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# SERBIA: CONTINUED QUEST FOR SUSTAINABLE GROWTH

Srbija - u potrazi za održivim rastom\*

## Abstract

The paper argues that Serbia must address a complex set of institutional, policy and behavioral challenges to enhance its readiness to respond to the likely pressures of the Fourth Industrial Revolution requiring profound social, industrial and organizational changes. These include rational and result-based allocation of resources aimed at improving key drivers of future production and economic growth, such as technology and innovation, human capital, institutional framework and sustainable resources. Behavioral changes are needed to shift from oversized input demands (for provision of ICT, education facilities, infrastructure, etc.) to achievement of better technology absorption, improved products and services, education achievements, elimination of corruption, the rule of law and resource sustainability.

**Keywords:** *Fourth Industrial Revolution, income convergence, growth diagnostics, institutional development, governance, economic complexities.*

## Sažetak

U radu se pokazuje da Srbija mora da razreši složen skup institucionalnih i bihejviorističkih izazova da bi podigla svoj nivo spremnosti da odgovori na očekivane pritiske koje će generisati četvrta industrijska revolucija, a koji će zahtevati duboke socijalne, industrijske i organizacione promene. Da bi se to postiglo, potrebna je racionalna alokacija resursa usmerena na ostvarivanje rezultata na planu poboljšanja ključnih pokretača buduće proizvodnje i ekonomskog rasta, kao što su tehnologija i inovacije, ljudski kapital, institucionalni okvir i održiva resursna osnova rasta i razvoja. Potrebne su duboke promene u ponašanju da bi se prešlo sa predimenzionisanih zahteva za inputima (na primer u oblasti ICT, obrazovnih institucija, infrastrukture itd) na ostvarivanje rezultata u oblasti boljeg korišćenja tehnologije, poboljšanog kvaliteta proizvoda i usluga, ostvarivanja rezultata u obrazovanju, eliminaciji korupcije, vladavini prava i resursne održivosti.

**Ključne reči:** *četvrta industrijska revolucija, konvergencija dohotka, dijagnostika rasta, institucionalni razvoj, upravljanje, složene ekonomske veze.*

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## Introduction

Today, Serbia still faces similar challenges we discussed a year ago at KBF 2019 [9]. It continues to lag significantly behind Europe (EU-15), measured both in GDP per capita expressed in Euros and in purchasing power parity (PPP) terms. There is a strong consensus that dynamic sustainable economic growth over longer time periods stands as the key of income convergence with Europe and better quality of life in Serbia and the Western Balkan (WB) region as a whole. Views start to differ as soon as we address the practical institutional and policy changes needed to achieve such dynamic and sustainable long-term economic growth in real domestic and international circumstances.

The global economic context continues to be difficult, marred by the low level of economic activity and institutional and political uncertainties. Following a sharp slowdown in 2018, global economic growth remained weak throughout 2019 due to the lowest level of manufacturing activity recorded since the global financial crisis and the increasing trade and geopolitical tensions stemming from unclear future of the global trading system and international economic order. This affected adversely the businesses and investors' confidence. The accommodating monetary policy and the resilient service sector have cushioned much of the impact on the level of economic activity and employment. Nevertheless, risks remain.

As a result, world growth estimate has been reduced to 3.0 percent in 2019, and 3.4 percent in 2020. Economic growth in the so-called systemic market economies (US, EU, China and Japan, which account for almost half of the global GDP) will stabilize at moderate levels. Global growth can be expected to strengthen only in the 2021-2, driven by stronger recovery in the emerging market economies. The latest IMF's World Economic Outlook warns that the overall economic outlook remains precarious, with large downside risks. It calls for policies that would defuse the growing trade tensions, reinvigorate multilateral cooperation, provide appropriate stimulus to economic activity and address financial vulnerabilities that pose risks to the medium-run growth.

The European economic environment will face additional constraints from weaker trade and manufacturing.

Domestic demand (in services and consumption) has been strong, based on labor market conditions and supported by an expansionary fiscal policy and looser financial conditions. At the same time, the longer-run prospects may be affected by some signs of softer investment demand. Overall, EU growth has been now estimated at 1.4 percent in 2019 (a drop from 2.3 percent in 2018) and projected to modestly increase to 1.8 percent in 2020 based on the recovery of global trade and GDP growth. Significant differences in economic dynamics between advanced and emerging Europe will remain. In 2019, advanced Europe will grow by 0.1 percentage points below average, while the emerging Europe's growth is estimated at 1.8 percent (0.4 percentage points above average), leading to further convergence.

The key downside risks come from the no-deal Brexit and further intensification of trade tensions globally, which could adversely impact investment. Additionally, the existing weaknesses in trade and manufacturing could spread to modern service sectors and further diminish growth prospects. A cumulative effect of negative tendencies may lead to a downward adjustment in risk appetite of investors, renewed financial vulnerabilities and reemergence of deflationary pressures in advanced economies.

Many EU countries continue to favor accommodative monetary policy to counter the slowing economic activity. Based on widespread social and labor union pressures, wage growth has risen above productivity gains, especially in new EU Member States. IMF's most recent Regional Economic Outlook (November 2019) projects that this is likely to have a more muted impact on inflation due to weaker pass-through from wages-to-prices when the inflation level and inflation expectations are low, corporate profitability is high and firms are exposed to greater competition, as it appears to be the case recently.

Extended reliance on loose monetary policy may increase financial sector vulnerabilities, not least rising real estate prices, and calls for in-depth monitoring and active use of macro-prudential measures. Given the low level of unemployment, fiscal policy should be allowed to assume a stronger counter-cyclical role in the short run and, for the most part, to focus on medium-term objectives. Countries with ample fiscal space could introduce

measures to boost potential output, while countries with elevated debt and deficit levels should proceed with fiscal consolidation. This nuanced approach would also help address external imbalances.

In an environment of elevated downside risks, and limited scope for active monetary policy, contingency plans become indispensable. The core content of contingency plans should be pivoted in synchronized fiscal response, appropriately differentiated across countries, and synchronized with structural reforms, including higher labor force participation, investment in human capital and infrastructure and strengthened governance. These remain vital to raise and sustain economic growth, and address long-term challenges.

Serbia and the Western Balkan region will need substantial institutional reforms and policy changes to effectively utilize a more limited scope for faster real per capita growth in the medium run and to avoid the risk of falling further behind Europe in the standard of living. Additional risks of new trade barriers and reverse capital outflows in response to weaker macro fundamentals and (actual and perceived) political instability are of critical importance. The availability of otherwise ample financial resources for economic growth and development will be progressively limited for countries that do not meet the highest financial regulatory and taxation standards. This includes macro- and micro-prudential policies critical for financial stability and increased resilience, cybersecurity, safeguards against excessive risk-taking and application of AML-CFT measures with a clear objective of leaving the FATF (Financial Action Task Force) gray list, already done, and further improving performance. Given the legacies of the past, Serbia will need to monitor carefully contingent liabilities and balance sheet mismatches.

Unfortunately, the status of most of the institutional reforms necessary for the efficient operation of market democracy and free flow of goods, people and capital is still not satisfactory. Institutional weaknesses range from the financial sector, the rule of law (judicial independence and legal efficiency), protection of property and creditor rights, the quality of public and private sector governance systems to the overwhelming presence of non-transparent and corrupt practices. They will continue to be a strong

deterrent for large institutional investors who require a transparent, stable and efficient legal environment to enter and comfortably operate in Serbia and the Western Balkan region. In addition to this, a sustained higher level of foreign and domestic investment effort is a sine-qua-non for income convergence that hinges on efficient infrastructure and sustained productivity growth anchored in innovations.

At this stage of development, the availability of public infrastructure is an important precondition for dynamic growth. Despite strong investment efforts in the recent years, infrastructure continues to face gaps which effectively constrain economic growth, private sector development and continued integration into the European supply chains. This conclusion equally applies to inadequate transportation networks (both in coverage and quality), insufficient and unreliable provision of utilities (water, power, district heating, etc.), underdeveloped communication networks and underinvestment in human capital and innovation capacity for sustained long-term growth.

Closing the infrastructure financing gap may prove challenging within a limited fiscal space, with constrained access to external financing and weak domestic private sources. The routine recommendations from the IMF and other IFIs (to mobilize additional domestic revenues, contain domestic spending and improve the quality of public investment management, especially in selecting and implementing public and PPP projects) are welcome, but fall significantly short of the infrastructure needs. This is clearly one area where a concerted EU effort in the WB region, along with substantial private sector participation, will be needed to overcome this legacy of the past and an overriding obstacle to growth and the EU integration process.

Last but not least, necessary improvements in the quality of human capital and innovation potential for productivity growth may appear to be more modest in terms of financial resources needed, but the actual task may prove to be quite difficult to design and implement, as it requires a change in the value system, work ethics and corporate culture. For example, Serbia ranks much better in education and productive labor skills than the WB region, but it lags behind the region in labor market

performance. This clearly shows that Serbia continues to value education and skills, but that it has inherited a strong resistance towards the very concept of labor market and labor force mobility, even in relation to comparator countries in the WB region.

Finally, although Serbia possesses solid innovation capacity, it is not yet in a position to address the likely challenges posed by the Fourth Industrial Revolution (IR 4.0). Tangible improvements in educational achievements, labor-employer relations and reliance on professional management will be needed to convince foreign investors and managers that productivity gains in Serbia and the WB region can be achieved and sustained for large investments to be profitable in the longer run. Regarding the quality of governance (in the state, public and private sector), Serbia presently lags significantly behind the core EU Member States and the new accession countries.

The main focus of the paper in section two will be to expand and deepen our understanding of the challenges posed by the Fourth Industrial Revolution, and in section three to explore various aspects of readiness based on the methodology developed by the World Economic Forum (WEF) team and applied to 100 countries globally. Sections four and five will discuss the assessment and valuation results for Serbia and propose policy and reform improvements. Section six concludes.

### **New challenges posed by the Fourth Industrial Revolution**

Exactly four years ago, Klaus Schwab coined the term the Fourth Industrial Revolution in a short paper published in *Foreign Affairs*. The opening paragraph was dramatic in its tone and substance: “We stand on the brink of a technological revolution that will fundamentally alter the way we live, work, and relate to one another. In its scale, scope, and complexity, the transformation will be unlike anything humankind has experienced before. We do not yet know just how it will unfold, but one thing is clear: the response to it must be integrated and comprehensive, involving all stakeholders of the global polity, from the public and private sectors to academia and civil society [5].”

The concept was so influential that it entered the *Encyclopedia Britannica* already in May 2018, by defining the Fourth Industrial Revolution (or IR 4.0 for short) as “a series of social, political, cultural, and economic upheavals that will unfold over the 21st century. Building on the widespread availability of digital technologies that were the result of the Third Industrial, or Digital, Revolution, the Fourth Industrial Revolution will be driven largely by the convergence of digital, biological, and physical innovations.”

Building on the digitalization and ITC started in the Third Industrial Revolution, the Fourth one additionally harbored technologies, such as artificial intelligence, genome editing, augmented reality, robotics and 3-D printing, which are deeply changing the way humans create, exchange and distribute value. Even more than in the previous revolutions, this one will profoundly transform social and political institutions (rules), industries and individuals. The social and political choices that we make today are likely to influence the world in decades and centuries to come.

Over and above the impressive breakthroughs in individual research fields and emerging technologies, it is important to note the additional crosscutting impacts and synergies between them. Schwab quotes examples that redefine and blur the boundary between the digital and physical worlds due to: fast expanding low-cost gene sequencing; the use of artificial intelligence in augmenting processes and skills in practically every industry; applying neuroscience and neurotechnology to enhance the human brain; bringing large-scale automation to century-old transport and manufacturing paradigms; and harnessing technologies such as blockchain and smart materials.

Schwab rightly warns that the implied changes in values, incentive systems and economic institutions (rules) will likely transform how we communicate, learn, entertain ourselves and relate to one another and how we understand ourselves as human beings, and that they will lead to societal transformation on a global scale. Furthermore, the increasingly rapid pace of change and everyday life will have “an impact on human identities, communities, and political structures. As a result, our responsibilities to one another, our opportunities for self-

realization, and our ability to positively impact the world are intricately tied to and shaped by how we engage with the technologies of the Fourth Industrial Revolution. This revolution is not just happening to us — we are not its victims — but rather we have the opportunity and even responsibility to give it structure and purpose.”

As before in history, this revolution is bound to have both positive and negative impacts on different stakeholders. Some nations have benefited greatly from the previous revolutions, but the sustainability of these benefits depended on their ability to fairly distribute the resulting gains and address future risks (i.e., externalities at national and global level).

The novelty in this revolution are risks, such as cybersecurity threats, massive misinformation through digital media, potential unemployment or increasing social and income inequality.

One of the key concerns among economists is that the Fourth Industrial Revolution could shed jobs, yield greater inequality and, potentially, disrupt labor markets. They warn that the net replacement of workers by machines might exacerbate the gap between returns to capital and returns to labor. However, they also note that it is possible that, in aggregate, there may be a net increase in safe and rewarding jobs. Schwab notes that, in his view, IR 4.0 will stress the importance of talent and creative innovative potential of individuals more than technical skills and the availability of capital.

On the other hand, Bianchi [1] emphasizes major developments and challenges brought by the Fourth Industrial Revolution.

1. *New efficient technologies* increasingly enable a reversal of past massive offshoring of production and related services to China, India and other emerging economies. To continue to attract FDI, the emerging economies will have to be more efficient overall rather than just offer cheap labor. Successful countries will need to provide competitive infrastructure and logistical services, top quality management and efficient institutional and administrative environment. This will create space for shared prosperity through higher real wages and job security and, thus, reverse

past trends of compensating inefficient government and institutional setup through lower wages.

2. *Hyper connectivity* which allows different organization of production, research and marketing functions, and substantially lowers the volumes of shipment requirements (ranging from printed documents to spare parts). The financial crisis stopped the exponential growth of global trade due to global recession. Post-crisis revival is increasingly based on data flows: digital globalization proceeds at an extremely rapid pace utilizing the evolution of ICTs into hyper-connected systems. Internet has become omnipresent in work, leisure and social relations of billions of people.
3. IR 4.0 will have a profound impact on the *structure and dynamics of industries*. The term industry has acquired a broader meaning. It indicates a capacity to organize production of goods and services to respond to market needs irrespective of the sector, from agricultural to manufacturing and services. Primary sectors (such as agriculture) are now seamlessly integrated with processing industry and saturated with innovation and knowledge. Likewise, high value-added manufacturing goods are intersecting with and often bundled with services.
4. There will be a need for a *new industrial policy*. Predictably, this will trigger deep transformations which, based on experience, require a new type of comprehensive industrial strategy and policy. The depth and complexity of the ensuing structural changes will require the inclusion of institutions (rules and regulation), social and education policies and a broader citizen participation at the regional and national level. Consistent with the broader definition of industry, industrial policy is defined as a set of actions aimed at enabling and facilitating structural changes and steering industrial development in the desired directions. Industrial policy is concerned with innovations, trade, intellectual property rights and antitrust laws, as well as human capital. Human capital in turn requires consideration of social policies, education and training.

5. *Digital globalization*, which entails a complex transformation of the economy, the society and culture, has been based on major science and technological developments in high-performance computing, artificial intelligence, robotics, new materials, genomics and nanotechnologies. In addition to having a profound impact in separate scientific fields, it allows developments across multiple fields that can converge to create completely new products and production processes.
6. *The changing roles of training and education, as well as geography and governance*. The entire education, training and learning systems will need to be rethought and adapted to the changing circumstances brought about by the ensuing technological revolution. Comprehensive treatment of geography and the linkages to the global ecosystem must gain primary importance in order to secure comprehensive competitiveness and long-run sustainability.

The main challenge for the emerging economies will be to create sufficient internal capacity to design and implement an appropriate new industrial policy that would enable timely institutional and policy changes to keep their economies competitive despite the likely disruptive changes across practically all industries.

Albeit impressive, the accelerated creation of new solutions, new products and new processes is not a distinctive feature of the Fourth Industrial Revolution, compared to the previous ones. Many leading authors in the field have identified similar periods of sustained technological changes, as well as convergence of different fields in the production process, as seen, for example, in the automobile industry. Likewise, each of the previous industrial revolutions introduced new technologies with a profound impact on the manufacturing regimes. The progression goes from the factory system brought by the First Revolution, over mass production systems (assembly lines) introduced by the Second, and flexible production systems enabled by the Third one, to mass customization to meet the demand which will dominate the world of the Fourth Industrial Revolution. They also created unique interactions between economic, social and political conditions.

For example, the mass production system of the Second Industrial Revolution was based on the division of production process into elementary tasks performed by well-trained and relatively low-skilled workers under time constraint. This had predictable consequences on the educational requirements, income levels, social structure, organization of the labor force (unions), the structure and style of management, as well as the main characteristics of the urban rural divide and the nature of the polity.

The Third Industrial Revolution, in connection with globalization, introduced massive changes in the global division of labor towards the emerging market economies. Starting from 1990s, globalization promoted unprecedented growth of world trade and foreign direct investments in a world characterized by trade liberalization, massive transition from plan to market and the birth of emerging market economies. Industrial policy played a major role in facilitating deep structural transformation of the economy. Good examples include China, Slovakia, Czech Republic and Slovenia. By contrast, lack of appropriate industrial policy and the dominance of chaotic and ill-conceived privatizations has been apparent in countries that experienced chronic difficulties during the transition process.

In addition to introducing substantial challenges, the Fourth Industrial Revolution offers a great opportunity to resolve the current global societal issues, such as demographic trends of population growth and population ageing, rapid and wide urbanization, as well as preservation of ecosystems and climate change. This opportunity will be exploited only if scientific, technical and economic changes are accompanied by appropriate ethical, cultural and social changes. To succeed, it is critical to develop awareness, build resilience and promote sustainability in policymaking at the national and global level. In doing so, it is essential to respect and properly address the complexity of deeply related (intertwined) issues. To be successful in facing the sweeping changes likely to come with the Fourth Industrial Revolution, societies will need to enable true ethical, cultural and social metamorphosis.

Therefore, the new industrial policy must be comprehensive and favor adaptation and adaptability by promoting innovation and adoption of new technologies, adjustment in human capital and provision of appropriate

infrastructure. Information has become the main raw material (input) and output. New technologies allow hyper-connection on a global scale between people, people and machine, and between machines (the so-called IoT – internet of things). Global data flows are growing exponentially, allowing a small number of firms to hold huge market power based on enormous amounts of data. This raises serious privacy and antitrust issues that require new legal solutions and enforcement mechanisms.

The volume of exports and imports in the world has not changed much since 2007, but Asia's share has increased. China became the leader in global manufacturing value added, both in terms of levels and dynamics. Furthermore, Asian countries are well-positioned to respond to the challenges of the Fourth Industrial Revolution. Based on their strong investment in R&D and in skills, they are likely to further strengthen their position in global trade and manufacturing value added.

New globalization is likely to generate exponentially growing data flows and stagnant trade of goods. The leading private companies (CISCO) estimate that mobile data traffic has increased 18-fold during the 2011-2016 period and is likely to increase another 7-fold in the future to 49 exabytes per month. Again, the fastest growth is expected in Asia, which will account for half of global data traffic by 2021.

Expectedly, smartphones are projected to be the main source of data traffic (43%) in 2021, followed by machine-to-machine data exchange (over 30%) without the involvement of humans. M2M data traffic is in fact the internet-of-things (IoT), and is at the core of the Fourth Industrial Revolution. Examples include GPS systems in cars, medical applications, patient health records and citizen data records, home and office security and automation systems, as well as the industrial internet. In short, while the flows of physical goods and capital have come to a halt in the last decade following the global crisis, globalization has not stopped but has become digital, including substantial portion of huge financial flows which have become digital, too.

A more detailed view reveals the supply-side changes, as well as a deep transformation of the demand side of markets. The revolution in the interaction between

consumers and producers has already happened and will continue to evolve based on online platforms. Obvious examples are new businesses, such as Uber and Airbnb, which have deep implications for the operation of the markets and the position of incumbent firms in the existing industries. Interaction between producers and consumers is also changing the nature of products and services. Many manufacturers and companies in general claim that they now sell solutions rather than products. Competition intensifies due to low cost of entry through new platforms and ability to customize products and services to specific needs. This also raises issues of competition policy.

New data platforms are able to create enormous databases of personal information without consumers' consent or awareness, especially containing information revealed through the use of online markets and applications. This raises the issue of product and services regulation, as well as privacy, market and political power. Companies such as Google, Amazon, Facebook and Apple have acquired monopolistic dominance that dwarfs the historical examples of Standard Oil.

## Readiness for the future of production in IR 4.0 – Methodology and global results

The World Economic Forum (WEF) surveyed one hundred countries across all continents in an effort to understand where countries are vis-à-vis the likely challenges posed by the ensuing IR 4.0. The authors of the WEF's Readiness for the Future of Production Report [11] start from the already observed trends associated with the Fourth Industrial Revolution. The report is based on new "emerging technologies — such as the Internet of Things, artificial intelligence, robotics and additive manufacturing", which "will fundamentally transform production", bring about greater "speed and the scope of technological change" and another "layer of complexity to the already challenging task of developing and implementing industrial strategies that promote productivity and inclusive growth."

Furthermore, they emphasize that IR 4.0 will put at risk "the competitiveness paradigm of low-cost manufacturing exports as a means for growth and development", forcing countries to adjust "their national strategies and their

ambition to leverage production as a national capability” , and “understand the factors and conditions that have the greatest impact on the transformation of their production systems”.

The Readiness report is intended to help countries understand how well they are positioned today to “benefit from the changing nature of production in the future” based on data-driven assessment in two critical areas: “Structure of Production, or a country’s current baseline of production, and Drivers of Production, or the key enablers that position a country to capitalize on the Fourth Industrial Revolution to transform production systems.”

As indicated in the table below, the assessment was conducted based on two dimensions, eight categories and ten subcategories with a total of 59 indicators. Expectedly, the brunt of the indicators (35, i.e., 60%) is concentrated in two categories most relevant for readiness to respond to challenges posed by the IR 4.0.

The Readiness report defines key dimensions, categories and subcategories as follows [11, pp. 5-7]:

*Structure of production* reflects the complexity and scale of the current production base. The assessment does not evaluate sector mix (of agriculture, industry, services), but rather looks at the scale and complexity of the production system, assuming that countries with a large, more complex structure of production today are better prepared for the future. More specifically, the Complexity category assesses the mix and uniqueness of products a country can make based on embedded knowledge and economic linkages as defined by Hausmann and Hidalgo’s research on economic complexity [3]. On the other hand,

the Scale category assesses the manufacturing value added and its relative importance (share in GDP).

*Drivers of production* identify key enablers that position a country to capitalize on emerging technologies and opportunities in the future of production. Six main drivers or categories (included in Table 1) have been identified through an iterative consultative process involving key stakeholders (including decision/policymakers, businesses and academia). Each driver includes corresponding subcategories and indicators that enable measurement. The logic behind the detailed Drivers of production dimension is that countries with higher scores across the mix of enablers will do better in the adoption and diffusion of technology underlying the future transformation of production systems.

The *Technology & Innovation* category assesses the quality of the existing technology platform (such as the availability and use of ICT) and country’s ability to foster innovation and commercialize innovations that have potential applications in production. As will be noted in the discussion of the empirical results, there is a constant tension and a potential trade-off between the supply side (such as provision of ICT and research results) and demand (use) of this potential at the firm and industry level. Namely, countries that are leaders in terms of high availability of ICT (Hong Kong, Bahrain, Ireland) are not the best in terms of securing effective absorption of technology at the firm level and impact on products and services (Sweden and Switzerland). Likewise, countries that make the strongest effort to finance science and R&D (Korea, Denmark) are not necessarily leaders

**Table 1: Readiness diagnostic model framework – Future of production capabilities**

Structure of production		Drivers of production					
60%	40%	20%	20%	20%	20%	15%	5%
<b>Complexity</b>	<b>Scale</b>	<b>Technology &amp; Innovation</b>	<b>Human capital</b>	<b>Global trade &amp; Investment</b>	<b>Institutional framework</b>	<b>Sustainable resources</b>	<b>Demand environment</b>
1 indicator	2 indicators	7+11 indicators	6+11 indicators	4+3+2 indicators	4 indicators	6 indicators	2 indicators
		Technology platform	Current labor force	Trade	Government	Sustainability	Foreign & Domestic demand
		Ability to innovate	Future labor force	Investment			
				Infrastructure			

Source: Readiness report [11, pp. 5-6].



in securing venture capital financing to turn innovative ideas into commercial products, or in transmitting the impact of innovations on industry activity (where the USA dominates).

The *Human capital* category assesses a country’s ability to respond to constant changes in the labor market triggered by the Fourth Industrial Revolution by looking at both the current labor force capabilities, as well as the long-term ability to cultivate the right skills, talent and incentives in the future work force.

The Global trade & Investment category assesses a country’s ability to operate efficiently under global trade competition (with substantial trade openness), secure domestic and international financial resources to invest in production-related development, as well as to provide high quality of infrastructure (in transport and electricity) to enable production-related activities.

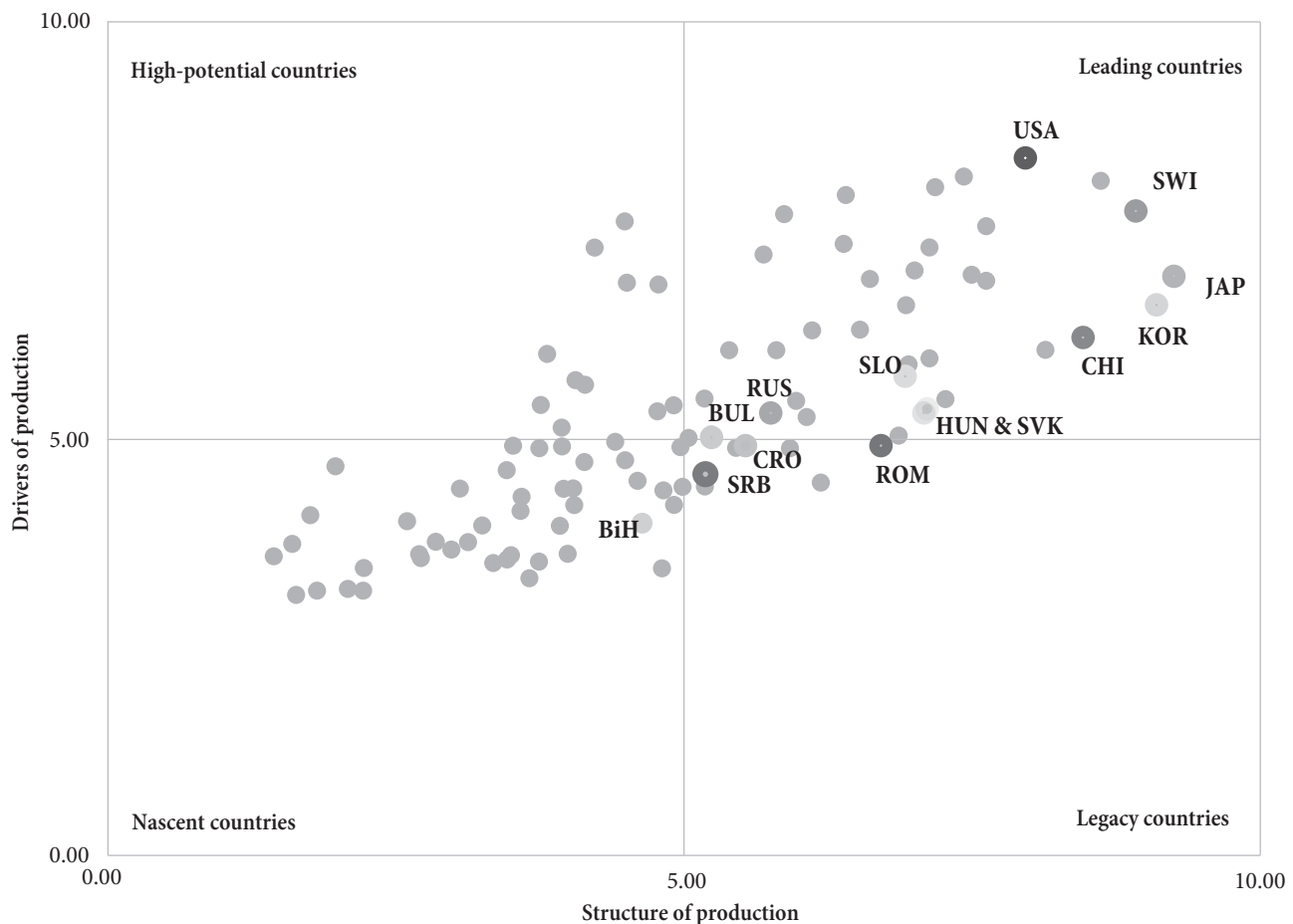
The *Institutional framework* category focuses on efficient and effective operation of the government in

securing regulatory efficiency, the rule of law, corruption-free environment and longer-run legal and policy orientation necessary for the private sector to harness technological development, novel businesses models and advanced manufacturing.

The *Sustainable resources* category assesses the impact of present and future production on the environment, including sustainable use of natural resources and due concern paid to the development of alternative energy sources.

Finally, the Readiness report assesses the overall *Demand environment* category by evaluating a country’s effective market size, i.e., access to foreign and local demand for optimal scale of production. This category also measures the sophistication of the consumer base by looking at buyer sophistication on one hand, and the level of competition (i.e., the absence of market dominance) on the other. The authors [11] note that the proposed sets of indicators were evaluated based on the existing measures

Figure 1: Readiness for the future of production – Global data/Evaluation results



Source: Readiness report [11] and author’s estimates.

defined by international organizations<sup>1</sup>, as well as the World Economic Forum's own evaluations and surveys.

Based on the methodology described above, the WEF team observed the 59 indicators for each country and calculated the aggregate values for subcategories, categories, and finally the two principal dimensions for the Structure of production (plotted on the horizontal axis) and the Drivers of production (plotted on the vertical axis), using the weights presented in Table 1 above.

Four country archetypes emerge from the assessment data: 1. Leading countries (top right quadrant), which exhibit both strong production base today and a high level of readiness for the future; 2. Legacy countries (bottom right quadrant), which inherited a strong production base from past industrialization efforts, but record relatively weaker performance across one or more drivers of production which puts them at risk in the fast-changing world following the Fourth Industrial Revolution; 3. High-potential countries (top left quadrant), which have strong future production drivers and a relatively smaller manufacturing base due to a rich natural resource base (such as oil and gas) or greater reliance on trade and services; and 4. Nascent countries (bottom left quadrant), which have both limited present production base and low level of readiness across drivers of future production.

There is a relatively heavy concentration of countries around the median score: 23 countries score between 4.5 and 5.5 on the Structure of production, and 32 countries score between 4.5 and 5.5 on the Drivers of production. Hence, the number of countries that fall within each of the archetype quadrants varies depending on the dividing lines (i.e., point where quadrants intersect).

The WEF team assumed that quadrants intersect at the average score of top 75% of performers in each dimension (i.e., 5.71 for Structure of production and 5.73 for Drivers of production). This puts 25 countries in the Leading quadrant, 57 countries in the Nascent quadrant, and nine countries each in the High potential and Legacy

quadrants. By contrast, if we assume that quadrants intersect at a median score of 5.0 for both dimensions (as indicated in Figure 1), we will obtain a substantially larger number of countries (36) in the Leading quadrant, only 44 in the Nascent quadrant, marginally more (11) in the High-potential quadrant, and an unchanged number in the Legacy quadrant.

Obviously, the choice of the intersection point is somewhat arbitrary and inconsequential for the analysis and policy recommendations, but it does affect the headline that captured global attention: Only 25 countries are ready to face the challenges of the Fourth Industrial Revolution.

Two obvious conclusions of the Readiness report [11, pp. 13-14] on a global scale are: to advance readiness, countries should seek to improve performance across all Drivers of production (or shift up in Figure 1), and expand their Structure of production (shift right in Figure 1). Generic recommendations will vary across archetype groups.

The best strategy for countries in the Leading quadrant is to push (up and right) toward the frontiers of their archetype and convert readiness into transformation by adopting and fully harnessing the potential of the emerging technologies. The downside risk for Leading countries is to rely too much on their current success and ease their efforts in expanding the platform for transforming production practices, potentially shrinking the future production base.

The Legacy countries should center their strategy on improving performance across all relevant Drivers of production. This will enhance their potential to transform current production systems and improve the Structure of production. The downside risk for Legacy countries is to underinvest across key drivers, resulting in a shrinking future production base.

The best strategy for High-potential countries is to use the existing strong Drivers of production to expand the scale and complexity of the Structure of production to the extent that this fits their development strategy. Some countries may want to pursue services or other opportunities instead of manufacturing as part of their strategy.

The best strategy for Nascent countries is to first invest in drivers (move up in Figure 1) to create the

1 Such as the International Energy Agency (IEA), International Labor Organization (ILO), International Telecommunication Union (ITU), Organization for Economic Co-operation and Development (OECD), United Nations (UN), United Nations Educational, Scientific and Cultural Organization (UNESCO), United Nations Industrial Development Organization (UNIDO), World Bank (WB), World Trade Organization (WTO) and others.

right basis and conditions to develop and implement a strategy to expand the Structure of production aligned with developments set by the IR 4.0.

## Readiness for the future of production in IR 4.0 – Results for Serbia

Serbia has a 5.2 score in Structure of production and a 4.6 score in Drivers of production. Based on the WEF archetype classification, this puts Serbia in the Nascent group of countries (with  $5.2 < 5.71$  and  $4.6 < 5.73$ ). By contrast, our classification puts Serbia in the Legacy subset ( $5.2 > 5.0$  and  $4.6 < 5.0$ ). In both cases, Serbia is close to the borderlines. We believe, though, that the complexity and

scale of manufacturing production (after accounting for the continued chronic low capacity utilization in older manufacturing sectors) better fits the Legacy than the Nascent profile.

The essence of Serbia's readiness can best be seen at the level of categories and subcategories in the Drivers of production dimension. As detailed in Tables 2a-2c below, Serbia records an uneven performance both across and within key categories. The last column in Tables 2a-2c indicates our brief assessment of the need to first analyze the problem and design appropriate policy/reform response, where Need indicates the desirable course of action, and Must indicates the presence of critical gaps and an urgent call for action.

Table 2a: Serbia – Readiness for the future of production under IR 4.0

		Serbia			Leader		Policy / Reform
		Score	Rank	Distance	Score	Name	
<b>I</b>	<b>Structure of production</b>	5.2	42	42.37%	9.0	JAP	
<b>I.1</b>	<b>Complexity</b>	6.3	37	37.23%	10.0	JAP	
	Economic complexity (2.5) – 2.5	0.6	37	74.29%	2.3	JAP	
<b>I.2</b>	<b>Scale</b>	3.5	63	64.66%	10.0	CHI	
	Manufacturing value added % GDP	13.9	46	56.76%	32.1	CHI	
	Manufacturing value added US\$ bn	5.72	69	99.81%	2999.9	CHI	
<b>II</b>	<b>Drivers of production</b>	4.6	64	43.76%	8.2	USA	
<b>II.1</b>	<b>Technology &amp; Innovation</b>	3.8	69	55.76%	8.5	USA	
<b>II.1.1.</b>	<b>Technology platform</b>	5.1	72	41.69%	8.7	SIN	
<b>II.1.1.a</b>	<b>Availability of ICT</b>	7.1	56	22.34%	9.1	UAE	
	Mobile phone subscriptions per 100 pop.	120.6	52	48.45%	234.0	HKK	Outlier
	LTE mobile network coverage % population	78.2	58	21.80%	100.0	BAH	
	Internet users % of adult population	67.1	49	31.57%	9.8	BAH	
	FDI and technology transfer 1–7	3.9	83	35.69%	6.1	IRE	
<b>II.1.1.b</b>	<b>Use of ICT</b>	5	92	39.74%	8.4	SWI	
	Firm-level technology absorption 1–7	3.9	97	35.83%	6.0	SWE	Need
	ICT impact on services and products 1–7	4.2	80	32.03%	6.2	SWI	Need
<b>II.1.1.c</b>	<b>Digital security &amp; Data privacy</b>	3.1	85	66.38%	9.3	SIN	
	Cybersecurity commitment 0–1	0.3	84	66.38%	0.9	SIN	Must
<b>II.1.2.</b>	<b>Ability to innovate</b>	2.5	47	70.54%	8.3	USA	
<b>II.1.2.a</b>	<b>Industry activity</b>	3.5	86	53.58%	7.6	USA	
	State of cluster development 1–7	3.4	80	40.90%	5.7	USA	Need
	Comp. Inv. in emerging technology 1–7	3	89	50.70%	6.0	USA	Must
	G-procure. of advanced technology 1–7	2.8	79	48.01%	5.5	UAE	Must
	Comp. embracing disruptive ideas 1–7	3	94	42.81%	5.3	USA	Need
	Multi-stakeholder collaboration 1–7	3.3	76	40.42%	5.6	USA	Need
<b>II.1.2.b</b>	<b>Research intensity</b>	3.7	27	63.33%	10.0	DEN	
	R&D expenditures % GDP	0.8	45	81.92%	4.3	KOR	Must
	Sci-technical publications: No/bn PPP\$ GDP	49.2	7	26.35%	66.8	DEN	
	Patent applications per million pop.	2.15	48	99.51%	439.0	JAP	Must
	Available financing 0–10	0.2	85	98.03%	10.0	UK/USA	Must
	Venture capital deals US\$ millions	156.3	84	99.99%	2121.5	USA	Must
	Venture capital deals % GDP	3.9	85	99.64%	1083.4	BIH	Must

Source: Readiness report [11] and specifically pages 212–213 for Serbia.

Table 2b: Serbia – Readiness for the future of production under IR 4.0

		Serbia			Leader		Policy / Reform
		Score	Rank	Distance	Score	Name	
II.2	<b>Driver: Human capital</b>	5	54	40.67%	8.5	SWI	
II.2.1.	<b>Current labor force</b>	6.8	40	21.94%	8.8	FIN	
II.2.1.a	<b>Labor force capabilities</b>	6.8	40	21.94%	8.8	FIN	
	Manufacturing employ. % working pop.	16.1	20	41.03%	27.3	CZE	May
	Knowledge-intensive employ % working pop.	28.9	42	46.86%	54.3	SIN	Need
	Ratio of female to male reimbursement	0.86	37	24.02%	1.14	MOL	
	Mean schooling years	11	38	21.72%	14.1	GER	
	Availability of scientists & engineers 1–7	3.9	60	34.82%	6.0	FIN	Need
	Digital skills of active population 1–7	4.2	58	29.08%	6.0	USA	
II.2.2.	<b>Future labor force</b>	3.2	73	60.85%	8.2	SWI	
II.2.2.a	<b>Migration</b>	0.7	98	91.91%	9.2	SWI	
	Migration migrants/100,000 pop.	-14.1	93	100.00%	229.4	OMA	Must
	Capacity to attract and retain talent 1–7 (best)	1.9	98	68.89%	6.1	SWI	Must
II.2.2.b	<b>Education outcomes</b>	4.8	52	40.63%	8.0	GER	
	Quality of universities Count.	1	62	99.37%	15.9	USA	Must
	Quality of math & science education 1–7	4.8	26	25.42%	6.5	SIN	
	Quality of vocational training 1–7	3.7	67	43.23%	6.6	SWI	Must
	School life expectancy years	14.6	54	28.91%	20.5	AUI	Need
	Pupil-teacher ratio in primary education	15.2	35	72.32%	8.8	KUW	Outlier
	Critical thinking in teaching 1–7	3.1	68	43.47%	5.5	DEN	Must
II.2.2.c	<b>Agility &amp; Adaptability</b>	4.1	76	48.86%	8.1	SWI	
	Active labor market policies 1–7	3	66	46.81%	5.7	SWI	Must
	On-the-job training 1–7	3.8	80	39.42%	6.2	SWI	Need
	Hiring and firing practices 1–7	3.6	57	37.19%	5.8	HKK	Need
II.3	<b>Driver: Global trade &amp; Investment</b>	5.1	60	43.64%	9.0	SIN	
II.3.1.	<b>Trade</b>	7.7	37	17.74%	9.3	SIN	
II.3.1.a	<b>Trade openness</b>	10	1	0.00%	10.0	AUS	
	Trade % GDP	109.2	24	70.70%	372.6	HKK	Outlier
II.3.1.b	<b>Trade facilitation &amp; Market access</b>	5.3	68	38.22%	8.7	SIN	
	Trade tariffs%	0.05	66	69.56%	0.0	HKK	Outlier
	Prevalence of non-tariff barriers 1–7	4	81	32.19%	5.9	SIN	
	Logistics performance 1 – 5	2.8	69	32.97%	4.2	SWE	
II.3.2.	<b>Investment</b>	1.5	67	85.11%	10.0	CHI	
II.3.2.a	<b>Investment and financing</b>	1.5	67	85.11%	10.0	CHI	
	Greenfield investments US\$ bn	3.65	41	95.05%	73.7	CHI	
	FDI inflows US\$ bn	2.24	56	99.12%	255.5	USA	
	Domestic credit to private sector % GDP	43.4	71	80.89%	227.3	CYP	
II.3.3.	<b>Infrastructure</b>	6.1	63	34.93%	9.4	SIN	
II.3.3.a	<b>Transportation and electricity</b>	6.1	63	34.93%	9.4	SIN	
	Transport infrastructure 0–100	50	47	43.72%	88.8	HKK	
	Electricity 0–100	71.7	77	28.27%	100.0	ISR	
II.4	<b>Driver: Institutional framework</b>	4.9	60	46.51%	9.1	SIN	
II.4.1.	<b>Government</b>	4.9	60	46.51%	9.1	SIN	
II.4.1.a	<b>Efficiency &amp; Effectiveness</b>	5	56	41.76%	8.7	SIN	
	Regulatory efficiency 0–100	69.9	51	22.43%	90.1	SIN	
	Incidence of corruption 0–100	42	53	53.33%	90.0	DEN	Must
	Future orientation of government 1–7	3.4	63	45.20%	6.2	SIN	Need
II.4.1.b	<b>Rule of law</b>	4.7	62	52.88%	10.0	FIN	
	Rule of law (2.5) - 2.0	-0.1	62	100.00%	2.0	SWE	
II.5	<b>Driver: Sustainable resources</b>	6.2	53	29.55%	8.8	NOR	
II.5.1.	<b>Sustainability</b>	6.2	53	29.55%	8.8	NOR	

Source: Readiness report [11] and specifically pages 212-213 for Serbia.

Table 2c: Serbia – Readiness for the future of production under IR 4.0

		Serbia			Leader		Policy / Reform
		Score	Rank	Distance	Score	Name	
II.5.1.a	<b>Energy &amp; Emissions</b>	4.8	82	46.52%	9.1	SWE	
	Alternative & nuclear as % total energy use	0.2	63	83.74%	0.9	ETH	Must
	CO2 intensity -- megatons/GDP (US\$ bn)	0.9	88	50.92%	0.1	SWI	Must
	CH4 intensity -- megatons/GDP (US\$ bn)	0.2	60	86.88%	0.0	JAP	Must
	N2O intensity -- megatons/GDP (US\$ bn)	0.1	75	95.07%	0.0	BAH	Must
II.5.1.b	<b>Water</b>	7.6	28	20.13%	9.5	AUS	
	Baseline water stress (use as % of available)	0.6	20	88.33%	0.0	UGA	Must
	Wastewater treatment	64	67	36.01%	100.0	SIN	
II.6	<b>Driver: Demand environment</b>	3.5	85	59.09%	8.5	USA	
II.6.1.	<b>Foreign &amp; Domestic demand</b>	4	71	59.62%	10.0	CHI	
II.6.1.a	<b>Market size</b>	4	71	59.62%	10.0	CHI	
	Market size 0–100	40.4	71	59.62%	10.0	CHI	Must
II.6.1.b	<b>Consumer base</b>	3	97	60.61%	7.5	SWI	
	Consumer sophistication 0-10	3	97	60.61%	7.5	SWI	Must
	Buyer sophistication 1–7	2.4	99	54.62%	5.3	USA	Must
	Extent of market dominance 1–7	3.2	89	46.65%	5.9	SWI	Must

Source: Readiness report [11] and specifically pages 212-213 for Serbia.

The following conclusions and direct policy recommendations can be derived from assessments presented in Tables 2a-2c:

Under the category **Technology and innovation**, Serbia scored 3.8, which is 55.8 percent behind the leader. Two thirds of this score are accounted for by the Technology platform subcategory (mostly based on solid Availability of ICT), and only one third by the Ability to innovate subcategory. In leading countries, these two categories contribute roughly with 50% each. The main reason that a very important subcategory, Ability to innovate, contributes so little can be attributed to weaker indicator scores under Industry activity (ranked 76-94 out of 100 countries) and a rather uneven performance under Research intensity (ranging from excellent performance on Scientific and technical publications ranked no. 7 in the world, to practically non-existent financial support for commercial development of innovations). This is confirmed by the following specific comments on the elements of Technology and innovation:

#### *Availability of ICT*

Serbia is doing reasonably well in the classical aspects of ICT availability.

#### *Use of ICT*

Serbia could do better in securing firm-level technology absorption and the effective use of ICT to improve products and services. See SWE and SWI.

#### *Digital security & Data privacy*

Insufficient attention is paid to cybersecurity.

#### *Industry activity*

Generally, much more attention is devoted to ICT availability than to the related and more important industry activity. More specifically, the following issues loom large and must be addressed: Mediocre level of cluster development; Companies are not inclined to invest in emerging technology; No effort from the Government to procure advanced technology; Companies are risk-averse and do not embrace disruptive ideas that are at the core of changes happening within IR 4.0; There is not enough multi-stakeholder collaboration in advancing industry innovation efforts.

#### *Research intensity*

Insufficient funding for science, R&D. Must be corrected immediately.

Must understand why patent applications are so low.

Financing for innovations is seriously lagging behind every effective model in the world.

Under the category **Human capital**, Serbia could do more to stop and gradually reverse the brain drain through a more adequate financing of science, R&D and innovation efforts, and better career prospects for young talents. Regarding the Future labor force issues, it is imperative to improve Education outcomes and on-the-job training (see the notes below).

*Education outcomes*

Quality of universities is an acute and painful issue. Attracting certified global universities in critical areas (for IR 4.0) may help. In vocational training, broader efforts are needed, synchronized with FDI projects.

Improve the quality of teaching and learning.

*Agility & Adaptability*

On-the-job training must be improved.

Under the category **Global trade and investment**, Serbia can diversify and improve financing of investments (especially credits to the private sector) and provision of infrastructure.

*Investment and financing*

Domestic credits to the private sector lag behind despite the fact that banks have ample resources which they tend to invest in Government bonds rather than the private sector.

*Transportation and electricity*

Serbia still lags behind in the provision of enabling full infrastructure services and electricity.

Finally, the category **Institutional framework** shows that there is room for more efficient and effective operation of the Government, especially in reducing the incidence of corruption and improving the rule of law (see the comments below).

*Efficiency & Effectiveness 0-10*

Incidence of corruption (perceived or real) affects the quality of the institutional framework and must be improved.

Future orientation of the Government becomes a critical dimension of readiness for IR 4.0. Less energy should be devoted to firefighting and more to strategic issues.

*Rule of law*

The economic importance of the rule of law is not recognized.

## Possible policy and institutional responses

The Fourth Industrial Revolution has already produced a deep and lasting impact on all industries, both on the supply and the demand side of goods and services. To enable the economy to efficiently and effectively respond to past and forthcoming challenges, adequate macroeconomic and industrial policies will have to be accompanied with

a significantly improved public and private investment effort. Presently, its size is too small, the structure is not aligned with likely infrastructure and human capital (knowledge) gaps, the efficiency is too low, and the efficacy in achieving stated objectives is inadequate.

Major improvements are needed in public investment planning, from identification to preparation, appraisal and implementation. Obvious areas for plausible interventions include building capacity for critical stages of selecting investment priorities, doing high-quality project preparation, competitive financing and implementation. In terms of structure, public investment will be expected to devote an increasing share to human capital development, ICT and connectivity, science, R&D and innovations, while meeting the highest international standards. Finally, public investment must be smart and focused on enabling and crowding in private investment aligned with the demands of the global economy.

In addition, a strong effort will be needed to design and implement a transparent incentive system for efficient private investments that would successfully apply the most recent technological changes and respond to challenges posed by the Fourth Industrial Revolution.

In this context, the main challenge will be to create sufficient internal capacity to design and implement an appropriate new industrial policy that would enable timely institutional and policy changes to keep the Serbian economy competitive. Breakthroughs in science and technology, which are at the core of the Fourth Industrial Revolution, have introduced disruptive changes virtually across all industries.

Future growth-enhancing policies will have to be introduced in an increasingly complex world characterized by continued globalization and the overpowering impact of the changes brought about by the Fourth Industrial Revolution.

Although post-crisis globalization has slowed down in its initial domain (trade of physical goods and services), it has triggered deep structural changes in companies and industries. It changed the behavior of firms in the areas of R&D and innovations. Rational behavior prevailed over competition and generated cooperation among fierce competitors in searching new solutions. This is particularly

obvious in the areas where digital technologies enable not only new forms of market interactions (continuous/online contact with consumers), and efficient search for market equilibria, but also allow better design of market regulation and government interventions in general.

## Conclusion

Serbia must address a complex set of challenges as it strives to reach sustainable dynamic growth in an increasingly competitive world of the Forth Industrial Revolution, and converge to the EU levels of income and quality of life within a reasonable timeframe.

Prioritizing and sequencing policy and institutional reforms should be based on a new development paradigm based on country-specific needs, comprehensive growth diagnostics and complex economic linkages at the national and regional level. Allocation of resources should be skewed towards priorities that will become critical for the country's readiness to address the challenges posed by the Fourth Industrial Revolution. This will necessitate policy measures that will target results, such as improved firm-level use of ICT technology and impact of new technologies on the quality of public and private sector goods and services, rather than the indiscriminate increase in the availability of ICT. Likewise, the litmus test of the Ability to innovate should be improved Industry activity and promulgation of

R&D and innovation results in new product and process innovations utilizing efficient venture capital endeavors.

Substantial efforts will be needed to boost all aspects of education outcomes, without which it would be impossible to close the knowledge and productivity gaps and embark on a sustainable income convergence path with the EU.

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