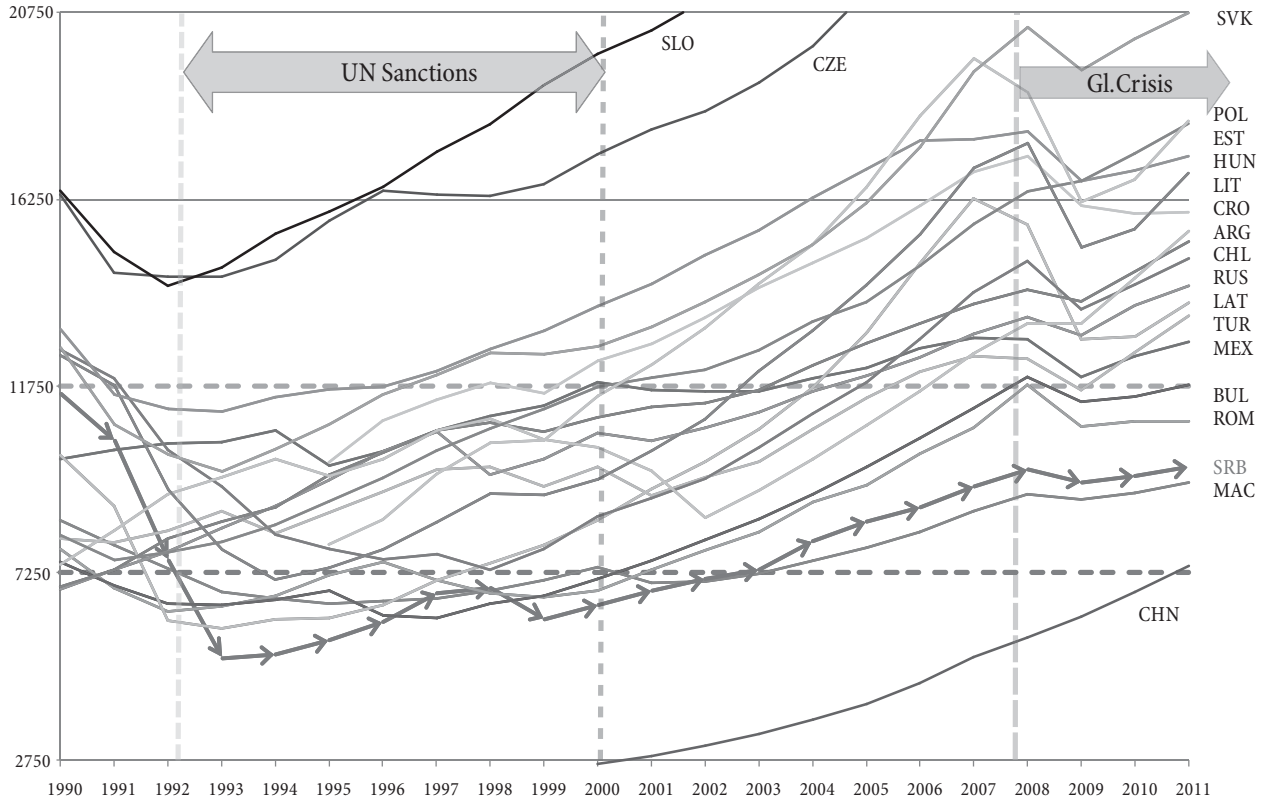
Fifth, it makes it more difficult to close the large gaps in social and economic infrastructure, and to upgrade the human capital needed to increase competiveness and unleash the growth potential of the Serbian economy in the longer run.

Sixth, it is likely to significantly slow down income convergence with the EU and hamper country's ability to effectively compete in the EU markets both during the accession stage and even more upon obtaining membership status.

The six elements highlight an ominous vicious circle: Demand driven growth, financed from easily available external sources in the pre-crisis period, quickly increased external public and private debt, but failed to upgrade physical and human capital, or generate sustainable domestic supply response. Everybody knew that this growth model was not sustainable in the longer run, but no one objected since it soothed consumer cravings for imported goods and durables, comforted politicians and provided an easy campaign slogan, benefited the omnipotent import lobby and increasingly foreign-owned banks. The voices of the shrinking industrial lobby, exporters, true entrepreneurs, and concerned analysts were muted or ignored.

What are the solutions? Going into another (probably inevitable) round of short-term austerity policies (with or without the IMF) will impose less pain and provide considerably more gain if it is preceded or accompanied by a resolute move to remove the binding constraints to growth, address key structural problems, and design coherent set of development policies that would avoid the

Figure 1: Serbia is lagging behind comparator countries – GDP per capita in constant 2005 PPP $



Source: World Development Indicators (WDI) database, World Bank.

looming middle income growth trap, and help restart the engines of growth through innovation and smart specialization.

We identified and extensively discussed the binding constraints on growth in our previous paper in this journal [22], while this paper turns to possible sources of future growth and focuses on some of the remaining issues. Next section is devoted to growth slowdown and middle income growth trap as it pertains to the Serbian economy. Section three discusses the importance of research and development (R&D) and innovation for economic growth in recent decades. Section four provides a brief diagnostics of Serbia's status and (unused) potential in research and innovation area. Section five concludes and presents a set of policy recommendations that would help put Serbia on a faster growth path based on its innovation potential, greater and more efficient expenditures on R&D.

Avoiding the middle income growth trap

Between 1990 and 1993 Serbia experienced an unprecedented economic decline, by far the largest among the Upper Middle Income (UMI) countries (see Figure 1), and the second largest decline among the transition economies – only marginally after Latvia in terms of annual GDP contraction rate, and after Ukraine in cumulative fall (see Table 1).

The decline was caused by transitional recession, the breakup of former Yugoslavia, the ensuing civil wars, and the UN sanctions imposed in May 1992. GDP per capita measured in constant 2005 PPP[1] Dollars fell by 55 percent, from 11,602 in 1990 to 5,220 in 1993. As shown in Figure 1, this pushed Serbia from the border line of high-income status to well below the lower UMI trash-hold of 7,250 PPP Dollars, and significantly behind all comparator countries – except Macedonia. Partial recovery during the 1990s – ridden with sanctions and wars – failed to bring Serbia back to the higher UMI group.

Sustained economic recovery started a decade later, after democratic changes in October 2000. It produced eight years of positive GDP growth averaging 3.6 percent

1 PPP stands for Purchasing Power Parity Dollars. GDP per capita expressed in Constant 2005 PPP Dollars enables comparisons across countries and over time as it accounts for both price and exchange rate fluctuations.

per annum and a safe return to the middle of the upper middle income range (see dashed line with arrows in Figure 1). If the growth trend set in the 1999-2007 period had continued, Serbia would have crossed into high income group later this year (see dotted line in Figure 2).

Unfortunately that did not happen. The global crisis caused a 3.5 percent GDP decline in 2009 and pushed Serbia down to a lower growth trajectory (indicated by a dashed line in Figure 2), which delayed the crossover to high income group by at least three years, to 2016.

Further setback was caused by a weak post-crisis recovery in 2010-2011 and the effects of a double-dip recession which produced another 0.5 percent GDP decline in 2012. Weak economic performance combined with inadequate policy responses, especially the lack of fiscal restraint and external debt build-up in recent years, led to lower sovereign credit rating and downward revisions of the medium term GDP growth prospects (see dash-dotted line labeled "Serbia – revised projections" in Figure 2). As a result, the crossover date to high-income group was pushed back to 2020, or later.

Everything suggests that Serbia is sliding into the infamous Middle Income Growth Trap (MIGT) experienced by many economies in the past 150 years. Although the terms "Middle Income Trap" and "Middle Income Growth Trap" are relatively new (see [15], [6], [7], [8], and [1]) the concept has been well established and theoretically defined decades ago. It depicts countries that have successfully escaped the low income poverty trap and grew to middle-income levels, but subsequently stagnate in the lower or upper middle income level and fail to grow to advanced high-income country levels [15, pp. 281-282].

MIGT phenomenon is a departure from the standard theoretical proposition according to which countries continuously grow from low middle to high income levels, and the rates of growth gradually decline as the income levels increase. The reality shows a variety of different growth patterns. Many middle income countries have periods of high growth followed by periods of growth slowdown, stagnation or decline that are not strongly linked to or induced by global or regional growth dynamics. "Instead of steadily moving up over time, their GDP per capita simply gyrates up and down. They are caught in the Middle Income Trap – unable to compete with low-income, low-wage economies in manufactured exports and unable to compete with advanced economies in high-skill innovations [15, p. 282]."

Table 1: GDP decline and recovery in a subset of comparator countries, 1990-2011

	Economic Decline			Economic Recovery			Net J-curve Effect		
	No of Years	Annual rate	Total decline	No of Years	Annual rate	Total recovery	Decline	Recovery	Net effect
							In 2005 PPP $ per capita		
Latvia	2	-23.5%	-41.4%	18	4.8%	132.6%	4188	7853	3665
Serbia	3	-23.4%	-55.0%	18	3.6%	88.3%	6382	4610	-1772
Albania	2	-18.9%	-34.2%	19	6.1%	205.6%	1338	5289	3951
Lithuania	4	-13.2%	-43.2%	17	5.2%	137.8%	5404	9781	4377
Ukraine	8	-10.1%	-57.5%	13	4.9%	85.6%	4633	2935	-1697
Romania	2	-10.1%	-19.2%	19	2.9%	71.8%	1506	4559	3053
Turkmenistan	7	-9.3%	-49.5%	14	7.3%	169.2%	3025	5229	2204
Kazakhstan	5	-8.7%	-36.5%	16	6.1%	157.1%	2590	7068	4479
Slovak Republic	3	-8.6%	-23.6%	18	4.3%	114.2%	3001	11065	8064
Belarus	5	-8.2%	-34.7%	16	7.4%	214.2%	2235	8992	6757
Russian Fed.	8	-6.6%	-42.0%	15	4.6%	95.3%	5297	7232	1935
Macedonia, FYR	5	-5.2%	-23.4%	16	2.3%	44.7%	1991	2920	929
Hungary	4	-4.0%	-14.9%	18	2.5%	55.0%	1961	6137	4176
Bulgaria	7	-2.8%	-17.8%	14	4.7%	90.7%	1339	5607	4268
Poland	3	-2.5%	-7.3%	20	4.4%	138.6%	601	10506	9905
Croatia				16	3.0%	60.7%		6029	6029
Estonia				16	5.3%	128.4%		10191	10191
Montenegro				14	2.8%	46.6%		3330	3330
Bosnia and Herzegovina				17	10.8%	473.7%		6281	6281

Source: Authors calculations based on WDI database, World Bank.

In a recent empirical study *Eichengreen et al.* [8] find strong evidence of a bi-modal occurrence of such growth slowdowns: one is around per capita income of $10,000, and the other around $15,000, both measured as per capita GDP in constant 2005 PPP terms. This implies that middle-income countries may face GDP deceleration in steps rather than at a single point in time as suggested in their previous papers (see [6] and [7]), and that it affects a larger group of countries. The study shows that the main cause of growth slowdowns can be attributed to *slower productivity growth*: 85 percent of slower output growth can be explained by lower total factor productivity growth – much more than by any slowdown in physical capital accumulation or by decreasing marginal returns to investment in physical capital, as a simple neoclassical growth model would suggest.

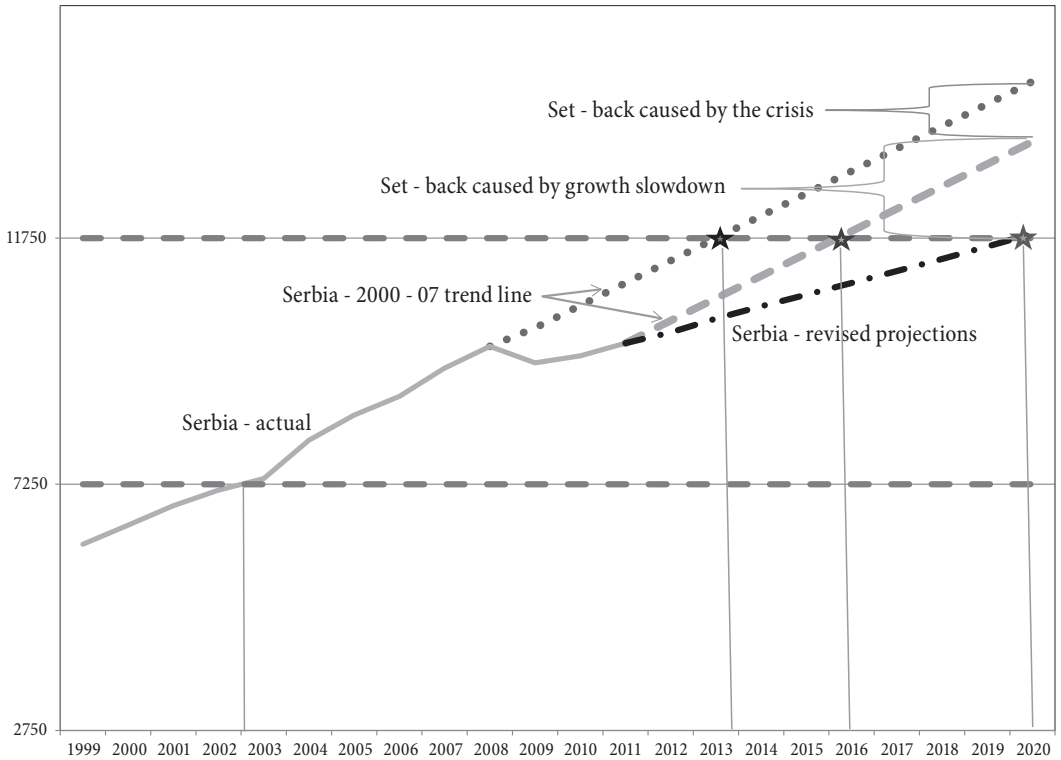
Growth slowdowns occur because low-cost labor and adaptation of foreign technology, key factors that generate high growth during lower levels of development, disappear at upper-middle-income levels. New sources of growth [1] and new development (policies and) strategies [15] are necessary to sustain increases in per capita income. In other words, upper middle income countries cannot compete in international markets by producing labor-intensive, low-cost products using technologies imported from abroad. Nor can they achieve large productivity gains by relocating labor from low-productivity agriculture or the pool of unemployed labor to high-productivity manufacturing. Growth slowdowns coincide with the points in the growth process where it is no longer possible to boost productivity by simply shifting labor across sectors, and reap gains from imported more efficient foreign technology.

On the positive side, the study finds that countries with greater innovation potential (higher share of workers with secondary and tertiary education in the labor force and greater share of high-technology products in exports) are considerably less likely to be affected by the growth slowdown. This is consistent with the standard proposition that moving up the technology ladder helps avoid the middle-income growth trap.

The root cause of growth slowdowns is failure to shift growth strategies after reaching middle-income status. Strategies that helped during the low-income stage soon become a constraint at the middle-income level.

Growth strategies for lower-middle income (LMI) countries are principally concerned with the supply side

Figure 2: Serbia per capita GDP (constant 2005 PPP Dollars), actual and alternative forecasts



Source: Authors calculations based on WDI database, World Bank, and World Economic Outlook 2012, IMF.

of an economy (i.e. the provision of enabling policies and institutions, and of quality factor inputs). LMI strategies seek to:

- Generate growth by moving labor from low to high productivity activities. Availability of jobs is crucial and simple export-led growth (whether in manufacturing as shown by East Asia or in modern tradable services, like business processing, as shown by India) provides almost unlimited scope for expansion and fast job growth once a successful niche is found.
- Grow fast by diversifying to build domestic production capabilities in most goods and services.
- Achieve high rate of capital accumulation to build infrastructure, cities, and centers of education (if they can save or borrow).
- Ensure political leadership and critical skills (in planning, organization and management, and implementation) in both public and private sectors.

By contrast, upper-middle income (UMI) countries rely on growth that is more capital and skill (knowledge) intensive in both manufacturing ("moving up the value chain") and modern services[2]. UMI growth strategies are much more focused on demand than supply. In upper-middle income countries, traditional exports can no longer be easily expanded since wages are higher and cost competitiveness declines. Export growth depends more on introducing new processes and finding new markets, than on expanding sales of the same product in existing markets. To do this, exporters must understand the quality, price, and consumer preference points of the global economy, which is a demanding task. Most firms start by developing in domestic markets, and only then expand to regional and global markets.

To help avoid the Middle Income Trap, new growth strategies must facilitate transition from diversification to specialization in the production of goods and services; and from emphasis on physical accumulation of factors to productivity-led growth, especially in sectors producing traded goods.

Specialization is critical to offset the cost disadvantages associated with higher wages (and higher cost of living in UMI countries), promote rapid innovation and the introduction of new products and processes based on the enhanced capabilities of firms.

The real policy challenge is to understand the role of the public sector in enabling and facilitating this process, correcting market failures and avoiding "state intervention failures." Emphasis on total factor-productivity growth in middle-income countries requires major changes in education, by moving focus from primary and secondary schooling to multi-tier tertiary education. It also requires the right blend of competition and public support for promising new areas: new "public private partnerships" are shaped through the so-called "discovery process" and "smart specialization." The knowledge economy has become a major source of technological progress and innovation. It is part and parcel of investment and capital accumulation process. Despite the recognized importance of innovation, middle-income countries often face significant legal, institutional and policy obstacles in becoming more innovative. We turn to these issues in the next section.

Innovation: Sine qua non for modern growth

There is little doubt that inventions and innovations were at the heart of modern economic growth. Following *Gordon* [11], the first industrial revolution (1750-1830) was enabled by the invention of steam engine and a widespread series of innovations in production and transport. The second industrial revolution (1870-1900) was based on the inventions of electricity, internal combustion engine, communications, petroleum and gas, chemicals, and utility networks which enabled an even broader range of innovations including airplanes and air-travel, modern house appliances, indoor plumbing (water and sewage), air-conditioning, interstate highways etc. The third industrial revolution started with the invention of computers and electronics in the 1960s and continues to this date with a

2 With new ICT technologies, huge productivity improvements become feasible as many services can be digitized, stored and delivered (transported) through modern telecommunications networks. Services have become a powerful engine of growth for many middle-income countries. In fact, service exports have become the fastest growing export sector globally and for many developing countries. Service productivity growth is outstripping industrial productivity growth in most developing and advanced economies.

major shift to widespread use of robots in the production process and in most products.

Clearly, the industrial revolutions would not have been possible without these inventions and spin-off innovations that enabled increases in productivity and economic growth for more than 250 years and completely changed the way we live, work, commute, entertain, travel and communicate. And yet, until recently, the mainstream economic theory saw (at least the first two if not all three) industrial revolutions primarily as the process of capital accumulation and labor relocation from low productivity (agricultural and traditional service) jobs to higher productivity jobs (in industrial employment and modern business services). The role of entrepreneurs was often reduced to mobilizing capital and labor and "taking risk." Inventions and innovations were pushed outside the theoretical model and policy intervention into exogenous sources of knowledge and technological change (manna from heaven), made available as public good to all or a freebee to lucky ones.

Schumpeter [20] was the first to recognize that "evolutionary character of the capitalist process" must not be reduced to capital accumulation and employment growth (i.e. "quasi-automatic increase in population and capital" as he put it), but rather treated as process of "creative destruction" based on entrepreneurial activity and innovation. Innovation "keeps the capitalist engine in motion," seeks "new consumers, goods, the new methods of production or transportation, the new markets, the new forms of industrial organization that capitalist enterprise creates" [20, p. 85].

Solow's neoclassical growth model also recognized that capital alone cannot be the basis of sustained growth due to diminishing returns. Hence, he identified "technological progress" as the main source of long run growth. *Solow* did the initial empirical estimates but he fell short of explaining what drives technological progress (and innovation) and left it in an exogenous "residual black box." This sent a huge number of eager researchers onto a futile empirical quest to estimate the black box residual. More importantly, the exogenous nature of innovations severed all links with economic policy and for decades deprived economists and policy makers of a meaningful policy framework to enhance economic growth through innovations.

This changed with endogenous growth models. *P. Romer* [19] created a simple AK model that took on a huge task to address the issues of economics behind technological advance. The AK model rests on a three point departure from the standard theory. First, it assumes that knowledge and ideas behind innovation are a non-rival good, i.e. that everyone can use the same idea (design, blueprint, recipe, chemical formula etc.) at the same time. Second, the production of innovation (ideas) is faced with increasing returns to scale since they are expensive to produce and very cheap (almost costless) to reproduce. Third, despite increasing returns, businesses will not be attracted to embark on an innovation activity unless they can impose some control over the new designs/innovations by patenting them, copyrighting them or simply hiding them as a secret until they recover the fixed cost of invention and make profit.

The core idea of the new theory of growth behind the AK model hinges on the institutional and policy framework that can orderly register and protect patents and other intellectual property rights (IPRs), as well as ensure public-private collaboration necessary to overcome possible market failures due to large possible externalities or lack of markets at critical stages in the research-innovation process.

Status of research and innovation in Serbia

At an applied level, national research and innovation (R&I) systems are rated based on the quality and adequacy of innovation inputs and outputs. Based on methodology used by INSEAD Global Innovation Index [13], innovation inputs include five dimensions evaluating the quality of: (1) Institutions (i.e. political, regulatory and business environment); (2) Human Capital (HC) and Research (i.e. I, II and III Education and R&D); (3) Infrastructure (i.e. ICT, general and environment); (4) Market Sophistication (credit access, investment climate, trade and competition); and (5) Business Sophistication (knowledge workers, innovation linkages, and knowledge absorption). Innovation outputs are evaluated based on: (1) Knowledge and Technology

Output (knowledge creation, impact and diffusion); and (2) Creative output (creative intangibles, creative goods and services).

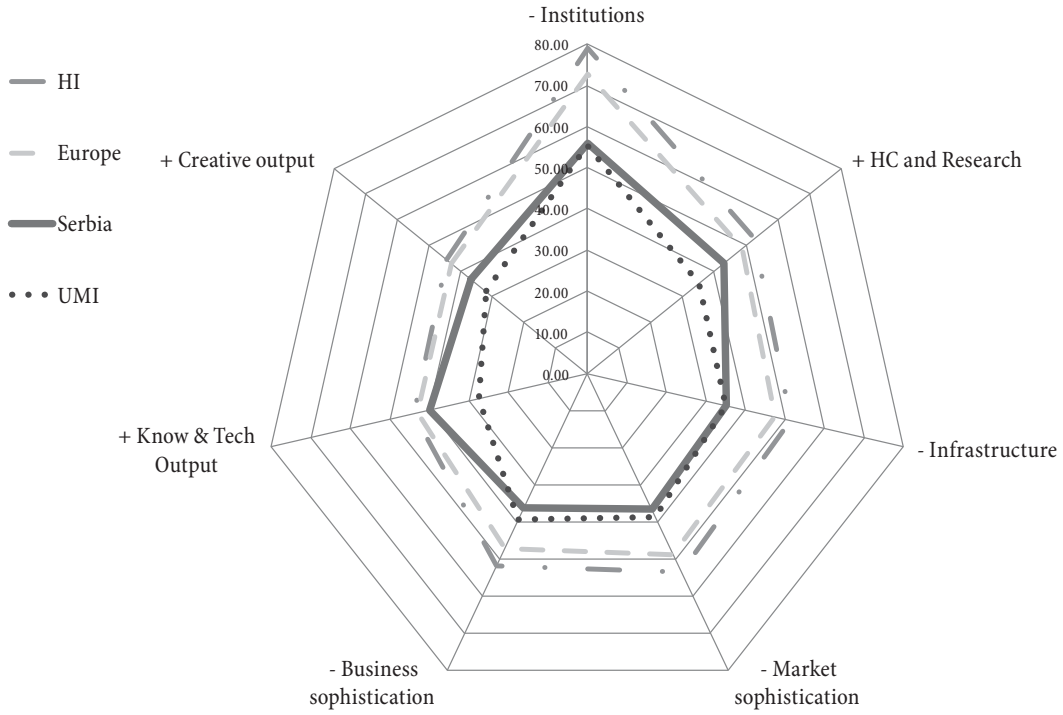
Overall, Serbia ranked no. 46 out of 141 countries covered in the Global Innovation Index for 2012. This rank actually averages very good innovation output performance (rank 35) achieved under somewhat unfavorable R&I conditions reflected in much lower innovation input rank (65). Output performance in imperfect conditions is best captured by Innovation Efficiency Index (IEI). In terms of IEI Serbia achieved an excellent 7th rank in the world, and a superb 2nd rank (only after China) in its income group (UMI). These IEI results should be interpreted with caution since they are designed to measure relative performance of the R&I systems rather than their impact on the economy. In other words, high innovation efficiency confirms the ability of an R&I system to perform well under existing imperfect circumstances, but the resulting absolute level of performance may not be sufficient to impart a real innovation impact on the national economy which must face world competition in domestic and world markets.

The source and nature of these innovation scores is best seen at the level of individual dimensions presented in Figure 3. Serbia outperformed its UMI group in both output dimensions and "HC and research" dimension on the input side. Most impressive is the result achieved in the most important dimension – the "Knowledge and Technology Output," where Serbia closed ¾ of the gap between UMI and HI groups. Figure 4 shows that Serbia belongs in the group of "innovation learners."

In Institutions and R&I Infrastructure Serbia performs at the average level of its income group which leaves a large gap vis-à-vis European and high income countries. This is a clear signal that more resources are needed to upgrade the R&I infrastructure, taking into account that the 2012 GII assessment only partially reflects efforts made in recent years, including a Euro 400 mil project under way aimed at boosting research infrastructure, improving R&I procurement systems, and improving living conditions for researchers.

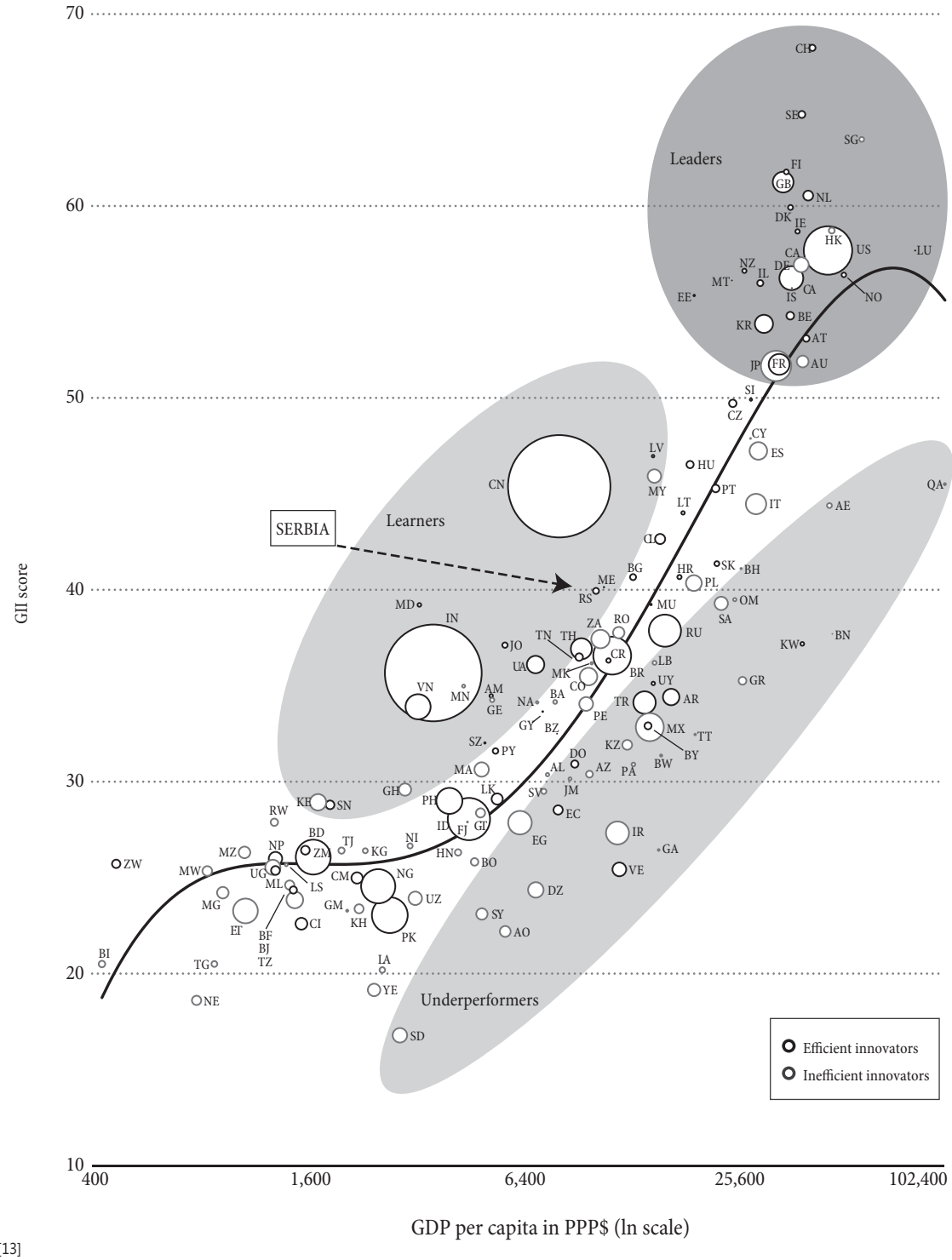
Finally, in two dimensions of innovation inputs (Market and business sophistication) Serbia lags even behind the UMI average. This doesn't come as a surprise and in many respects echoes the results of broader competitiveness diagnostic framework [22], especially in the availability of financing, stock market development, investment climate, and the level of competition. A conscious effort is needed to finally complete the institutional reforms

Figure 3: Serbia – Innovation input and output scores



Source: [13]

Figure 4: Serbia Research and Innovation performance – successful learner



Source: [13]

restarted more than a decade ago and make advances in public support for the R&I sector.

Since 2007 the share of public expenditures Serbia allocated on R&D[3] has fluctuated in a wide range between 0.63 and 0.92 percent of GDP. This is relatively high compared to other countries in the Western Balkans region, but lags behind the transition economies that have recently joined the EU and, more importantly, significantly behind the Lisbon Agenda target GERD of 3 percent of GDP for R&D. The potential impact of larger investments in research and innovation and better use of R&I resources is quite high. Empirical research and model simulations for a subset of recent EU accession countries [26] illustrate

3 This share is usually called GERD (Government Expenditures on R&D).

that increasing R&D expenditures to 3 percent of GDP would have a strong positive impact on accelerating GDP growth and enhancing "catching-up" with EU income levels, and increasing export levels in the long run, both acutely needed by the Serbian economy. For example, higher R&D expenditures would increase GDP level by 11.7 percent in Romania and 13.1 percent in Bulgaria; and permanently boost the value of exports by 12.9 percent in Croatia and 13.5 percent in Romania. Effects are smaller but still significant in other accession countries and range from 5.5 to 8.9 percent for GDP increase, and from 8.0 to 10.5 percent for larger exports.

Results from a background study using firm level data for the Western Balkans [29] indicate that:

- Innovative firms grow faster than non-innovative firms, by 15 percent in sales and 8 percent in labor productivity;
- Higher R&D expenditures significantly contribute to sales and labor productivity growth; and
- Expenditures on R&D expenditures have a higher correlation to growth than expenditures on training or on infrastructure services.

The broader diagnostic work carried out in the context of national and regional innovation initiatives confirms that Serbia suffers from a legacy of unfinished or partially finished reforms. Good IEI results in relative innovation output performance notwithstanding, Serbia's national research and innovation system performs substantially below its potential due to:

- Severe input constraints;
- Imperfect and highly skewed incentive systems;[4] and
- Weak "linkages" with the economy (in both technology transfer and collaboration).

As a result, R&I absolute output and contribution to economic growth and job creation has been too low.

The limited supply of "inputs" to scientific research, a widely recognized cause of suboptimal performance, is particularly relevant for Serbia. In part, reduced funding for R&I was an unintended consequence of stringent fiscal policies and tight budget situation in the past. Under fiscal pressure, public expenditures on R&I were cut more than social expenditures based on a widely shared perception among policy-makers that public expenditures on research do not generate relevant economic returns (at least not in the politically relevant short and medium run). Cumulative impact of low R&I investment and inadequate maintenance had a devastating impact on the state of research infrastructure. Large diversification of the "science-base" and research activities deepens the fragmentation of already scarce resources and makes the adjustment more difficult.

As public funding for research and innovation declined and became more unstable over the years, the social status of scientists deteriorated, and the political and economic uncertainties undermined future prospects in Serbia and the region, a large number of highly qualified researchers emigrated or left research for more rewarding employment in business during the past two decades. As a result, research staff has aged and declined in numbers, and research potential deteriorated compared to the world. Highly mobile researchers continue to emigrate in search of jobs and career prospects. Young scientists will likely continue to leave (brain drain) and expats not likely to come back (no or delayed brain gain) without better research conditions and more transparent, merit-based career opportunities.

Technology transfer, another important link in modern R&I systems, is weak and collaboration between public research organizations and industry is "fragile" at best. Patent applications (both national and international), a pre-requisite for licensing, have been stagnating or decreasing over the last decade. Given the initial low level, the gap vis-à-vis comparable economies in Europe and the world is further increasing. Recently signed patent agreements may change that, but the impact is not yet reflected in the data.

Quality interactions between industry and science have declined over the years and are essentially missing at this time. At present, collaboration happens mainly at the individual level, driven by occasional opportunities and short-term objectives. Recorded private sector expenditures for R&D (direct or through collaborative

4 Bibliometric data analysis suggests that changes in the incentive systems led to huge overproduction of published journal papers (of untested and hence unknown relevance and impact) at the expense of patents and other highly relevant forms of research, teaching and publications. See more in Vujović [23].

efforts with research institutions) declined significantly. The vast majority of R&D spending in Serbia is done by the public sector.

Research and university systems encounter profound structural and institutional limitations coupled with a lack of a strategic vision to better impact the national economy. The allocation of budget funds is heavily tilted toward basic research. Available data sets indicate that universities are the most productive organizations both in terms of quantity and quality of publications, but research institutes, clinics and hospitals receive the bulk of the public funding[5].

Despite recent legal and institutional efforts, a consistent institutional approach for technology transfer is still not fully developed. A handful of spinoff companies have emerged in recent years as the experiences of the University of Novi Sad and Institute Mihailo Pupin illustrate. But these cases result from very specific circumstances that were much more an exception to the rule than the rule. What's more, these special circumstances will not necessarily continue to exist nor can they be easily reproduced elsewhere. The establishment of full TTOs in recent years is a major step in the right direction which is expected to show impact in the coming years.

The limited demand for knowledge from the enterprise sector is often cited as the main cause of weak research commercialization and collaboration in Serbia and other countries in the region. As reported in the background studies for the Western Balkans regional innovation strategy [29], the economic reforms associated with transition have extinguished (or significantly reduced) most of research-intensive industries and with that the need for knowledge and innovations. The resulting demand for knowledge is constrained by the "new structure" of the economy – which creates a vicious circle that needs to be broken.

Last but not least, institutional framework for innovation has been the weakest link in the innovation chain which received very limited attention in past policy discussions. Policy disincentives (both economic and non-economic, intended and unintended) tend to affect the behavior of individuals and organizations. Rigid salary structures, job classifications, and promotion rules (allowed or mandated by laws) severely constrain incentives for good researcher performance. Regulatory frameworks and funding practices often discourage research excellence, commercialization and collaboration. Meritocracy is still weak in R&I organizations and the use of performance evaluation limited.

- Research funding continues to be made on a simple head-count basis based on formal research or teaching titles (institutional block grants), or on the basis of nominal research projects justified by the number of publications alone, rather than on basis of results based on program/project performance (competitive grants or scientific excellence).
- Career promotion has been linked to performance which is often based solely on the number of publications in scientific journals rather than on their impact factors, complemented with adequate recognition of technology transfer activities and other research activities (including the expansion of the base of young researchers needed for future advances in R&I sector).
- Policy frameworks regarding the ownership and commercialization of results from public-funded research (e.g. Intellectual Property Rights) are still weak or unclear, with the resulting uncertainty about the expected benefits to institutions and researchers (e.g. revenue and royalty sharing) from engaging in technology transfer activities.

A limited integration with the global scientific community is another constraining element of the current institutional framework. Further integration would enable "gains" from sharing ideas and research facilities, promoting research specialization and, thereby, research excellence and productivity. Reformed national research and innovation system must provide incentives to encourage the return or collaboration of national researchers (diaspora), including visiting and post-doc fellowships, and installation grants. Policies that go beyond removing barriers to mobility and seek to provide direct tangible support for the return of expatriates or attraction of top foreign researchers should be aware of

5 This result may be biased as the same individuals and teams may receive research funding through institutes and hospitals, and publish the results of that research under their "university titles." See more in Vujovic [23].

possible risks and an imperfect track record in this area. Experience of Croatian "Unity through Knowledge Fund" (UKF) shows that mobilizing the scientific diaspora to collaborate with local researchers (without a re-location goal), works in practice.

To compensate for the deteriorating research infrastructure, Serbia is striving to develop "centers of excellence" as part of the Serbian R&D Infrastructure Investment Initiative. During a five year period (2011-2015) EUR 400 million will be invested in a number of research fields, including nano-science and new materials – an area of formal interest of all other countries in the region.

Serbia has moved to improve conditions for technology transfer from research institutes and universities. Changes in the higher education law and the Innovation Law of 2010 have been implemented to stimulate the creation of university spinoffs and intermediary organization for support of innovation activities and technology transfer.

The supply of risk capital in the early stages of enterprise development is still at an early stage. The gap in venture capital markets in Serbia is estimated to be in the range of EUR 10-15 million per year. With the exception of some small initiatives already started in Serbia, technology transfer financing is almost non-existent and represents an obstacle to the development of a solid "deal flow." National and regional markets are relatively better supplied with financing for later stages and expansion of innovations. Given the prevailing characteristics of the equity industry, it is unlikely that those funds will "trickle down" to earlier stages of the innovation-chain without external support. Schemes to promote finance innovation have also been introduced in recent years, but are still scarce. The recently created Science and Innovation Investment Fund will finance knowledge-based startups in Serbia, just as BICRO's programs addressed several phases of the innovation process in Croatia.

The diagnostics of Serbian Research and Innovation system shows many common features with the neighboring Western Balkans (WB) countries. The small size of economies and R&I sectors in the region limits the opportunities for economic and research specialization in individual countries. The "smart specialization" process, in which research and innovation efforts leverage existing comparative advantages, could help pool regional resources to create a critical mass and more effective synergies that might pay major economic dividends. Moreover, economic clusters that tend to evolve from knowledge spillovers – given their cumulative and tacit nature – are not necessarily consistent with political boundaries. A relative expertise in the areas of agriculture and biological sciences, medicine and chemistry is shared by most Western Balkans Countries, providing an opportunity to enhance research collaboration and maximize opportunities for innovation. Equally relevant for regional collaboration is energy saving research and technologies, which become crucial to the challenges imposed by climate change.

The proposed Regional R&D Strategy for Innovation [29] combines the advocacy of policy reforms at national level and joint investments promoting research and innovation (R&I). *Policy reforms* seek to improve the impact of R&I on economic growth and job creation in the longer run. *Joint investment initiatives* aim to finance regional programs and institutions that could jump-start innovations and contribute to job creation and growth in the short-medium term. The initial set of regional initiatives includes: (i) a research fund to foster international collaboration with the scientific Diaspora, (ii) regional centers and networks of excellence in selected fields, (iii) a technology transfer facility, (iv) an early stage innovation financing facility, and (v) a non-profit entity mandated to continue the advocacy of reforms in the region and manage future programs.

Conclusion

Looking at the combined findings of our previous paper [22] and this text, we conclude that Serbian economy has both urgent short-term stabilization needs, to control inflation pressures, domestic (fiscal) and external imbalances, and worrisome long term structural and growth problems.

Abundant external financing and political optimism have dried up after a series of persistent shocks dealt by the global downturn and setbacks on the diplomatic front. "Let's wait and see" attitude clearly demonstrated by the international community (especially by the EU, the IMF and all key international players) suggests that Serbia cannot really count on external professional and

financial support now, when it really needs it, or any time soon. In a way, this is better. With the IMF money and conditionality out of the way, Serbia can focus on longer-term challenges and tasks at hand. Much like China did in the early 1990s, Serbia should design its own IMF-style stabilization program which would not undermine pro-growth policies. And stick to it with more vigor than the IMF would (i.e. allow no waivers).

In parallel, immediately start to remove the five obvious constraints to growth we identified in September:

1. Align Real Effective Exchange Rate (REER) which strongly affects the tradeable sector and represents a bottleneck in moving the economy to a sustainable growth path with macro stability, sustainable fiscal and external balance.
2. Remember not to overdo the REER adjustment since the exchange rate works in tandem with product design, marketing, R&D and innovations in case of differentiated industrial goods.
3. Get to the bottom of structural and policy causes of the limited availability of credit, high real cost of financing, and inefficient financial intermediation. No economy can grow at the present level of interest rate spreads.
4. Control and scale down expensive, large and intrusive state. Eliminate its interference that creates costly business environment, and focus state actions to secure and promote competition policies. Set and maintain state and public sector wages levels at or below the market reference points generated by the private sector. Stop crowding out the private sector from the financial and labor markets.
5. Enact laws and policies that would promote competent corporate management and efficient labor force (with productivity levels that result in competitive unit labor costs). Aside from the obvious training programs for staff, to provide more efficient administrative and public services and utilities, e-government services, electronic payment of bills etc. to lower compliance cost and free up time lost on inefficient government services.

Complete all ongoing institutional and policy reforms and start all pending reforms knowing that the effects will come not in 4-5 years from now, but in 4-5 years after the reforms were really started.

Adopt a coherent set of policies that would avoid further sliding into the Middle Income Growth Trap. First and foremost change the development strategy (laws, institutions, policies) geared towards lower income country deriving growth from capital accumulation and relocation of labor from low productivity to higher productivity activities. Move away from sectors/goods where low income countries can compete in price and quality. Make a massive effort to better train the labor force and better educate youth. Put emphasis on quality intermediate tertiary technical training in ICT and modern business services.

Enhance support for innovation capacity as a basis for job creation and growth by promoting:

- Research excellence through scientific collaboration, involvement of diaspora, merit based financing and incentive systems;
- World class research infrastructure and other innovation inputs;
- Close collaboration between research organizations and enterprises, through better technology transfer offices (TTOs), protection of patents, trademarks and other industrial property rights (IPR);
- Better financing at all stages of innovation process, especially early stages where existing financial markets have limited knowledge and instruments; and
- Quality governance of the R&I process and financing.

Use smart specialization approach to identify a two-way match between research and innovation potential and the needs of the business sector in creating production and export opportunities.

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