

INFRASTRUCTURE IN A CHANGING WORLD: TRENDS AND CHALLENGES

edited by **Carlo Secchi** and **Alberto Belladonna**

with the knowledge partnership of

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ISPI

INFRASTRUCTURE IN A CHANGING WORLD

TRENDS AND CHALLENGES

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INFRASTRUCTURE IN A CHANGING WORLD. TRENDS AND CHALLENGES
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The Centre on Infrastructure focuses on how geopolitical and economic trends shape and are shaped by investment decisions on infrastructural projects. It aims to analyse global trends (new technologies, mobility, sustainability, etc.) and monitor major projects, also with a view to gauging their complementarity/competition and financing channels. Specific attention is devoted to the role of key economic and political players at all levels – from local to global – including regional and international development banks, whose “political” agenda is often crucial to foster public and private investment.

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Introduction

“Infrastructure for growth” is the title of the ISPI Centre’s 2019 Report on Infrastructure. That headline is now timelier than ever. In a world on the brink of a global recession due to the coronavirus outbreak, the mission of infrastructures today and tomorrow is a challenging one. They are nevertheless a formidable countercyclical tool in a time when consumption, investment and trade are restrained by economic slowdown. They are an indispensable part of the fiscal stimulus plans that many countries will be adopting in the weeks and months to come in an attempt to mitigate the negative effects of economic paralysis, while fostering employment and improving competitiveness. Investment in infrastructure is essential because it has an impact on GDP both directly and indirectly, producing a multiplier effect on invested resources. Today and tomorrow, the role of infrastructure is more crucial than ever.

Far before the current crisis began, the infrastructure gap was widening around the world: in most countries, the difference between investment trends and needs was increasing at a growing pace. The demographic boom in many areas of the world, mostly emerging countries with limited investment capabilities, has triggered an increased demand for new infrastructure (greenfield investments); on the other hand, developed economies suffer from ageing infrastructures that require large investments in modernisation and maintenance (brownfield investments). If this gap is not addressed, it could harm long-term competitiveness and undermine economic recovery.

The first part of the Report focuses on analysing infrastructure trends from 2007 on in different countries. It highlights infrastructure investments during the global financial crisis – as a part of fiscal packages – and how they played a countercyclical role (or not) in economic recovery (Chapter 1 – Alberto Belladonna, Alessandro Gili, ISPI). In most countries, reduced investment in infrastructure compared to national needs has led to lower GDP growth and lower employment rates. This is one of the reasons underlying the recent establishment of several independent authorities devoted to assessing objectively the most urgent infrastructural needs in the countries concerned (Chapter 2 – Luca Milani, Stefano Napoletano, Nicola Sandri, McKinsey & Company). In recent years, however, countries have also implemented policies of fiscal consolidation aimed at reducing their deficit and accumulation of debt stock. Consequently, an increasing number of private operators have entered the infrastructure market, generally in cooperation with states or other regional or local public authorities. Long-term contracts in the form of PPP (Public-Private Partnership) have been adopted to design, finance, build and operate both physical and digital infrastructures (Chapter 4 – Remo Dalla Longa, Bocconi University). However, economic and political risks could undermine this pattern of cooperation. Political risk is a key factor that dramatically affects decisions on investments in infrastructure, particularly in emerging countries: the long-term nature of investments of this kind demands political stability, an effective and clear regulatory framework and other conditions. Today's international political risks are negatively affecting private investment decisions and the economic policy uncertainty index has reached historical highs (Chapter 3 – Claudio Cesaroni, Andrea De Meo, Andrea Gorga, SACE SIMEST).

Complementing the economic rationale of infrastructure, the second part of the Report focuses on a growing and fundamental dimension of infrastructure: geopolitics. International connections have always represented milestones in the history of humankind, from the roads that linked cities

in the age of Imperial Rome to the ancient Silk Road that shaped a new era in the relationship between East and West and the discovery of America that led to exchanges between the Old and the New Continent and symbolically marked the end of the Middle Ages and the beginning of the Modern Era. In all these cases, infrastructures formed the backbone of new ways to produce, trade and meet and also served as essential means to expand political power and influence.

In a context of restrained private investment, the major powers are regaining advantage in infrastructure decisions, transforming infrastructure plans into geopolitical tools. In the last decade, China has started playing the great geopolitical game of infrastructure. With an infrastructure spending of 7% of GDP (vs. 2% in Europe and 1% in the US), Beijing has focused heavily on connectivity. China has used infrastructure first as a driving force for internal growth and more recently as a means of projection to the outside. The flagship of Beijing's infrastructure plans is the Belt & Road Initiative. The BRI aims to create a closer economic and strategic interconnection between China and the Eurasian block through an ambitious program of infrastructure investments, which – from 2013 onwards – has translated into over \$600 billion of finance (Chapter 7 – Alessia Amighini).

Faced with the Chinese infrastructural challenge, the EU is trying to take action by improving criteria for awarding tenders, to the benefit of quality, and by increasing interconnection funding at the levels of transport, telecommunications and energy. The EU has also decided to counteract China's massive investments in its neighbourhood through the projection of the TEN-T beyond EU borders: the goal is to ensure the consistency and effectiveness of integrated multimodal connectivity between the networks of EU Member States and those of its immediate neighbours and partner countries. In this sense, the Council's adoption, in October 2018, of the Commission's proposal for a new initiative called "Europe-Asia Connection – Essential elements for an EU strategy" has

proved of fundamental importance (Chapter 5 – Carlo Secchi and Chapter 6 – Stefano Paci, European Commission).

In the great game of infrastructure, and against the backdrop of Chinese dynamism, Washington has lost ground on many sides, and is now trying to recover by launching new projects, though with limited starting budgets. The US government has reorganised the agencies dedicated to supporting American investments abroad. The US Development Finance Corporation (USDFC) was established with the BUILD Act of 2018; this is a new investment agency operating in developing countries, with an investment capacity doubled to \$60 billion. Furthermore, American strategy is based on alliances with like-minded countries that share the same concern over Chinese infrastructural assertiveness. This is the case of the Indo-Pacific Strategy with Japan, Australia and India, and particularly Japanese-led Partnership for Quality Infrastructure (Chapter 8 – Daniel Runde, CSIS).

In a rapidly changing scenario, the world of infrastructure is addressing new challenges and embracing opportunities offered by new technologies. Future trends and new needs in infrastructure are therefore at the heart of the third part of the Report. For a start, fierce competition has encouraged the rise of global players in the infrastructure and construction market. In the European Union, many national groups are merging and this path is clearly heading towards the creation of European champions. However, this strategy must not be pursued at the expense of EU competition policy, inaugurating a sort of race to be bottom (Chapter 9 – Stefano Riela, Bocconi University). The second challenge for infrastructure is to embrace sustainability. This has progressively become an imperative, since more than 70% of global greenhouse gas emissions are caused by the construction or operation of infrastructure. Given the global emission reduction targets enshrined in the Paris Agreement, and the adoption of the UN Sustainable Development Goals (SDGs), it is crucial for infrastructure to be designed in the most sustainable way, environmentally, economically and

socially (Chapter 10 – Daniel Taras, GIZ). As a result, public financial institutions are being called on to share the burden and are at the forefront of the green revolution. In November 2019, the European Investment Bank (EIB) launched a new climate strategy and Energy Lending Policy, becoming de facto the EU Climate Bank. The EIB will end financing for fossil fuel energy projects from the end of 2021 and align all financial activities with the goals of the Paris Agreement by the end of 2020. New lending activities will be focused on energy efficiency, renewable energy, new green technologies and all the energy infrastructures required for the transition. The EIB will also gradually increase the share of its financing dedicated to climate action and sustainability to 50% by 2025 (Chapter 11 – Matteo Rivellini, EIB). Technology may well drive progress in achieving infrastructure sustainability. Traditionally, infrastructure projects have been labour-intensive, engineering-driven and not at the cutting-edge of technology. Today, however, a wide array of breakthrough technologies is rapidly transforming the way infrastructure is built and operated, especially using big data. Technology will be essential to enhancing productivity in construction sectors, improving safety and working conditions during construction and ensuring a better operation and management of infrastructure through analytics (Chapter 12 – Luca Milani, Stefano Napoletano, Nicola Sandri, McKinsey & Company).

Quality is the keyword that must drive infrastructural investments in the years to come. Only quality infrastructure can ensure sustainability and positive spill-overs in long-term growth. However, quality is only achievable if geopolitical competition in the field of infrastructure gives way to an international, cooperative and coordinated approach. This is essential if the economic efficiency of investments is to be ensured and the overlapping and waste of public and private funds avoided. On the international level, attempts to coordinate investments in infrastructure bilaterally are already increasing, but the most appropriate level of cooperation is multilateral,

as in the G20 or G7 fora (Conclusions – ISPI). The current international health and economic crisis will probably reshape the paradigms of international cooperation and this could represent a boost for the achievement of a level playing field at a global level. If a cooperative approach prevails, infrastructure investments will effectively play their countercyclical role, mitigating the economic impact of the crisis and promoting the conditions for a sound recovery when the storm is finally over.

PART I
INFRASTRUCTURE: AN OVERVIEW

1. Infrastructure Between Old and New Trends

Alberto Belladonna, Alessandro Gili

Over the next ten years, the world's population will grow from today's 7.5 billion to around 8.7 billion, three quarters of whom will be living in developing countries. When the coronavirus pandemic crisis will be over, such growth will come with incommensurable challenges for these countries, which will have to provide jobs, resources and infrastructure to guarantee at least current levels of well-being to their citizens. On the other side, the developed world will face an increasing need to modernise its fast-outdating infrastructure stock, especially under the pressure of new technologies and new environmental challenges, particularly the need to cope with environmental sustainability issues.

Infrastructure, however, typically involves large up-front investments and long repayment periods. That is why they have always been associated with the direct or indirect intervention of the state, which is able to bear the risk of uncertain returns since the positive externalities, i.e. the benefit to society of an infrastructure project, can often be greater than the economic returns for private investors.

Today, however, the ability to provide reliable and efficient infrastructure is increasingly under pressure, making it even more difficult to “feed” the world with the needed infrastructure endowment. The aim of this chapter is thus to explore the main trends in infrastructure, their principal characteristics and how they can change in the future.

The Economic Rationale of Infrastructure

Investment in infrastructure has always constituted a pivotal component of a country's development. Due to its "special foundational role, supporting other factors of production",¹ investment in infrastructure brings important benefits and increases the potential output and productivity of all inputs. Larger and better public transport networks, for example, reduce transport costs, improve people's quality of life and improve the business environment for enterprises. To a certain extent, "the structure of our economy is bound by infrastructure",² since infrastructure also constitutes a platform through which major disruptive and incremental innovation could thrive, in a series of self-sustaining *spillover* effects that pave the way for future growth.³ Investment in telecommunications infrastructure can improve access to information and technology, for example, in turn broadening markets, promoting competition and enabling the development of technological innovation.

However, investment in infrastructure also plays an important role in the short term since it has a direct impact on the growth of gross domestic product (GDP) both directly and indirectly – directly, because infrastructure investment is an integral part of aggregate demand, and indirectly, because, depending on the state of the economy at the time of the investment, it produces an amplified effect on both GDP and employment through the so-called economic multiplier effect. According to the International Monetary Fund, for example, an increase in US public investment financed by a deficit of 1% of GDP tends to increase overall GDP by 0.9% in the first year and by

¹ J.R. Baldwin and J. Dixon, "Infrastructure Capital: What is it? Where is it? How much of it is there?", *Canadian Productivity Review*, no 16, Ottawa, Statistics Canada, 2008.

² R. Carlsson and A. Otto, "The role of infrastructure in macroeconomic growth theories", *Civil Engineering and Environmental Systems*, vol. 30, 2013.

³ W. Easterly and S. Rebelo, "Fiscal policy and economic growth: An empirical investigation", *Journal of Monetary Economics*, vol. 32, issue 3, 1993, pp. 417-458.

2.9% after four years. The IMF itself also suggests that, among OECD countries, an increase in public investment of 1% of GDP generally reduces the unemployment rate by 0.11% in the short term and by 0.35% in the medium term.

For this reason, in the countercyclical policies implemented by many countries, the increase in infrastructure investment has been one of the most frequently used instruments, often in line with the expectation of longer-term positive effects, which, however, depend on the multiple and complex response of all the factors connected with private supply.

Countercyclical Actions Following the Financial Crisis

Depending on the individual country's political and economic situation, after an initial phase when capital investment was cut in favour of current expenditure, most central governments were called upon to take swift and unprecedented actions, and infrastructure spending was considered the main countercyclical instrument to react to the 2007 financial crisis.

The United States

In the United States, where the global financial crisis originated, the Gross fixed capital formation (GFCF), which accounted for around 22% of GDP in 2007, fell at 19% in 2009. Household spending was the main reason for this drop, while general government progressively intervened in the economy increasing its share of GFCF from 16.3% to 22.2% in 2009.

Indeed in 2009, in response to the Great Recession, the Obama administration enacted the American Recovery and Reinvestment Act (ARRA), nicknamed the Recovery Act,⁴ consisting of an economic stimulus package with an estimated

⁴ <https://www.govinfo.gov/content/pkg/PLAW-111publ5/pdf/PLAW-111publ5.pdf>

cost of \$831 billion.⁵ Almost 55% of the resources were allocated to tax incentives and state and local fiscal relief (with more than 90% of the state aid going to Medicaid and education), while the remaining 45%, equivalent to almost 2.7% of GDP, was allocated to federal spending programmes, especially infrastructure such as transportation, communication, waste water and sewer infrastructure improvements, energy efficiency upgrades in private and federal buildings and scientific research programmes.

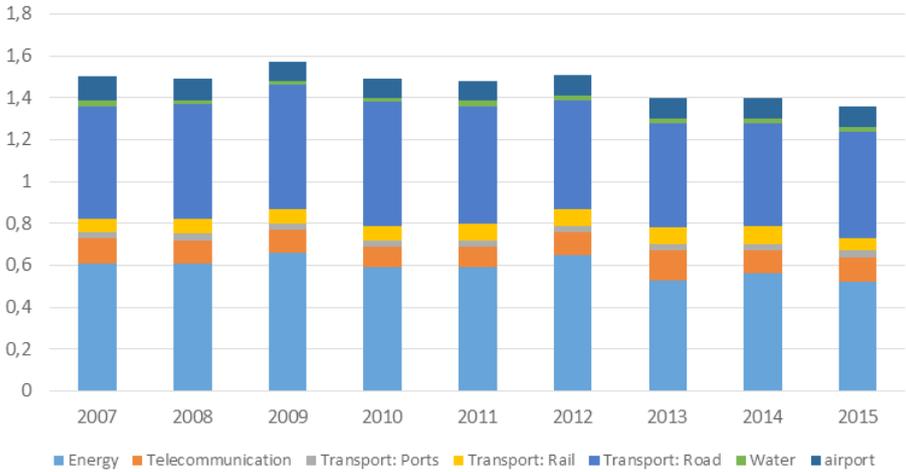
FIG. 1.1 - US GOVERNMENT'S INVESTMENT AND INFRASTRUCTURE SPENDING



Source: Oxford Economics and OECD

⁵ “Estimated Impact of the American Recovery and Reinvestment Act on Employment and Economic Output from October 2011 Through December 2011”. A CBO Report. Congressional Budget Office, February 2012.

FIG. 1.2 - US INFRASTRUCTURE INVESTMENT FOR EACH SECTOR (% OF GDP)



Source: Oxford Economics and OECD

The Act sparked a heated debate among leading economists such as Nobel prize winners Paul Krugman and Joseph Stiglitz,⁶ who argued that the Plan was too small than the economic crisis required, and those who argued that in the long run the impact of the stimulus would be to create major public deficit and a crowding out effect on private investments.⁷ Nevertheless, the Congressional Budget Office has estimated that ARRA positively impacted GDP and employment: over a period of six years, real GDP was boosted, on average, by between a low of 1.7% and a high of 9.2%, while the unemployment rate was reduced, on average, by between a low of 1.1% and a high of 4.8% with full-time equivalent employment-years boosted, on average, by between 2.1 million and 11.6 million.⁸

⁶ J. Stiglitz, “Stimulus or bust”, *The Guardian*, 10 August 2009.

⁷ https://web.archive.org/web/20090203170743/http://cato.org/special/stimulus09/cato_stimulus.pdf

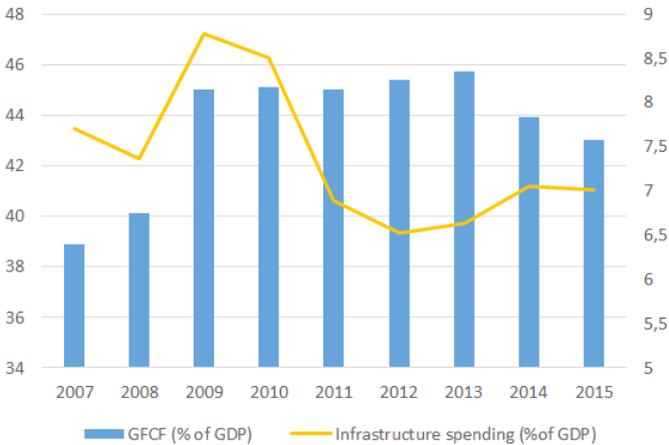
⁸ “Estimated Impact of the American Recovery and Reinvestment Act on

After the peak shown in 2009, what is clearer from Figure 1.1 is that infrastructure spending as a percentage of GDP follows a downward trend, the reasons for which will be examined in detail in the last part of the chapter.

China

In China, the situation was slightly different. GFCF, coupled with external demand has always been a major component of Chinese GDP (42% in 2018) and, indeed, it kept growing even during the crisis, peaking at 45.7% of GDP in 2013. The Chinese government, which was progressively moving towards a more consumption-driven economy, acted to tame the impact of the reduced external demand caused by the world economic crisis and intervened with a stimulus package announced by the State Council of the People's Republic of China on 9 November 2008.

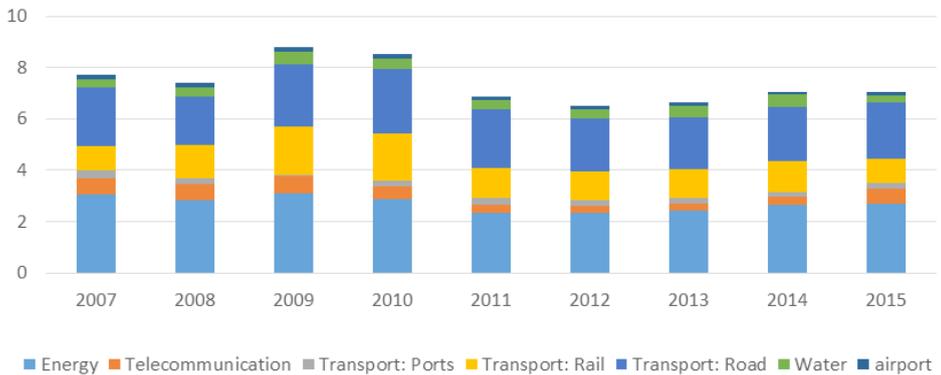
FIG. 1.3 - CHINA'S GOVERNMENT INVESTMENT AND INFRASTRUCTURE SPENDING



Source: Oxford Economics and OECD

The stimulus package, worth \$586 billion, represented a pledge comparable to that of the United States but came from an economy only one-third the size. Public infrastructure development in particular took up the biggest share of the total package (51%), with a focus on transportation but also on energy saving, gas emission cuts, environmental engineering projects and technology innovation.

FIG. 1.4 - CHINA'S INFRASTRUCTURE INVESTMENT FOR EACH SECTOR (% OF GDP)



Source: Oxford Economics and OECD

The economic stimulus plan was considered quite a success. While Chinese economic growth dipped sharply during the last quarter of 2008, one year later it was estimated that the stimulus contributed to a 1.2% increase in GDP, which was around 8.4% in 2009. Nevertheless, the package has been criticised, since some infrastructure plans have been shown to be unproductive and to have caused at the same time a surge in Chinese debt after 2009, especially at the local government level.⁹

⁹ Y. Huang and C. Bosler, *China's Debt Dilemma: Deleveraging While Generating Growth*, Carnegie Endowment for International Peace, 18 September 2014.

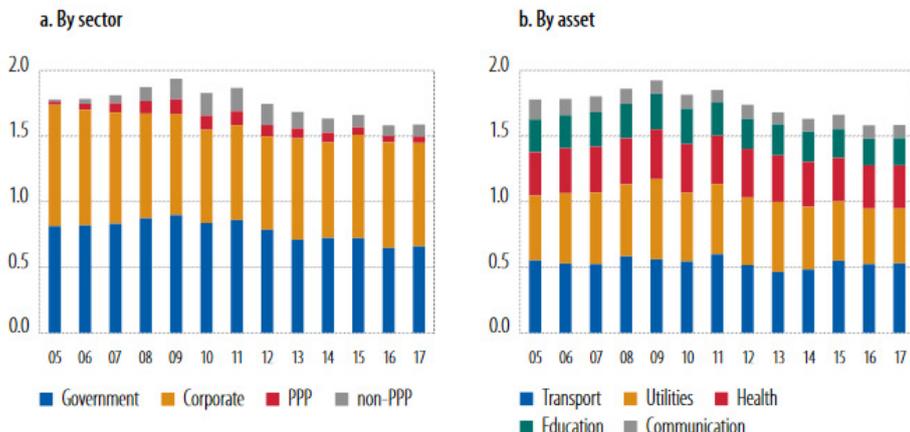
However, as with the United States, China also shows a downward trend in infrastructure spending as a percentage of GDP, proving that broader and more global reasons are behind it.

The European Union

The European Union saw a similar and even more marked downward trend in investment as a percentage of GDP, but with different aspects having to be taken into consideration, especially for those countries that adopted the single currency and which were bound by the Stability and Growth Pact. Investment in infrastructure in the EU has been broadly procyclical. This is particularly evident if we analyse the decline that occurred from 2010 onwards, mainly driven by a sharp fall in public infrastructure expenditure. Throughout the crisis, but especially after the outbreak of the 2011–2012 sovereign debt crisis and the period of cyclical fiscal consolidation adopted in many countries, government spending was mostly devoted to current expenditure, with consistent cuts to gross fixed capital formation. As a matter of fact, the government sector has accounted for about 80% of the fall in total infrastructure investment over the past decade. Some countries with broader fiscal room to manoeuvre tried to adopt countercyclical measures, such as the €50 billion stimulus package launched by the German Chancellor Angela Merkel in 2009. The package, equivalent to 1.6% of gross domestic product was the biggest of its kind in German history and included €17.3 billion of investment in the country's infrastructure. The most rigorous critics accused it of causing national debt to rise in real terms to as much as €74.3 billion, yet it is true that it spurred a strong rebound in growth: Germany took three years to make up the ground it lost during the recession, less than half the time needed by the euro area as a whole. Despite the return to stability, however, at the EU level, investment rates have remained well below pre-crisis levels (75%), and in 2016 investment rates were around 20% lower than pre-crisis financial rates, at around 1.7% of GDP. The biggest drop

between 2009 and 2016 was in the transport sector, accounting for around 0.2% of GDP,¹⁰ with public services and education also experiencing a significant decline in investment of 0.18% and 1.15% of GDP respectively.

FIG. 1.5 – INFRASTRUCTURE INVESTMENT (% GDP)



Source: EIB Infrastructure Database (IJ Global, EPEC, Eurostat)

Note: Data missing for Belgium, Croatia, Lithuania, Poland and Romania. EU average excludes the United Kingdom. Slight deviations from the 2018 results are due to a refinement in the estimation of depreciation in government infrastructure investment

As underlined by the EIB, “the decline in infrastructure investment as a share of GDP paints a more benign picture of the fall in infrastructure investment than is possibly merited, because GDP growth was relatively weak in the past decade”. If the potential GDP is taken into consideration, infrastructure investment has fallen short by 1.4% in the EU and by 3% in its periphery region. Indeed, the overall decline in infrastructure investment has been uneven across Europe, with

¹⁰ Transport accounted for 26% of total infrastructure investment in 2015, compared to 31% in 2007.

macroeconomic conditions at the root of countries' diverging experience of infrastructure investment in recent years, and infrastructure investment having fallen most in regions with already poor infrastructure quality.¹¹ In this respect, a recent study conducted by the Council of Europe development Bank¹² identified five clusters of countries. The first cluster consists mainly of the countries that have been most severely affected by the economic crisis, such as Greece, Spain, Italy and Portugal, which experienced an average annual decline in gross fixed capital formation of 8.35%. Fiscal consolidation has had a negative impact on public investment spending, while the weak economic recovery has further slowed down infrastructure investment. The second cluster is the largest and includes countries such as Germany, France and the Netherlands, which experienced a better economic recovery but with declining growth rates in government gross fixed capital formation. The third and fourth cluster share the characteristic of a weak GDP recovery but with growth in gross fixed capital formation. The last cluster includes countries such as Sweden and the United Kingdom, which experienced a sound GDP recovery (5.29%/year), with positive gross fixed capital formation (+2.83%).

As a matter of fact, the European Commission, tried to stimulate the role of investment as a way to relaunch economic growth in Europe, and in 2014 come up with Investment Plan for Europe known as the "Juncker Plan" or "EU Infrastructure Investment Plan". The Plan is an ambitious infrastructure investment programme aimed at unlocking public and private investments in the "real economy" by mobilising at least €315 billion over a three-year fiscal period (2015-2017) to help close the investment gap caused by the financial and economic crisis. The Juncker plan has financed new technologies and supported several EU infrastructural objectives, such as in digital, social and transport policy, and overall it is estimated to have supported

¹¹ European Investment Bank, *Investment report 2018/2019*, 2019.

¹² *Investing in Public Infrastructure in Europe. A local economy perspective*, Council of Europe Development Bank, February 2017, p. 22.

the creation of some 750,000 jobs – 1.4 million by 2020 – and increased EU GDP by 0.6%, rising to 1.3% by 2020.¹³

Major Current Trends

According to the most recent and reliable data collected by the Global Infrastructure Hub (a G20 Initiative, hereafter GIHub), during the last decade, the world's infrastructure spending has increased at around 28%, from \$1.8 trillion in 2007 to \$2.3 trillion in 2015 (3.1% of world's GDP).¹⁴ However, if we look at the trajectory of spending, especially as a percentage of GDP, we can clearly see the impact of the financial crisis of 2007-2008. Indeed, investment in infrastructure increased globally during 2009-2010 at almost 3.3%, mostly as a countercyclical measure. But it progressively decreased to a minimum low of 2.9% in 2013-2014, when major stimulus measures were being phased out, and then, recovering, it remained steady at the current level of 3.1%, which represents almost 12% of world total fixed investment.

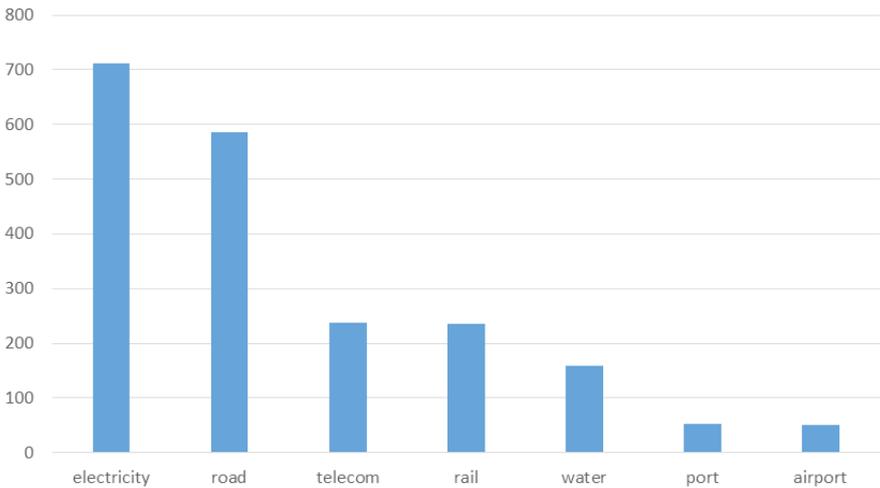
Asia is the region that invested most in infrastructure: spending increased by more than 50% between 2007 and 2015 and now accounts for an average expenditure per country of more than 4% of GDP, double that of Europe (2%) and of the United States, which is lagging behind at only 1.47% of its GDP. As a result, Asia's share of global spending in infrastructure is now 59%, way ahead of Europe (23%). China is at the heart of these dynamics. With an average expenditure in infrastructures of 7% of its GDP, Beijing has bet on infrastructure as a major driver of its long-term growth and used infrastructure as a countercyclical instrument in the short run.

¹³ European Commission, [Investment Plan for Europe: the Juncker Plan](#), July 2018.

¹⁴ Oxford economics and Global Infrastructure Hub, *Global infrastructure outlook*, 2018.

According to the GIHub, since 2007 global infrastructure spending has mainly been concentrated in two sectors: electricity and roads, which account for almost two-thirds of total spending, mostly driven by the economic growth of developing countries. The electricity sector in particular is the one that accounted for the highest growth (+33%).

FIG. 1.6 - WORLD'S AVERAGE ANNUAL INVESTMENT BY SECTOR
(2007-2015, \$ BILLION)



Source: Oxford Economics

Long-Term Challenges

Several major factors will affect investment needs in the forthcoming years. The first is economic growth. It is quite straightforward: as the economy grows, there is a growing demand for services and infrastructure to support the economic process and upgrade the existing ones. Asia is the region that has been growing the most during the last decade, at an average rate of 5.3%. In 2000, Asia accounted for just under one-third

of global GDP (in terms of purchasing power parity), and is expected to account for over 50% of global GDP by 2040 and for 40% of the world's consumption.¹⁵ Apart from Asia, Africa is expected to be the fastest growing region in the world, with an average annual GDP growth rate of 4.2% by 2040. Asia and Africa will be the centre of gravity of another major trend that will affect infrastructure need: demography. Over the next ten years, the world's population will grow from today's 7.5 billion to around 8.7 billion. Asia remains the most populous region in the world: with 4.4 billion people in 2015, its population is expected to grow by 15%, reaching 5.2 billion in 2040. Africa will be the fastest growing continent in terms of population, which is expected to almost double from 1.2 billion in 2015 to almost 2.08 billion in 2040. Such growth will come with incommensurable challenges for these countries, which will have to provide jobs, resources and infrastructure to guarantee at least current levels of well-being to their citizens. In particular, what is most challenging is the fact that almost two-thirds of the total population will be living in urban areas: from 55% in 2018 to 68% by 2050, according to the 2018 World Urbanization Prospects produced by the Population Division of the UN Department of Economic and Social Affairs (UN DESA).

Today, the most urbanised regions include Northern America (with 82% of its population living in urban areas in 2018), Latin America and the Caribbean (81%) and Europe (74%). The level of urbanisation in Asia is now approximating 50%; in contrast, Africa remains mostly rural, with 43% of its population living in urban areas. The future increases in the size of the world's urban population are expected to be highly concentrated in just a few countries, concentrated once again in Africa and Asia. Together, India, China and Nigeria will account for 35% of the projected growth of the world's urban population between 2018 and 2050. By 2050, it is projected that India

¹⁵ McKinsey Global Institute, "[Asia's future is now](#)", July 2019.

will have added 416 million urban dwellers, China 255 million and Nigeria 189 million.¹⁶ Some of the fastest-growing urban agglomerations are cities with fewer than 1 million inhabitants, many of them located in Asia and Africa, with estimates that one in eight people live in 33 megacities (with more than 10 million inhabitants) most of them in developing regions.

These trends are particularly important because urbanisation with higher population density on the one hand reduces the cost of providing efficient systems of infrastructures and services to the population. On the other hand, however, it poses a major challenge for city planners that have to conceive a well-functioning system that can avoid the so-called diseconomy of scale produced by overpopulation.

Furthermore, population growth and urbanisation have led to another major challenge for our future i.e. meeting the needs of the present without compromising the ability of future generations to meet their needs in a sustainable way both environmentally and economically. Industrial activities associated with infrastructure development have followed an unsustainable path that has led to increasing climate change threats and negative impacts on society. If the current effects of climate change continue, by 2030 more than 100 million people will live in poverty due to environmental consequences. This situation exposes both developing and developed countries to a major challenge linked to environmental factors, i.e. improving quality standards and advancing technological progress but also conceiving a new growth model that can even go further than the 2030 Agenda for Sustainable Development.

Finally, developed countries will have to invest heavily in infrastructure, in particular to maintain, upgrade or replace existing (and often obsolete) infrastructure.¹⁷ America's infrastructure for example is desperately in need of investment,

¹⁶ UN Department of Economic and Social Affairs, *World Urbanization Prospects*, 2017.

¹⁷ B. Stevens and P.-A. Schieb, "[Infrastructure to 2030: Main Findings and Policy Recommendations](#)", OECD, 2007.

according to the American Society of Civil Engineers, which estimates that the US needs to spend some \$4.5 trillion by 2025 to fix the country's roads, bridges, dams and other infrastructure such as schools and airports.¹⁸ Similar issues can be seen in Europe. In Germany, for example, the KfW – Germany's state investment bank – has calculated that local municipalities need to spend at least €138 billion to bridge the backlog of urgent infrastructural investments.

However, the weight of investments in infrastructure may decrease in the forthcoming years, as the public investment component will continue its downward trend even after the economic crisis because of major pressures on budgets and tax collection capacity. The evidence suggests that public capital investment in advanced countries has represented a steadily decreasing share of total public spending, especially in those OECD countries and some BRICs, such as China, where population ageing is likely to lead to a reduction in wage expenditure, thereby reducing tax revenues. At the same time, social expenditure has increased significantly, especially health and pension expenditure. Both are expected to expand significantly over the coming decades, far outstripping the growth of public budgets and GDP growth.¹⁹

Infrastructure Gap

There is widespread agreement among major studies that the current investment trend may not be sufficient to meet the constantly growing demand for infrastructures. According to the McKinsey Global Institute, at current trends, in order to maintain expectations of economic growth to 2030, it

¹⁸ American Society of Civil Engineers, *Infrastructure Report Card*, 2017.

¹⁹ Projections indicate that for the OECD area as a whole, expenditure on public health and long-term care could increase from the current level of 6.7% of GDP to between 10.1% and 12.8% by 2050, while pensions could increase on average by around three to four percentage points of GDP over the same period.

is necessary to fill the infrastructure gap with investments equivalent to 3.8% of GDP, or about \$3.3 trillion per year.²⁰ The challenge has apparently already been lost, according to a GIHub report, which states that, if current trends continue, by 2030 the world will suffer an infrastructure gap of \$600 billion, equivalent to 0.6% of the world's GDP.²¹

These figures could be even higher if the UN Sustainable Development Goals (SDGs) are taken into consideration. The SDGs are seventeen goals adopted by all United Nations Member States in 2015, as a universal call to action to end poverty, protect the planet and ensure that all people enjoy peace and prosperity by 2030.²² In some cases, meeting these goals will require additional investments. The GIHub study assesses the impact on accrued infrastructure spending of achieving SDG 6, i.e. “ensuring availability and sustainable management of water and sanitation for all” and SDG 7.1, i.e. “ensuring access to affordable, reliable and sustainable and modern energy to all”. According to their estimates, achieving these objectives would require an additional 0.3% of world GDP spending in infrastructure by 2030. Furthermore, when it comes to specific sectors, spending needs are greater for electricity and roads, which together will account for 67% of global infrastructure investment needs by 2040. However, the gap between the current trends and needs will be proportionally greater in the roads and ports sectors, where investments needs will be 30% higher than under current trends.²³

A large share of investments will be needed in the developing world, where countries will be spending billions of dollars on infrastructures to underpin their booming economies and satisfy the growing aspirations of their populations. According to the GIHub, Asia alone will account for nearly 59% of the

²⁰ In 2017, requirements were adjusted upwards, reaching \$3.7 trillion a year until 2035.

²¹ Oxford Economics, *Global Infrastructure Outlook*, 2018.

²² *Ibid.*

²³ *Ibid.*

estimated global infrastructure investment requirements by 2040, but at current trends it is expected to fill only 10% of its infrastructure gap. Africa and the Americas, on the other hand, are forecast to have the largest infrastructure gaps, at 39% and 47% of their needs respectively.²⁴

Since 2007, 38% of infrastructure investment in Africa has been directed towards the electricity sector, while the water sector has accounted for 20% of total investments. Given the limited access to electricity and potable water in many areas of the continent, the amount of investment in these sectors is above the world average. In particular, investment in water infrastructure is more than twice the world average. This is at the expense of investments in road infrastructure, where the investment need is about twice the current trends. The infrastructure gap is set to increase steadily and reach a cumulative amount of \$1.7 trillion in 2040. According to Oxford Economics, Morocco and Kenya are performing relatively well among African economies: the gap between investment need and current investment trends is no more than 21%. On the other hand, the gap is much larger in Egypt, South Africa and Tanzania, where the investment need forecast is 50% higher than the current trend.

The infrastructure scenario in the Americas is dominated by the US, which has contributed to about 60% of infrastructure spending since 2007. In the United States, the road sector is the area with the biggest gap, where investment needs are almost twice the current investment trend. In telecommunications, energy and water facilities, US investment has been lower than for other developed economies in recent years; however, the overall quality of these infrastructures is very high, suggesting that only a small increase of future investments will be needed. As is well known, the rail network in the US is not as extensive as in many other developed economies, since it is not widely used for internal travel in the country. The investment gap between current trends and needs is thus modest and will not significantly

²⁴ Ibid.

increase in the foreseeable future. Based on current trends, the US is likely to invest \$8.5 trillion in infrastructure to 2040, whereas infrastructure needs will be around \$12.4 trillion, 45% higher. Under these assumptions, the US has invested 1.5% of its GDP in national infrastructure since 2007. To bridge the existing gaps, the United States would need to increase the share of GDP allocated to infrastructure investment to 2.2%.

Excluding the United States, countries in the Americas will invest over \$5 trillion to 2040, compared to \$7.8 trillion of investment needed. Similar to the US, other countries in the Americas will suffer a consistent infrastructure gap in the road sector: about \$1.6 trillion of investment in roads as against \$3.5 trillion of investment needed. Overall, the current investment rate in American countries is equivalent to 2.6% of GDP; the investment need scenario requires an increase to 3.4% of GDP to cope with the widening gap. In this context, Brazil has the widest gap, with \$1.5 trillion of estimated investments to 2040, compared to \$2.7 trillion of investment needed.

In Asia the situation is quite different. In China, a huge infrastructure investment programme has triggered rapid economic development. The country alone accounted for almost 30% of all global infrastructure investment. As a result, China's infrastructure investment gap is estimated to be quite low in comparison with other regions of the world. Indeed, it is estimated that Beijing will invest \$26.5 trillion to 2040, compared to \$28.4 trillion of investment needed. No gaps are foreseen for the road and rail sectors, while electricity will experience an increasing gap due to investments not being in line with the country's economic and demographic characteristics. The analysis does not differ substantially if we consider the rest of Asia. Asian economies (except China) will invest \$19.7 trillion to 2040, against an investment need of \$22.4 trillion. The main gaps will be in the road and electricity sectors: in order to bridge the gap the share of investment should increase slightly from 3.3% to 3.7% of GDP.

The situation in Europe is highly diversified. Under current trends, Europe is likely to invest \$12.8 trillion in infrastructure to 2040, against an estimated investment need of about \$14.8 trillion. The major investments will be dedicated to the electricity and road sectors. Railways, roads and airports show investment gaps of more than 20%, while for ports the gap is 62%. On the other hand, only a small gap is estimated for the water and telecoms sectors. Overall, Europe has invested 2.2% of GDP since 2007, one of the lowest shares compared to other regions. However, data for Europe are partially misleading: the estimates include Russia, which has the widest investment gap (\$1.06 trillion trend in investments *vis-à-vis* \$1.79 trillion of investment needs). Among EU countries, Italy shows the widest gap. Rome will face an increasing gap in ports (\$79 billion of cumulative gap to 2040), airports (\$15 billion) and railways (\$239 billion).

What Are the Possibilities for the Public Sector To Bridge the Infrastructure Gap?

Since tax-fuelled public budgets will not be sufficient to close the infrastructure gap, the current trend is to resort to private sector financing, together with greater diversification of public sector sources of income. New business models involving the private sector, in particular the variants of the public-private partnership (PPP) models which are increasingly being used, offer further opportunities to unlock the capital and expertise of the private sector. The same applies to the huge private sector capital pools managed by pension funds and insurance companies. Infrastructure, with its low risk and constant return profile, is of considerable potential interest to these funds. If well planned and with the appropriate sovereign guarantee, infrastructure projects can easily boost private fund participation, as in the European Juncker Plan, where two-thirds of the funds raised came from private investment. The main idea of the plan was in fact to direct the large amount of cash in circulation towards

investments that would be profitable for private entities with state support in a PPP scheme. However, the potentiality of PPP is greatly reduced by a series of problems. These include regulatory frameworks, the knowledge gap and lack of data for the investment characteristics of infrastructure needed for accurate assessment, and the complexity of the planning, design and financing phases of infrastructure projects. In order to unleash the full potential of the PPP, constant dialogue between policymakers and private investors can prove to be key.

As megatrends revolutionise infrastructure needs, policymakers should not crowd out private investors. Legislators need to have a sound understanding of the potential of long-term private investments, while private investors should communicate their needs to public stakeholders in order to make the infrastructure market work more efficiently and reduce regulatory and political risk exposure.²⁵

²⁵ M.E. Perretti, and S. Tranfa “Condition that facilitate infrastructure investment”, in C. Secchi and S. Riela (eds.), *Infrastructure for Growth: How To Finance, Develop, and Protect It*, ISPI, 2019.

2. Infrastructure Gap and the Lost Growth

Luca Milani, Stefano Napoletano, Nicola Sandri

Today the world invests some \$2.5 trillion a year in the transportation, power, water and telecom systems on which businesses and populations depend. Yet this amount continues to fall short of the world's expanding needs, resulting in lower economic growth and depriving citizens of essential services. In the next 10-15 years, merely to support expected growth rates, the world needs to invest about 3.8% of GDP, or an average of \$3.3 trillion a year in economic infrastructure. Emerging economies account for the majority (60%) of that need. But if the current trajectory of underinvestment continues, the world will fall short by roughly 11%, or \$350 billion a year. The size of the gap triples if we also consider the additional investment required to meet the new UN Sustainable Development Goals.

Since the global financial crisis, investment in infrastructure has declined as a share of GDP in 11 of the G20 economies, despite glaring gaps and years of debate about the importance of shoring up foundational systems. Cutbacks have occurred in the European Union, the United States, Russia, and Mexico. By contrast, Canada, Turkey and South Africa have increased investment.

There are several ways to increase public infrastructure investment. Governments can increase funding streams by raising user charges, capturing property value or selling existing assets and recycling the proceeds for new infrastructure. In addition, public accounting standards could be brought in line with corporate accounting, so infrastructure assets are

depreciated over their life cycle rather than adding to deficits during construction. This change could reduce pro-cyclical public investment behaviour.

- About three-quarters of private finance is made up by corporate finance. Unleashing investment in privatised sectors requires regulatory certainty and the ability to charge prices that produce an acceptable risk adjusted return as well as enablers such as spectrum or land access, permits and approvals.
- Public-private partnerships have assumed a greater role in infrastructure, although there is continued controversy about whether they deliver improved efficiency and lower costs. Either way, they will continue to be an important source of financing in the future. But since they account for only about 5% to 10% of total investment, they are unlikely to provide the silver bullet that will solve the funding gap. Public and corporate investment remain much larger issues.
- Institutional investors and banks have \$120 trillion in assets that could partially support infrastructure projects. Some 87% of these funds originate from advanced economies, while the largest needs are in middle-income economies. Solid cross border investment principles are required to match these investors with projects. Impediments that restrict the flow of financing, from regulatory rulings on investment in infrastructure assets to the absence of an efficient market, also need to be addressed. The most important step, however, is improving the pipeline of bankable projects.

Beyond ramping up finance, there is even bigger potential in making infrastructure spending more effective. Accelerating productivity growth, which has flatlined for decades in the construction industry, can play a large role in this effort. Additionally, improving project selection, delivery and management of existing assets could translate into 40% savings.

Even the most advanced economies have significant room for improvement by learning from each other and building stronger capabilities and learning institutions with strong oversight. A rigorous assessment that benchmarks each aspect of infrastructure development against global best practices can identify the areas where a well-targeted transformation could yield substantial results.

Given such a context, the key question regulators are facing for the near future is: how will the reduction/gap in infrastructure investments affect growth? The answer to this question lies in two fundamental areas:

- The loss of growth in terms of GDP growth;
- The loss of growth in terms of employment/jobs.

The two areas can be quantified using WIOD/McKinsey Global Institute (MGI) research on the growth multiplier, which takes a panel of historical figures on infrastructure investments, and the benefit that they have historically brought in terms of GDP, and employment/job growth. This research has led to the calculation of different multipliers, which in turn make it possible to calculate the expected growth for GDP and employment/jobs given the amount of investment. More specifically:

- GDP multiplier: This multiplier represents the total \$ change in value added (GDP) that occurs in all industries for each additional \$ of output that is delivered to final demand by the industry in question;
- Employment/job multiplier: This multiplier represents jobs created in all industries per job created or the additional output delivered to final demand by the industry in question.

The table below has details of the different multipliers, differentiating the multiplier base by industry (e.g. construction, manufacturing, etc.). For this analysis, only the industries related to infrastructure investment have been taken into account, in particular: air transport, construction,

land transport and transport via pipeline, manufacturing of machinery and equipment, manufacturing of other transport equipment, telecommunications, warehousing and supporting activities for transportation, water collection and treatment, and water transport.

MULTIPLIERS		
SECTORS	GDP	JOBS
Air Transport	0.55	7.95
Construction	0.81	11.95
Land transport and transport via pipelines	0.79	8.00
Manufacture of other transport equipment	0.69	8.26
Telecommunications	0.87	6.09
Warehousing and support activities for transformation	0.85	8.86
Water collection, treatment and supply	0.76	6.58
Water transport	0.67	7.53

Taking the aforementioned infrastructure gap of \$350 billion per year, this would be equivalent to a 0.2-0.3% increase in world GDP, and to 2-3 million additional jobs per year.

Such results show lost growth should be at the forefront of every policymaker's mind. A failure to address this issue could seriously jeopardise future growth.

Obtaining such a significant amount of investment requires delivery capacity from the different players in the value chain. This additional capacity can be obtained using a more coordinated infrastructure planning process for the different stakeholders (e.g. governments, investors, operators, owners, etc.). To overcome this obstacle, some countries (e.g. Australia, Canada, UK, etc.) have already created infrastructure authorities, enabling them to plan infrastructure investment more thoughtfully, with a national, long-term vision.

Having a long-term vision, at both national and regional level, is of paramount importance in the infrastructure investment planning process, given the long-lasting nature and significant costs of such investments. Infrastructure should anticipate social and demographic changes and be sufficiently forward-looking to capitalise on the advantages of technological progress. At the same time, uncertainties about the future – due to the rapidly changing technological framework and constant social evolution – require a certain degree of flexibility in planning and delivery. In such a context, having a sound and credible institutional framework can be a key factor. Independent and transparent planning, together with political audacity and commitment, are the fundamental pre-requisites for the development of a successful infrastructure investment plan. This process should be independent of the political/election cycle and anchored only to a long-term vision and funding commitments. Such a stable framework can be achieved by establishing independent national advisory bodies that support the entire investment planning process. Such an institutional setting enhances transparency, reduces the impact of political exigency and increases the longevity of infrastructure plans, ultimately reducing the cost of projects. The objective of an independent planning body is not to take the decision-making process away from politicians, which would remove the necessary leadership and commitment, but rather to provide politicians and other stakeholders with the information necessary to take the right decisions in a short time period.

The principles mentioned above are at the basis of the independent infrastructure advisory bodies established in several developed countries (e.g. Infrastructure Australia, Infrastructure Canada, Infrastructure and Projects Authority in UK, etc.). These are institutions that advise and assist all levels of government, as well as infrastructure investors and owners, in identifying and prioritising the delivery of infrastructure. In developed countries in particular, the focus will be on brownfield investments (i.e. upgrades of existing projects), since there

might be limited capacity to introduce new infrastructure (i.e. greenfield projects). The construction of new roads, railroads and ports in developed countries may prove difficult given their environmental impact and the overlap risk with existing infrastructure. Independent advisory bodies are essential to assess the pros and cons of infrastructure projects, as they can evaluate the long-term economic performance and social wellbeing effects of investments. These agencies can also address inconsistent approaches to infrastructure planning, preserving an integrated national perspective.

The key responsibilities of these bodies include:

- Definition of nationwide long-term infrastructure strategies;
- Advice on policies to favour infrastructure development;
- Individual project evaluation and prioritisation, for both existing and new infrastructure;
- “Post-mortem” analyses of past projects to identify insights/best practices to be used for future projects;
- Support in finding access to funding and resources, both private and public;
- Guarantees on timely delivery, measurement of performance and definition of improvements for existing projects;
- Advisory support to regional and local governments to enhance their capacity to identify and prioritise their infrastructure needs;
- Improve the quality of infrastructure procurement and delivery.

Experts agree the creation of such independent advisory bodies has several positive impacts on infrastructure planning. These agencies are usually welcomed by all stakeholders to secure more bi-partisan support for project priorities. Decisions taken by an independent body help develop a broad consensus on long-term strategy, enabling coordination of infrastructure planning and providing advice and best practices to guide

infrastructure decision making. These agencies also add greater transparency and visibility to the process of project selection and prioritisation. Independence from national governments is a key element to enhance the effectiveness and credibility of such institutions, particularly when engaging with the private sector and local governments.

The work of the designated authorities starts by considering the geographic scope (e.g. national and/or local level, etc.) and time-span of the plans (e.g. 5-10 years, etc.). The scope and mission of such agencies might differ significantly and they can range from the formulation of new investment projects to the assessment of projects proposed by other entities. The assessment involves some key variables, such as effectiveness, cost for taxpayers, environmental impact and territorial balance. At the end of the assessment process, the institution produces its output, which often includes a list of approved projects, a ranking of selected infrastructure or the provision of direct feedback for the proposing party. The effects of the output then depend on the legal force of the institution's assessment on government decision making, which might be binding or non-binding. Finally, the independence and transparency of the advisory institution must be evaluated taking into account the institution's governance, decision-making process and accountability.

To conclude, independent advisory bodies in infrastructure are increasingly seen as essential to ensure the responsible use of public funds and the correct prioritisation of infrastructure needs, especially in countries where public finances are limited. In a long-term strategy, independent advisory bodies should be entrusted – alongside their national governments – with drawing up infrastructure development plans, ensuring the planning and construction of infrastructure using a cross-sector, systematic approach.

3. Infrastructure Investment and Political Risk

SACE SIMEST

Political Risk in Infrastructure Investments: A Global Outlook

Andrea Gorga

Because of its role as an important driver of both economic and productivity growth, the development and maintenance of the infrastructure network are usually a major concern for the political agenda. Political instability, however, often provides a strong disincentive for investments in long-term projects.

Changes in the political agenda and the subsequent uncertainty regarding the regulatory framework are not a problem confined to emerging economies, but involve all countries: Brexit is the most resounding case, but certainly not the only one. Several studies suggest how efficiency, even in advanced countries, is not necessarily the main driver of investment decisions. Political reasons are often important in investment allocation decisions, for instance, show how the risk of gaining or losing representatives in a certain district decisively influences government investment decisions.¹ Therefore,

¹ A. Castells and A. Sole-Olle, “The regional allocation of infrastructure investment: The role of equity, efficiency and political factors”, *European Economic*

investors have to take into account potential changes in political sentiment that can have a disruptive effect. Nowadays, waves of political support often seem to be stronger but shorter and more polarised than in the past. This could mean more volatility in investment decisions and more uncertainty for investors. In 36 advanced countries (the only ones with available data), the ideological gap between new and old cabinets has more than quadrupled since the financial crisis. This means that every time there is a change in government, the distance between preceding and succeeding decisions widens and the risk of completely different approaches to agreements in discussion increases. In extreme cases, even agreements and contracts that have already been entered into can be reconsidered. Frequency of government changes is also increasing in many countries.

Infrastructures seem to be particularly affected by political risk because they are characterised by high monopolisation, high value, long payback periods, large sunk costs and significant economies of scale. Additionally, governments are usually shareholders in an infrastructure project, much more often than in other sectors. If electoral swings can be detrimental for infrastructure investment, what we define as political risk is nevertheless a broader concept.

The sources of risk can be different and specific to the different implementation moments. In the financing phase, aspects linked to monetary policy are identifiable, directly affecting the cost of capital. Poor management of monetary policy or lack of independence from fiscal policy can directly affect financial markets and credit lines. Particularly relevant at this stage are the prudential regulation and supervision of the banking sector. This determines: i) the availability of loan capital, ii) the variety of financial instruments that allow for better matching with investors' risk profiles, iii) the share of non-performing loans and the consequent need for budgetary consolidation.

The presence of barriers limiting the operation of the actors involved and the availability of regional development funds that guarantee advantageous credit conditions for key infrastructure projects may play a significant role. Procurement and construction phases present other risks related to public management, concerning tender participation requirements, selection procedures and the actual subsistence of a level playing field. Compliance with contractual constraints by the public authority is often the crucial node, due to the duration of infrastructure investments.

Fiscal policy is again fundamental at this stage in determining levels of labour market flexibility and wages, while also affecting both the supply and prices of other inputs. Finally, revenues from operational management are threatened by factors linked to political instability: different governments can re-negotiate the terms of agreements, undermine the continuity of supplies and divert resources to other projects. In extreme cases, infrastructure can even be expropriated – a rare possibility that should not be underestimated in such a strategic sector.

An additional risk, common in some developing countries where the investment gap is particularly severe, is the restriction on capital movements and dividend repatriation. In the case of foreign currency needs, the authorities may declare the local currency inconvertible, thus preventing domestic firms from paying their foreign suppliers and contractors.

Every year SACE SIMEST publishes its Country Risk Map for almost 200 countries and territories, assessing the major sources of credit and political risks.² In particular, political risk is defined by three components (risks), namely expropriation and breach of contract, war and civil disturbance,³ and transfer and convertibility.⁴

² Country risk scores range from 1 to 100, with 100 denoting maximum risk.

³ This risk category encompasses all violent actions undertaken with a political objective, including war, terrorism and civil unrest, and that could result in damages to physical assets and/or business interruption.

⁴ It means that investors' ability to convert profits in hard currency or to repatriate

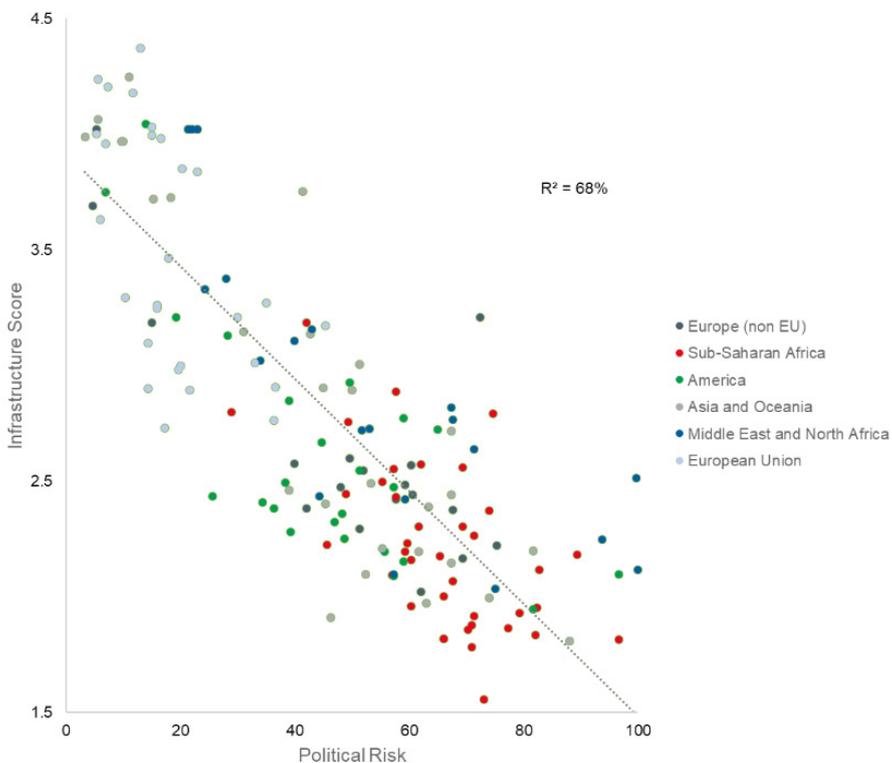
Figure 3.1 shows a clear negative correlation between SACE political risk indicators and the infrastructure score of the Logistic Performance Index of the World Bank. SACE indicators measure risks related to transfer and convertibility, breach of contract, expropriation and political violence, while the infrastructure score is a synthetic measure of the presence and quality of ports, airports, roads, railways and ICT networks. For the reasons explained above, high-quality infrastructure is associated with low political risk. This is especially true for developing, middle-income countries. Asia and Oceania and Middle East and North Africa are the regions with the highest correlation, while low-income countries and advanced economies tend to have lower negative correlations due to consistently high or low infrastructure scores and self-evident political risk. Sub-Saharan Africa observed a steep increase in correlation between the two variables in the period 2014-2018. The EU, meanwhile, observed a drop in the coefficient, but the correlation remains strong.

Each region faces different challenges. Sub-Saharan countries have to fill the infrastructure gap with the rest of the world. To do so, the ability to attract foreign direct investment will be of paramount importance in future years. Political risk plays an important role in determining a country's attractiveness. South America is currently facing a new wave of political violence affecting many countries on the Pacific coast, plus Argentina, which is still stuck between economic recession, debt restructurings and capital control. Asia, by contrast, is probably the most attractive region worldwide, but many countries are

them is limited. This risk generally arises from a series of adverse macroeconomic conditions, such as strong balance of payments imbalances; a low level of Central Bank's international reserves holdings; high levels of foreign currency debt. Also, a country's foreign exchange regime plays an important role: in the presence of a currency peg, or with managed floating systems, policymakers may struggle to maintain the exchange rate at the desired level, especially if international reserves are not ample enough; conversely, strong currency depreciation coupled with a free-floating exchange regime might jeopardize debt serving in countries with high burdens of foreign currency debt.

still subject to political violence (South-East Asia) and limited, but nonetheless present, risks of expropriation and breach of contract.

FIG. 3:1 - INFRASTRUCTURE SCORE AND POLITICAL RISK INDICATOR BY REGION



Source: World Bank, SACE SIMEST
Note: 0-minimum risk; 100-maximum risk

Political Risk in Infrastructure Investments in Sub-Saharan Africa

Andrea De Meo

Owing to rising public debt burdens, opaque regulatory frameworks and political instability often marred by violent transitions, it is not surprising that political risks are deemed particularly relevant when it comes to infrastructure investments in Sub-Saharan Africa. Yet consensus has built around the idea that current investment trends would leave the African population a gap in infrastructure financing that ranges from \$107 billion per annum, forecast by the African Development Bank,⁵ to \$266 billion per annum, estimated by G20 Global Infrastructure Outlook. Closing the gap means addressing urgent needs in logistics, health, energy and telecommunications, thereby laying the foundations of a diversified economy that would not only unlock Africa's largely untapped economic potential, but also reduce resource-rich countries' vulnerability to exogenous shocks, while mitigating climate change effects. This, in turn, would endow governments with a more stable and predictable revenue base, thus minimising a prominent source of political risk.

Building such a virtuous circle has proved to be a challenging task. Although African infrastructure-related debt shows relatively low default rates, according to a Moody's research report,⁶ investors have been kept on hold by high political risks, whether real or perceived, often exacerbated by a chronic lack of reliable data and transparency on both projects and public finance management. One consequence has been an overreliance by most countries on limited and costly sources of funding, with China contributing to a large share of infrastructure investments, greatly extending its influence

⁵ "Africa's Infrastructure: Great Potential but Little Impact on Inclusive Growth", in African Development Bank (AfDB), *African Economic Outlook*, 2018.

⁶ Moody's, "Default and recovery rates for project finance bank loans, 1983-2018", 2020.

over the region. Although general wisdom has labelled the Chinese approach a “debt trap”, particularly in the wake of rising concerns about African debt sustainability, it makes clear that traditional lenders have failed to provide a financial basis for Africa’s ambitious infrastructure plans. Nevertheless, the past couple of years have probably marked a turning point for China’s role in Africa, as both commercial viability and benefits sharing schemes have increasingly been questioned.⁷ With record-low yields in mature bond markets, African countries have witnessed renewed interest from international investors, often in place of multilateral borrowing at concessional terms, thus contributing to driving up public debt trajectories to levels that the IMF deems at high risk of unsustainability for 23 of the 38 countries analysed.

As the recent case of the European Union stepping in to replace Chinese financing in a railway rehabilitation project in Uganda proves, there is room for alternative sources of funding. Making Africa’s infrastructures attractive for investors means dealing with commercial and political risks that may be high enough to offset expected returns, even when mitigated by price and currency risk-minimising mechanisms. Figure 3.2 depicts Africa’s relatively high political risk profile, as summarised by the SACE political risk index: only two countries show a low-risk profile (Botswana and Mauritius), while 15 out of 49 countries exhibit a high-risk profile (i.e. a score of over 70), which reaches extreme levels in Somalia and South Sudan – and this data shows no noticeable improvements compared with five years ago.

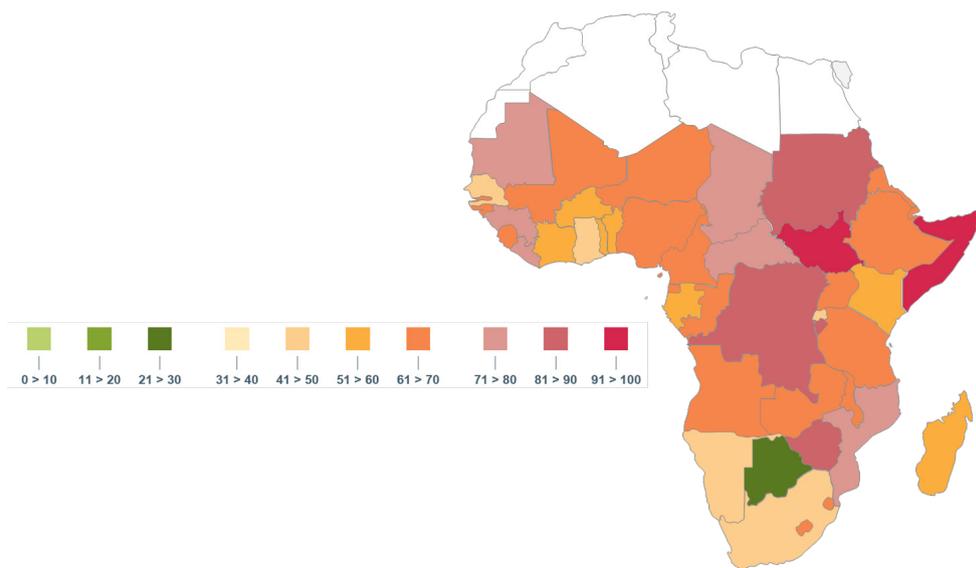
Although it is not possible, in principle, to disentangle the underlying drivers of political risk due to their close interlinkages, it may be instructive to consider the evolution of

⁷ A number of African countries, including Kenya, Tanzania and Sierra Leone, have decided to cancel Chinese-funded infrastructure projects, while Beijing’s scrutiny is becoming stricter, as various railway projects, already face serious challenges as operational losses threaten debt repayment (e.g. the Ethiopian-Djibouti and Mombasa-Nairobi Standard Gauge Railways).

the three SACE political risk components separately. The risk that government-imposed restrictions on capital movements and exchange rate controls may prevent the conversion of local currency into foreign currency (the so-called “transfer and convertibility risk”) is high in 22 countries and low in just one case. Nevertheless, such a risk varies greatly across the continent. Fourteen countries adhere to the West African Economic and Monetary Union or the Economic and Monetary Community of Central Africa, which limits monetary policy discretionality by pegging the French-backed CFA franc’s value to the euro. As convertibility is guaranteed by France’s treasury, while members can access a reserve pool, this group of countries typically shows lower transfer and convertibility risks. Besides these exceptions, concerns regarding the implementation of capital controls in Africa are widespread and typically caused by the interaction of two factors. On the one hand, structural balance of payments deficits arise, as burdensome public infrastructure projects drive large outlays, often requiring monetary authorities to resort to international reserves in order to defend the domestic currency from large fluctuations. On the other hand, both a reduced economic diversification and a narrow revenue base constraining counter-cyclical policy magnify exposure to downturns in commodities markets.

In Africa, Angola has been a prominent example of capital controls induced by the latter factor, coupled with extensive use of oil-backed obligations. In the wake of the 2014-2015 oil glut and the consequent dwindling oil export returns and liquidity shortfalls, Angolan authorities reacted by announcing exchange rate controls to defend a rapidly weakening kwanza, including the prioritisation of the allocation of dollars and the restriction of withdrawals from foreign currency accounts. These controls, in turn, delayed the repatriation of dividends, resulting in foreign exchange losses for international investors. Infrastructure projects have been cancelled or postponed, thus unravelling Angola’s ambitious plans to invest \$15 billion per year.

FIG. 3.2 – SACE POLITICAL RISK INDEX IN SUB-SAHARAN AFRICA
IN 2020



Source: SACE SIMEST

Note: 0–minimum risk; 100–maximum risk

Nigeria represents a similar, yet peculiar case. The Central Bank of Nigeria (CBN) introduced capital controls in 2015 in response to declining oil prices, thus limiting the government's ability to attract financing for priority infrastructure projects, such as the 2,700km Lagos-Kano railway. High inflation and import-driven demand for hard-currency have since exerted pressures on the naira-dollar peg, which was eventually substituted by a complex multiple exchange rate regime, in which investors and exporters need the CBN's approval to access hard currency for eligible transactions.

Due to a combination of large infrastructure projects (mainly hydroelectric power plants and railways) and a narrow and shrinking export base, Ethiopia's structural current account

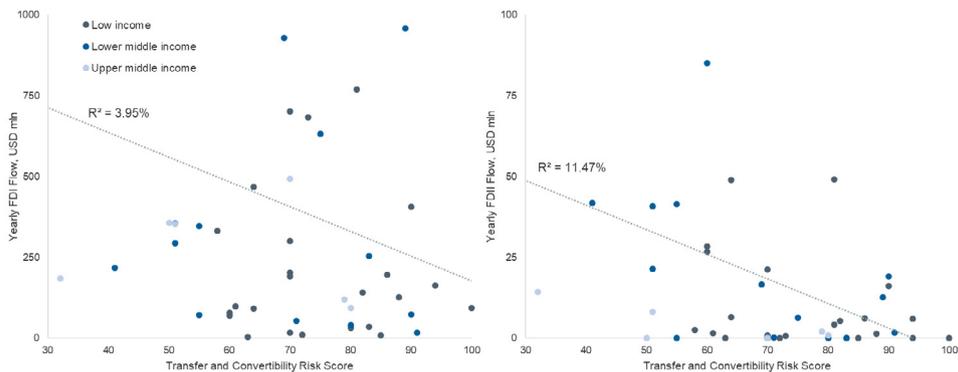
deficit has drained international reserves, thus exposing the country to external pressures and forcing the National Bank of Ethiopia to put in place several forms of capital controls. As a consequence, foreign businesses face payment delays and infrastructure-related transactions are not exempt.

Figure 3.3 shows the relationship between SACE transfer and convertibility risk and both average yearly inflows of foreign direct investments (FDI) and foreign private investment in infrastructure (FDII) for each Sub-Saharan country in the period 1990-2019. In both cases the correlation is negative, although it rises from -0.199 to -0.338 as we move from aggregate investments to investments in infrastructure. The difference can be explained in terms of infrastructure's relatively long investment horizons, resulting in higher levels of uncertainty regarding the future evolution of policies on capital movements.⁸ In order to assess the magnitude of the relationship between FDII and transfer risk, we estimate a simple linear model,⁹ which tells us that a 10-point increment in the transfer and convertibility risk score is associated with a \$5.1 million decrease in yearly FDII inflows. The correlation is economically sizeable, as it amounts to roughly 84% of the sample median.

⁸ It should be noted that this difference in correlations between FDI and FDII vanishes as we consider non-Sub-Saharan emerging countries, possibly reflecting a non-linear relationship between such a risk and the difference in correlations, i.e. for sufficiently low transfer risk levels, the longer horizon peculiar to investments in infrastructure is no more detrimental relative to other kinds of investment.

⁹ More formally, for each country i and for each SACE risk score X we estimate the following model: $FDII_i = \beta X_i + \gamma_k Z_{i,k} + \varepsilon_i$, where $Z_{i,k}$ is a vector of country-specific controls (encompassing current account balance, public debt, public deficit, GDP per capita in PPP, real GDP growth, inflation and population, each computed as the 1990-2019 average), ε_i is random disturbance. $FDII_i$ is computed using the "Private Participation in Infrastructure Database", made available by the World Bank.

FIG. 3.3 – SACE TRANSFER AND CONVERTIBILITY RISK SCORE AND YEARLY FDI (LEFT PANEL) AND FDII (RIGHT PANEL) INFLOWS IN SUB-SAHARAN AFRICA



Source: World Bank, SACE SIMEST

Note: 0–minimum risk; 100–maximum risk

Risks stemming from expropriation and breach of contract are inherent to both the construction and the operation phases and are particularly relevant for long-lived infrastructure projects. Although instances of direct physical seizure of the property of an existing infrastructure have historically been rare, potential deterrents to foreign investments in Sub-Saharan Africa may take other forms. More concrete risks are represented by the probability that authorities may, for example, act in order to indirectly deprive investors of the ability to control or productively use their property (e.g. procedures for revocation of business permits, so-called “*indirect expropriation*”), or restrict the viability of a project through changes in taxation or regulation (so-called “*creeping expropriation*”). A closely related, more concrete risk in the construction industry is constituted by the threat that authorities may fail to perform contractualised obligations. The most typical cases include unfair calling of a guarantee or calling of a guarantee owing to political risks, such as wars or civil unrest that prevent contractors from fulfilling

their obligations. In this respect, Sub-Saharan Africa is still significantly riskier than the rest of the world, as shown by a median value of 68 in the SACE expropriation and breach of contract risk score, compared to 55 in Asia Pacific and 51 in Latin America. This difference lies mainly in Africa's relatively low rule of law standards, weak legal frameworks, widespread corruption practices, lack of transparency, shortage of qualified personnel and inefficient contract enforcement procedures.

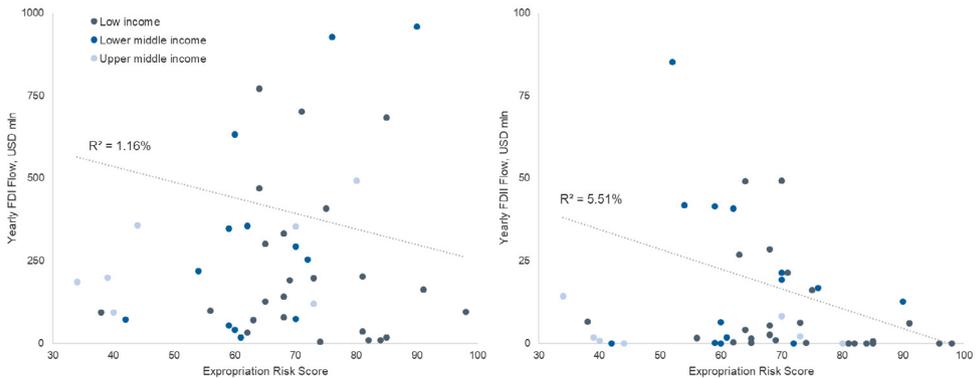
Tanzania's expropriation risk profile has deteriorated in recent years. President Magufuli's election in 2015 has marked a shift in Tanzania's economic policy towards a more interventionist role for government, which has prompted the renegotiation of contracts in the hydrocarbons, mining and telecommunication industries. Foreign investments in infrastructure developments through public-private partnership are not immune to Magufuli's rhetoric. The PPP Act 2010, amended in September 2018, has restricted the rights of foreign investors to resolve commercial disputes with the government through international arbitration, seen as a tool to contravene the Constitution, while also potentially blocking compensation payouts related to bilateral investment treaties that violate the public interest.¹⁰

Breach of contract risk is also rising in Ghana, as take-or-pay contracts with independent power producers, signed under the former government, force Ghana to buy excess energy, which is adding roughly \$500 million per year to the fiscal deficit and contributing to the country's worsening financial position.

¹⁰ The prominent example of the growing operation risk for infrastructure investments in Tanzania regards a breach of an energy contract between a foreign bank and the government-owned utility TANESCO. The High Court ordered the parties not to enforce, comply or operationalize any decision reached by the World Bank's International Centre for the Settlement of Investment Disputes (ICSID) that, in October 2019, finally ruled against TANESCO, ordering Tanzania to pay \$185 million. Nevertheless, the government kept denying any responsibility, in fact violating the obligation for the ratifying countries to automatically recognize and enforce an award issued in an ICSID arbitration, leaving foreign investors in infrastructure relatively vulnerable in the operation phase.

This example makes it clear that short-sighted infrastructure investments that fail to take into account the foreseeable evolution of a country's future needs always bear an inherent political risk.

FIG. 3.4 – SACE EXPROPRIATION RISK SCORE AND YEARLY FDI (LEFT PANEL) AND FDII (RIGHT PANEL) INFLOWS IN SUB-SAHARAN AFRICA



Source: World Bank, SACE SIMEST
 Note: 0-minimum risk; 100-maximum risk

Figure 3.4 shows evidence that expropriation risk, like transfer risk, is negatively correlated to both FDI and FDII inflows – the correlation with the latter being significantly larger, possibly reflecting the relatively high policy unpredictability for long-lived infrastructure investments.¹¹ A 10-point increase in SACE expropriation risk score is associated with a \$5.2 million

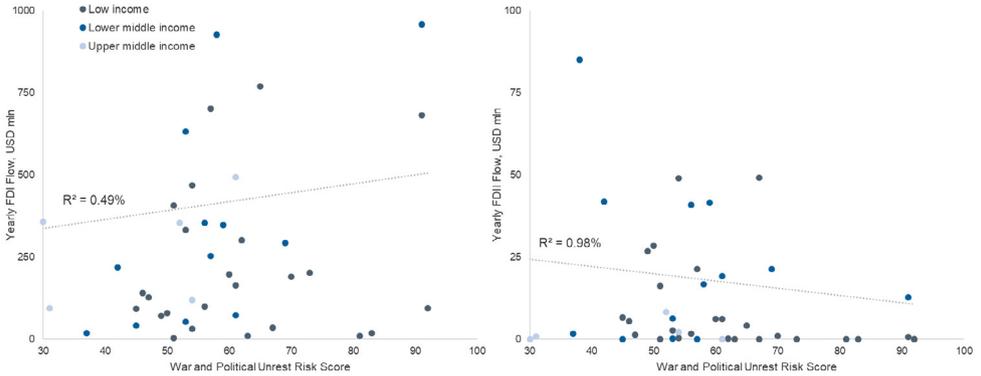
¹¹ The correlation between expropriation risk and FDII in other emerging countries is positive, though not statistically significant at any conventional confidence level. As the non-parametric equality-of-medians test ensures that the median expropriation risk score is statistically different (at the 99% confidence level) between Sub-Saharan and other emerging countries, this result could suggest that the correlation is non-linear, i.e. negligible for low expropriation risk levels and negative for high risk levels.

decrease in yearly FDI inflows (roughly 86% of the median).

Risks related to war and civil unrest characterise many emerging countries, which are often ruled by dictatorships or weak democracies in a highly unstable and unpredictable political cycle. For instance, frequent political transitions may undermine governments' commitment towards foreign investors, while potentially fostering a reallocation of public funds according to new priorities. Due to Africa's fragmented ethnic landscape, this kind of risk may be associated with ethnicity as well as political affiliation, thus feeding further social discontent. Moreover, terrorism and civil wars have marred Africa's recent history, making investments in physical infrastructures relatively prone to such a risk, as they typically represent valuable targets. The Grand Ethiopia Renaissance Dam proves that infrastructures may themselves be the cause of interstate disputes. The beginning of construction of the dam on the Blue Nile in 2011 has been a recurrent source of contention between Ethiopia, Sudan and Egypt, with each claiming their rights to Nile water resources. As a full resolution of the dispute looks unlikely in the near term and ethnic fragmentation threatens political stability and Ethiopia's dense infrastructure development plan, SACE gives the risk of war and civil unrest in Ethiopia a score of 65, which is above the regional median.

The rest of the continent exhibits high levels of heterogeneity, with four countries (Democratic Republic of the Congo, Somalia, South Sudan and Sudan) showing extreme levels (i.e. a score of over 90) of war and civil unrest risk.

FIG. 3.5 – SACE WAR AND POLITICAL UNREST RISK SCORE AND YEARLY FDI (LEFT PANEL) AND FDI_{II} (RIGHT PANEL) INFLOWS IN SUB-SAHARAN AFRICA



Source: World Bank, SACE SIMEST

Note: 0–minimum risk; 100–maximum risk

Although Figure 3.5 shows a fairly low (0.98) correlation between SACE war and political unrest risk score and FDI_{II} inflows in Sub-Saharan Africa, the linear model tells us that a 10-point increase in the score is associated with a \$7 million decrease in yearly FDI_{II} inflows. The effect is both statistically significant and economically sizeable, as it exceeds the median value of the sample. This result, coupled with the lack of evidence that FDI is significantly affected by conflicts in Africa, is again consistent with the view that investments in infrastructure are particularly prone to political risks. Careful investment planning is therefore crucial, while relying on competent partners to seize opportunities offered by one of the most attractive markets.

Political Risk in Infrastructure Investments in APAC

Claudio Cesaroni

Encompassing countries with above-average growth rates compared with their peers in other regions, developing Asia is one of the world's most attractive destinations for infrastructure investments. A recent report¹² by the Asian Development Bank (ADB) suggests that supporting the region's growth momentum in the next decade will require investments averaging \$1.5 trillion per year, with the bulk of total spending on the power (52%) and transport (35%) sectors. This number is even higher when taking into account climate-related investments, which add roughly \$240 billion to yearly spending needs, and doubles the previous estimates presented by ADB in 2009, due to robust regional growth, better data availability and a clearer understanding of the role of infrastructure in tackling the impact of climate change. Data from government budgets and the World Bank's Private Participation in Infrastructure Project database show that infrastructure investments in the region totalled \$881 billion in 2015, thus highlighting a considerable gap with respect to the estimated needs. Most of the funding is provided by the public sector, although the relative importance of governments' contributions varies significantly across countries, as governments' ability to fund large projects in developing countries is often constrained by scarce fiscal revenues, narrow fiscal spaces and thin financial markets.

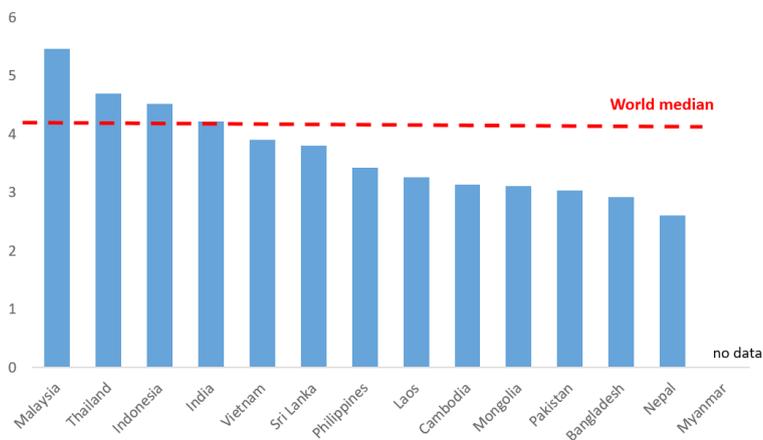
It is therefore clear that the ability to attract private investors becomes critical for infrastructure development in these countries. In this regard, the role of foreign investors from developed countries is of great importance, not only from a purely financial point of view, but also for the potential spill-over effects on technology and human capital, as well as on

¹² Asian Development Bank (ADB), *Meeting Asia's Infrastructure Needs*, 2017.

trade integration. However, poor institutions and political risks often act as a deterrent to FDI in developing countries. This is particularly true for FDI in the infrastructure sector, which is characterised by larger capital investment and longer payback periods, and is often plagued by delays in project start-ups and legal disputes, as previously discussed.

Developing countries in Asia display large differences in infrastructure development and in the severity of the political risks related to project execution. According to the latest available Global Competitiveness data published by the World Economic Forum (WEF), only a few countries, namely Malaysia, Thailand, Indonesia and India, are endowed with relatively good infrastructures, whereas all the others suffer widespread deficits (Figure 3.6).¹³

FIG. 3.6 - QUALITY OF OVERALL INFRASTRUCTURE FOR THE SELECTED COUNTRIES



Source: WEF Global Competitiveness Index database

¹³ WEF assesses general infrastructure (e.g., transport, telecommunications, energy) quality through an index ranging from 1 to 7, where 1 = extremely underdeveloped-among the worst in the world and 7 = extensive and efficient-among the best in the world.

Infrastructure investments in countries starting from a very low base generally promise high rewards, but might also entail significant political risks. Table 3.1 shows the scores for the three sources of risk for the same country group represented in Figure 3.6.

TABLE 3.1 - POLITICAL RISK COMPONENTS FOR THE SELECTED COUNTRIES

Country	Expropriation and breach of contract	War and civil disturbance	Transfer and convertibility	Average political risk
Pakistan	71	84	81	79
Myanmar	74	71	78	74
Laos	68	49	86	68
Nepal	64	61	65	63
Bangladesh	67	61	55	61
Cambodia	71	52	60	61
Sri Lanka	55	51	64	57
Vietnam	53	46	50	50
Indonesia	61	55	32	49
Mongolia	56	32	60	49
Philippines	56	63	28	49
Thailandia	50	55	23	43
India	40	51	32	41
Malaysia	31	36	19	29

Source: SACE SIMEST

Note: 0=minimum risk; 100=maximum risk

According to Table 3.1, foreign investors should be aware of potentially high security, operational and legal risks when undertaking projects in countries such as Pakistan, Myanmar and Laos, whereas economies such as Malaysia, India and Thailand have been able to develop more business-friendly environments. The remaining part of the article describes the three components of political risk separately, focusing on those countries that exhibit a high risk profile.

Expropriation and breach of contract

When undertaking long-term projects in countries with poor institutional quality, investors bear expropriation and breach of contract risks, especially when operating in strategic sectors of the economy. In Myanmar (score 74), the government is attempting to attract foreign investments, but risks to contract enforcement persist. Contracts signed under the previous government have faced revisions, and projects that carry non-negligible environmental risk are likely to face reviews, especially if they trigger mass protests and demonstrations (e.g. the Myitsonne Dam hydropower project suspended in 2011). In Cambodia (71), notwithstanding a negligible risk of expropriation (no foreign firm has been affected so far), contract enforcement takes a very long time and domestic dispute resolution is influenced by corruption and political interference. In many cases, moreover, Cambodia does not recognise foreign judgements, which makes it more difficult to enforce a foreign court's verdict. A similar environment with low expropriation risks but lengthy and difficult contract enforcement characterises Bangladesh (67), where the judiciary is also prone to corruption and is increasingly influenced by the Awami League government. Contract alteration risks are high in Pakistan (71), where the Pakistan Tehreek-e-Insaf-led government, which has been ruling the country since August 2018, has indicated that it will seek to review projects and contracts signed by the former government. Risks associated with expropriation and contract alteration are also a concern in countries where there is only one party dominating the political (and economic) scene – as in Laos (68), where courts are not politically independent and expropriation upon compensation is allowed if deemed necessary for a public purpose – and in countries where years of government instability have hampered successful reforms in the legal system, as happened in Nepal (64) in the aftermath of the 1996-2006 civil war.

War and civil disturbance

War and civil disturbance risk is a serious concern for investors operating in countries characterised by high security threats. Political violence risks are significant in Pakistan (score 84), due to a combination of factors including the presence of radical Islamic groups, tensions with neighbouring India and social instability. India-Pakistan tensions have recently worsened, as documented by the killing of 44 Indian paramilitary officers by Kashmiri militant groups supported by Pakistan in February 2019. Risks related to terrorist attacks have decreased substantially since military operations targeted Tehreek-e-Taliban Pakistan, the main non-armed group operating in the country, but they are still a matter of concern, with infrastructure and facilities as preferred targets. Myanmar (71) is the scene of the world's longest civil war, which started suddenly after the country declared its independence from the United Kingdom in 1948 and consists primarily of ethnic conflicts. Since 2015, fighting has intensified and tends to be concentrated in Shan, Rakhine, and Kachin states, posing disruption risks to infrastructure projects, as happened in August 2019 with the interruption of projects related to the China-Myanmar Economic Corridor, a vital part of China's Belt and Road Initiative. Security threats in the region's other countries are generally more localised and easier to contain. It is worth mentioning the case of the Philippines (63), where, on the one hand, the defeat of the Islamic-State-linked groups by military forces after the five-month siege of Marawi in 2017 has dramatically reduced their ability to carry out effective attacks, on the other hand, the recent decision by President Duterte to terminate the Visiting Forces Agreement with the US will drastically decrease the number of joint military activities between Filipino and American troops, thus dampening the country's ability to fight back Islamic insurgencies.

Transfer and convertibility

With a large current account (CA) deficit of about 12% in 2019, a very low, and declining, level of reserves equal to 1.3 months of imports, a managed floating exchange rate system and public external debt at over 50% of GDP, Laos (score 86) has all the ingredients for being classified as a country with substantial transfer and convertibility risks, which is consistent with businesses often reporting problems in exchanging the Lao kip into foreign currencies, even though these difficulties mostly prove to be temporary. Pakistan (81) presents similar macroeconomic imbalances (in 2019, CA deficit at 4.6% of GDP, reserves at about 2 months of imports, high level of external debt, equal to 43% of GDP) and, in fact, its Central Bank strictly controls the exchange rate and monitors foreign exchange transactions in the open market, with banks required to report and justify outflows of foreign currency. Notwithstanding consistent external imbalances (recurrent CA deficits and low reserve levels), Myanmar (78) has made significant progress in opening its capital account and managing foreign exchange over recent years. The Central Bank of Myanmar is making progress in adhering to a market-determined exchange rate, as reflected in the sharp depreciation of the kyat in 2018, and the government liberalised foreign exchange controls and abolished restrictions on uses and sources of foreign exchange between 2012 and 2014. Nevertheless, in practice, transferring funds in and out Myanmar might be difficult, especially as the country has a long history of international sanctions and international banks have been slow to adapt to changing regulations. Transfer and convertibility risk also deserves a mention in Sri Lanka (64), although it is much more bearable than in the above mentioned countries. Sri Lanka causes concern mainly because of its large stock of external debt (equal to over 65% of GDP in 2019) and its relatively low level of reserves (\$8.5 billion or 3.5 months of import cover), with the populist spending plans of the Rajapaksa brothers, who returned to power in the November 2019 elections, representing a risk for the completion of the

IMF three-year programme launched in late 2016. However, risks have been mitigated by the new Foreign Exchange Act that came into operation in November 2017, further liberalising capital account transactions.

4. Reorganisation of the Infrastructure Sector and New Forms of Financing

Remo Dalla Longa

Until a decade ago, the term “infrastructure” clearly referred to roads, highways, airports, ports, power stations, gas networks, water supplies, sewers and waste disposal systems. Going back only a few decades, there was a widespread conviction that state intervention in the financing of infrastructure was unsustainable: growing needs could simply not be met due to limited public investment resources and the necessity to contain the role of the state in national economies.

Since then, the very concept of infrastructure has undergone a “multifaceted” evolution. Typologies have grown in number and new means of financing them have also appeared. As the state has reduced its role as financier, new forms of infrastructure have appeared along with new actors, financiers and procedures in which the state is no longer the sole protagonist. The Public-Private Partnership (PPP) has emerged and developed. For investments in infrastructure, we have moved from public procurement to concession contract and more generally to PPP. Direct intervention by the private sector has also increased. The nature of the infrastructure has changed.

What Is PPP and How To Interpret It?

PPP differs from corporate finance as it finances one specific project. Debt remains “potentially” borne by the economic operator through a project company or a Special Purpose Vehicle (SPV). There is also a different approach to assessing risk compared to traditional interventions. PPP is the traditional evolution of public-private and state and market models: it passes from traditional public procurement to Long-Term Contracts (LTCs). The LTC there is only when financing for a project comes from banks, funds and economic operators and in ways other than public procurement.

PPP initially focused on production, and only secondarily on infrastructure, though more than 20,000 kilometres of railways were built with project finance techniques in England, France, Germany, Belgium and Italy over a century and a half ago. It is really at the end of the last century that we see the emergence of modern PPP, with the embryonic Private Finance Initiative (PFI) introduced by the government of John Major and later developed by Tony Blair’s New Labour. Today, PPP occupies a broad perimeter and encompasses not only economic infrastructures (those that first gave rise to PPPs), but also social infrastructures, complex urban interventions¹ and many other forms of infrastructure.

The Criticalities and Potential of PPPs Compared to Traditional Public Procurement

The problems and potentials of PPPs are almost never absolute, and need to be assessed in context.

It can be a problem when:

- The cost of PPP infrastructure is very higher than that financed by traditional public procurement.

¹ R. Dalla Longa (ed.), *Urban Models and Public-Private Partnership*, London, Springer, 2011.

- There is possible cultural asymmetry between the Procuring Authority and the Project Company.
- Risk management extends over a Long-Term contract (LTC). It is already complicated to manage a risk in public procurement; it is exponentially with LTCs.
- New forms of social exclusion appear, even if mitigated by currently little-known interventions.

PPP represents a potential when:

- It can improve operability and integrate different parts of an infrastructure.
- It allows the circulation of citizens' savings in a virtuous circle for collective benefits. However this is not always within the same country, to make this happen several virtuous circles must be activated simultaneously (e.g. attractiveness of investment, large amounts of national savings).
- The private sector proves more efficient at infrastructure management than fragmented state actions.
- It can encourage improvements in tariffs and standard forms of them, fees, (or public rate), output, quality and satisfiability.
- It permits radical modernisation and innovation in services and infrastructures.

Regardless of problems and potential, PPP needs absolute interdisciplinarity and new organisational forms, both for the state and the market. The boundary between criticality and potentiality remains weak and not entirely resolved.

PPP Around the World

Following the advent of modern PPP and recent developments, PPP is now distinguished by different components. If we consider the more traditional and consolidated application of

PPP, that of economic infrastructure,² many representations can be identified around the world.

Both developed countries (13.4%) and emerging countries (12.8%) declare 15% of PPP infrastructures on average. China draws its own trajectory.³

The following groups of countries can be identified: a) Anglo-Saxon nations with PPP figures above 15% compared to other forms of infrastructure investment;⁴ b) follow the historical European Community countries;⁵ c) South American and African nations with a below-average uptake of PPP.

Other important variables that must be taken into account are:

- The uncertainty of data on infrastructures and even more so on PPPs: this is a serious problem that will remain untouched for some time⁶. If we analyse different sources of data, it also seems that there is a general underestimation of the volume of PPP.
- Differences in infrastructures, such as classifications into greenfield (new infrastructures) or brownfield (consolidated infrastructures): these can be very marked in relation to countries' economic context and geo-political location.
- The different economic and geo-political weight of nations and geographic areas that use PPP in one way

² The economic infrastructures referred to here and in the next two paragraphs are: energy, telecommunications, airport, ports, rail, road, water, the source is mainly GIH / Oxford Economics (several years). See Oxford Economics, *Global Infrastructure Outlook, Infrastructure investment needs: 50 countries, 7 sectors to 2040*, Global Infrastructure Hub, 2017.

³ It is the financing of the State that is used and the PPP appears, in absolute terms, marginal.

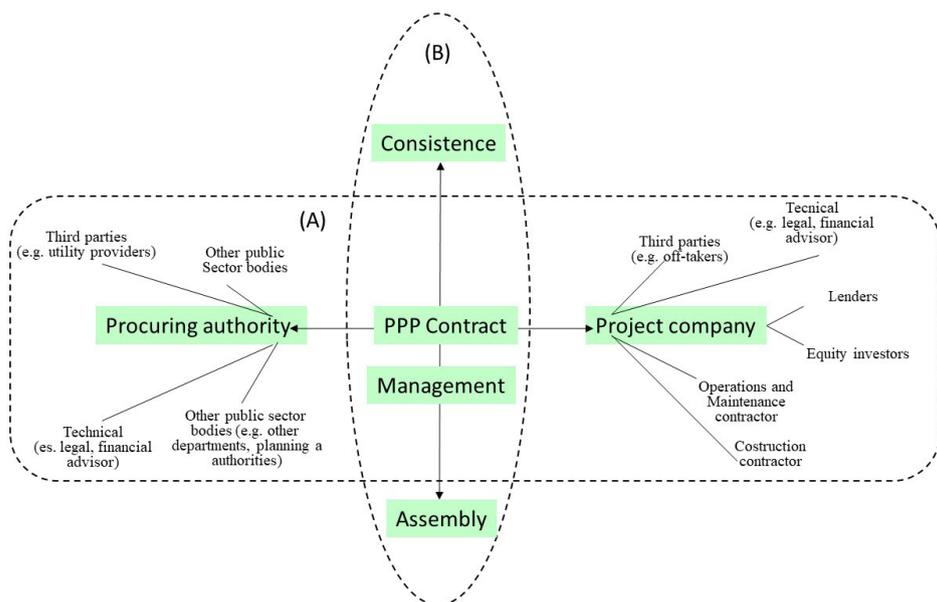
⁴ The USA is below average (13.3%), while Australia 37.4%, Soud Africa 27.6%, the United Kingdom 26.6% and Canada 17.7%.

⁵ Germany is below average (9.5%), while France 15.4%, Spain 14.5%, Italy 11.7%.

⁶ The reference is to data from GIH, OCDE, Eurostat, EIB / Epec, IJ Global (several years). See also R. Dalla Longa, *Il Public-Private Partnership: L'evoluzione Stato-mercato in opere pubbliche ed infrastrutture*, Roma, Carocci, 2017.

or another. For all PPP formulas, the basic element is represented by the relationship between contracting and project companies through a contract. This formula was valid until a decade ago, now no longer. In the case of some countries (e.g. European Union) we are seeing a new generation of PPP, in which (A) is added to (B) (see Figure 1).

FIG. 4.1 - EVOLUTION OF PPP MODELS (A), (B)



Source: our elaboration on GIH data, (2018)

Ppps Around the World: First Macro-Differentiation

Emerging countries⁷ can typically be profiled as follows:

- They are countries with high infrastructure needs (and recent investments represent a substantial part of fixed investments).
- They invest mainly in economic and greenfield infrastructures; they are countries with increasing growth forecasts (GDP) and this type of infrastructure can be a push factor for growth.
- The important thing for these countries remains a correct balance between the Procuring Authority and the Project Company enshrined in the PPP contract.
- The partial and imperfect transmission of risks from the public sector to the economic operator can be bridged by steady GDP growth. Increased growth will gradually outweigh asymmetries and incomplete knowledge of LTC consistency (Fig. 4.1 point A). In the end, what happens in the management of the LTC is not as important as the investment itself.
- In addition, emerging African, Asian and to some extent south American countries are the ones where significant urban growth is expected and urban infrastructures more suited to new forms of PPP are needed.

⁷ The emerging countries considered by the G20 are: Africa (a: low and lower middle income): Egypt, Ethiopia, Kenya, Morocco, Nigeria, Senegal; (b: upper middle income): South Africa. - Americas (b: upper middle income): Argentina, Brazil, Colombia, Mexico, Peru. - Asia (a: low and lower middle income): India, Philippines, Vietnam; (b: upper middle income): Malaysia, Thailand (Turkey an China between emerging and developed).

Developed European countries⁸ typically have the following profile:

- They have a developed infrastructure system.
- In future, investments will mainly involve brownfield infrastructures, i.e. pre-existing infrastructures that require modernisation or the merging of other typologies (new technologies, greens, etc.).
- They have very low growth rates (GDP) and the weight of infrastructure investments is reduced compared to fixed investments in other countries.
- They have high public debt. It is also useful to remember that stability pacts (Maastricht) and fiscal compacts are in force at EU level.
- For these countries, a correct balance between the Procuring Authority and the Project Company is insufficient. It is essential to establish immediately a correct balance between hard consistency (object), PPP contract and management of the PPP assembly for the duration of the LTC (Fig. 4.1 point B).
- The effective and permanent transmission of risk from the public sector to the economic operator becomes the central point of the PPP around which the feasibility and legitimacy of the formula are focused.
- Developed European countries are highly urbanised (more than 70% of the population living in urban areas compared to 40-50% in regions such as Asia and Africa). On the other hand, the increase in future urbanisation will be more contained than in other parts of the world. For these countries, this also indicates that PPP will become more focused on the reconversion of brownfield urban infrastructure.

⁸ The developed countries considered by the G20 are: Europe (c high income): France, Germany, Italy, Spain, United Kingdom. Among the Americas: USA, Canada, Oceania: Australia, New Zeland, Asia: Japan, South Korea, Singapore.

Growth in Infrastructure Investment Needs and Prospects for Ppps

An analysis of the 52 most developed countries worldwide showed investments in economic infrastructure for 2.3 trillion dollars in 2015 and a natural trend likely to take this figure to 3.8 trillion in twenty years (2040). To meet growing needs, however, investments for an additional 1.2 trillion dollars (+1/3) are already required at present.

Only with an injection of private capital through PPPs will it be possible to cover growing demand for infrastructure, considering that state spending on public procurement in developed countries, and particularly those of the EU, has been declining for several years.⁹

The highest growth in demand according to today's trend is seen in American (47%) and African (39%) countries, followed by Europe (16%), while global demand is estimated at 19%. Within the EU, the greatest demand is in Italy, which has compressed public investment in recent years due to the stability pact rules and a huge stock of sovereign debt. The need for off balance sheet investment is therefore key to development in many countries and a proper use of PPPs would be consistent with this need.

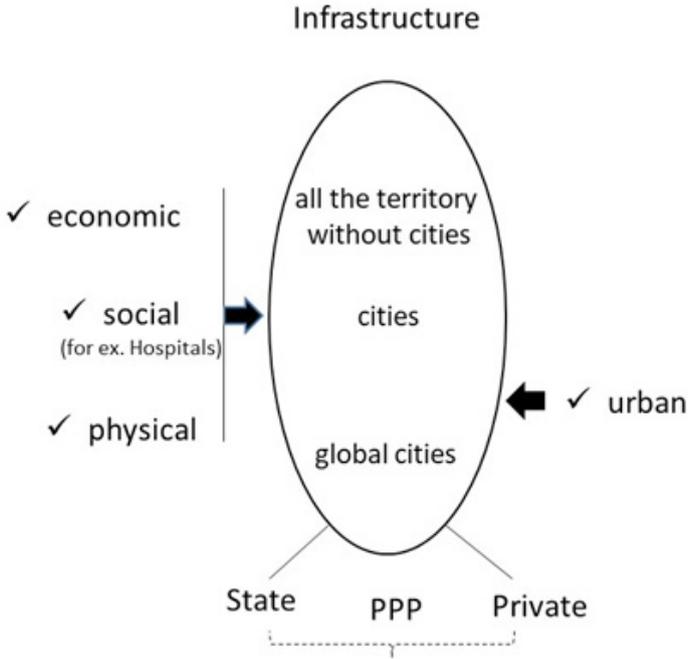
Data indicate that PPPs are destined to grow and assume different forms in future years. PPP perimeters will widen and PPP models will also vary depending on the type of infrastructure: management components, interdisciplinary knowledge, organisation culture and risk management will all be fundamental in diversifying models and in the symmetrical development of PPPs.

The Breakdown of Infrastructure

In terms of global macro-differentiation, PPPs can differ significantly depending on infrastructure type, region, and development and urbanization levels.

⁹ R. Dalla Longa (2017).

FIG. 4.2 - BREAKDOWN AND ORGANISATION OF INFRASTRUCTURES:
REGION AND STATE - MARKET



Source: author's elaboration

Different Forms of Infrastructure and Their Evolution Between State and Market

*Economic / social infrastructure
(the European PPP model)*

The primary difference here is between economic and social infrastructure.

Economic infrastructures are those that derive their revenues, and therefore the production of value (NPV¹⁰ and IRR¹¹), from tariffs paid by users. They generally operate according to market principles, often contrasting the emergence of monopolies (because they allow users to choose different solutions) and inhibiting state aid. European Directive 23 of 2014 introduced concessions in EU law for the first time and established the principle of “operating risk”: the state can no longer intervene, given an initial contribution limit (not exceeding 50%), to cover deficits or loss of value (NPV and IRR) of the project. National states violating the directive are subject to possible warnings and sanctions.

The state has a progressively diminishing role, if not a secondary one (planning, verifying impacts, evaluating transferred functions, avoiding implosions and taking on future costs). It is therefore up to the market to bear the greatest burdens: it is the economic operators (builders, lenders, providers, general contractors) who must assess whether a specific infrastructure is capable of producing value, for how long, and with what trend; in other words, they assume all operating risk.

Social infrastructures are based on public fees¹². The state contributes to fuelling the revenues of these infrastructures, therefore determining their production of value (NPV and IRR). The difference with respect to economic infrastructures is more crucial than it appears. Although these infrastructures are included in the PPPs and therefore share the management formulas of the Long-Term Contract (e.g. DBFOM - Design Build Finance Operation Maintenance, and other formulas), they are not included in the concessions but fall within EU directives 24 and 25 of 2014 on public procurement and special

¹⁰ NPV – Net Present Value

¹¹ IRR – Internal Rate of Return

¹² *Public fees* - in which government pays to a non-government partner all or a majority of the fees under a specific contractual arrangement, thus covering most of the total cost of the service provided (including the amortisation of the assets). In national accounts, this feature distinguishes PPPs from concessions.

sectors. Except in special cases, they don't have operating risk as reference; rather, the focus is on construction and availability risks. The birth of social infrastructures within a PPP takes place with the British PFI (Private Finance Initiative), later incorporated in the 2004 Green Paper¹³ by the European Commission. The role of the public administration in this case is more complex and must respond to more detailed, widespread and growing accountability rules. The most critical aspect for the Public Administration is how to transfer risk and make sure that it remains borne by the economic operator as if it were in fact an operating risk, even if it takes on a different connotation¹⁴. If this capacity is missing, investment with private capital is considered "on balance sheet" (with an immediate impact on public debt), and not "off balance sheet": this has a major impact on public finances, especially for countries like Italy with high structural deficits. In Europe, accountability applied to PPP for social infrastructure requires a high increase in management and knowledge by the Public Administration and consequently by the economic operators, who have to adapt. New (interdisciplinary) tools have to be introduced to ensure convergence between public and economic operators. The success of a Long-Term Contract cannot be determined by contract clauses alone. The Public Administration must considerably strengthen its internal skills and learn how to assemble a PPP. This is crucial, since the economic operator has no direct interest in on/off balance sheet accountability; this belongs only, or mainly, to the public "mission".

The evolution of governance, financeability and the assembly of infrastructures are central issues. The EU directive regulates the transfer of risk from the public to the economic operator. This requires a huge leap (almost a revolution) in Public Administration from the point of view of programming,

¹³ COM (2004) 327 final.

¹⁴ For social infrastructures the references are mostly the construction risk and above all the risk of availability which must remain constant throughout the Long Term Contract (LTC).

planning and the use of internal control and verification tools: the process must last the life cycle of the Long-Term Contract (LTC). If this revolution is missing, the PPP is destined to be constrictive and remain on stand-by. Before the EU directive, the programming was delegated to the PSC (Public Sector Comparator) which identified risks and demonstrated their transferability. VfM (Value for Money) has also been used to demonstrate the feasibility of a PPP compared, for example, to traditional public procurement. What indicated by the PSC and VfM was then often reported in a concession contract (or PPP). The legitimacy of a PPP was therefore delegated to instruments and a static contract more similar to a public procurement rather than a Long-Term contract (LTC). The weakness of this approach lay mainly in the possibility of manipulation (the optimistic transposition of risks from the public to the private sector and, in the case of economic infrastructures, overestimation of revenues from users based on unsustainable growth figures). From the 1990s onwards it has been shown that the overestimation of data (technically speaking, the incorrect assessment of “consistency” and the incorrect transfer of risks) and the evolution of environmental variables (the result of incorrect programming and planning) requires ex-post state intervention. That is to say that all the risks return to the public field and private value destroys public value, rather than creating a growing balance between the two. EU accountability (Directive 23 of 2014, the rules of ESA 2010¹⁵ and the transposition of EUROSTAT manual rules¹⁶) sanctioned this step.

At EU level, it is no longer possible for PPPs to delegate the transfer of risk to the contract. The Public Administration (Government sector) needs to greatly increase with management and tools, its capacity to assemble PPPs. If this cannot be done, the development of PPPs stops. They will create vicious circles

¹⁵ ESA - European system of Accounts.

¹⁶ EPEC-Eurostat, *A Guide to the Statistical Treatment of PPPs*, September 2016; EPEC-Eurostat, *A Guide to the Statistical Treatment of Energy Performance Contracts*,

of illegitimacy, an accounting defect and a lack of respect for vertical (EU) accountability. EU sanctions will then follow.

It is no longer automatic that debt remaining in the “belly” of a project company or private SPV (Special Purpose Vehicle) is considered off balance sheet. To remain off balance sheet, new European rules must be respected. This represents a revolution and a new critical issue when considering PPPs.

The key difference between the European model and others in emerging or developing countries concerns the standardisation of PSCs, VfM and contracts.¹⁷ In many of these countries, a Public Administration capable of intervening in the critical assembly stages is missing. Defining the elements (consistence of the object) to be included in the assembly of a PPP is difficult for these countries, in particular compared with EU nations: data, the upstream culture, and traceability are often missing. As a result, in Latin America, the average share of renegotiation of a significant sample of PPP was 42% after two years of activity. These figures would simply be incompatible with European accountability. Data show that what was initially indicated as a benefit soon turns into a criticality. And there is no advanced Public Administration capable of directing and regulating this choice ex-ante, during or ex-post¹⁸. As for the ECA area¹⁹ (Europe and Central Asia), sources close to the World Bank²⁰

May 2018; Eurostat, *Manual on Government. Deficit and Debt: Implementation of ESA 2010*, Luxembourg. EU, 2019.

¹⁷ A. Estache and C. Philippe, *The Impact of Private Participation in Infrastructure in Developing Countries: Taking Stock of about 20 Years of Experience*, ECARES Working Paper, 2012-043, Universite Libre de Bruxelles, Brussels, 2012.

¹⁸ J.L. Guasch, *Granting and Renegotiating Infrastructure Concessions: Doing It Right*, Washington DC, World Bank Development Studies, World Bank, 2004.

¹⁹ The ECA (Europe and Central Asia) is a World Bank classification made up of 23 most important nations of which are: Russia, Turkey, Serbia, Ukraine, Kazakhstan (the others are: Albania, Armenia, Azerbaijan, Belarus, Bosnia and Herzegovina, Georgia, Kosovo, Kyrgyz, Republic Moldova, Montenegro, North Macedonia, Tajikistan, Turkmenistan, Uzbekistan), among the ECAs, however, there are also 4 community members such as Poland, Bulgaria, Croatia, Romania.

²⁰ V. Cuttara and X.C. Mandri-Perrott, *Public-private Partnerships in Europe and*

stated that in the face of a difficulty in attracting private capital, the state sometimes assumes the risk of user transport (loss of revenue) directly from the concessionaire, thereby undermining one of the constitutive mechanisms of the EU PPP.

Klijn and Koppenjan²¹ (2016) emphasise how the articulated interests of stakeholders within a PPP (assembly) can be a problem in the classic interpretation of Public Administration. However, this is not the case for the new forms of “Governance Network” that go beyond traditional categories of public administration in the Klijn-Koppenjan proposal. It is an evolving world and ambiguity is often necessary to motivate a greater number of actors. Accordingly, disagreements about the assembly of PPPs can easily occur: the process involves actors with different points of view on more aspects (problems, profit, the division of risks) this can cause bitter conflicts and possible dead spots. Klijn and Koppenjan support the idea that PPPs must be able to absorb all these complexities: it follows that a certain ambiguity may prove useful. Ambiguity creates the possibility for different actors to embrace an idea, despite disagreeing on certain aspects. Excessively tight rules would preclude the possibility of developing PPPs in these circumstances. When accounting rules were changed in the UK to avoid a discrepancy between the PSC, VfM and implementation, PPP projects became less attractive for many actors.

Urban Infrastructure

Another formidable field of development for the PPP is represented by global cities, evolved urban settings and the new logic and theory of urban infrastructure. In the future, the PPP through infrastructure will find even more space to shape urban form.

Central Asia: Designing Crisis-resilient Strategies and Bankable Projects, Washington DC, World Bank Publications, 2011.

²¹ E.H. Klijn and A.J. Koppenjan, *Governance Networks in The Public Sector*, London, Routledge, 2016

Looking at infrastructure in urban terms, significant changes can be identified. It is within this area that we have seen the most radical developments and the greatest variety in financing methods. Some authors²² emphasise that urban systems and especially big cities have revolutionised the concept of infrastructure, making it a fundamental, constitutive element. Globally, we are faced with growing urban concentrations where everything is interconnected between centers: transport, networks, energy transformations, wage and energy conversion systems, technologies, databases and switchgear and transformers of all kinds. Public and collective spaces together with infrastructures far overshadow private spaces (i.n. housing), if it were possible to liquefy them there would remain a quantity of cables, pipes, infrastructural systems, fluids and connective impulses. There is a new interconnectivity between ubiquitous ICT infrastructures and traditional, physical ones. In evolved urban systems, even the roads can change their meanings and functions. They are made of the same material as streets in smaller towns, but technology has made their use different: shared services mean that pavements are no longer for pedestrian use alone and apps guide the delivery of food by bike. Bike stations are found on pavements or at interconnections; charging stations with wallboxes are progressively more common; car parks are being replaced by cycle paths or routes for other vehicles (e.g. electric scooters). This is just one aspect of the evolution of PPPs. Global cities are in fierce competition with each other²³ the competitive advantage means being able to quickly transform obsolete functional areas, no longer responding, with new needs.²⁴ These areas, if precious and if enhanced and re-oriented, lead to major transformations and the rapid conversion of infrastructures. The goal is to allow an effective intertwining with real estate, which would otherwise become value-destruction.

²² A. Amin and N. Thrift, *Cities. Reimagining the Urban*, Cambridge, Polity Press, 2002; A. Amin and N. Thrift, *Seeing Like a City*, Cambridge, Polity Press, 2017.

²³ R. Dalla Longa, *Globalization and Urban Implosion*, London, Springer, 2010.

²⁴ R. Dalla Longa (2011).

Often, significant resources are spent and city skylines redefined. The financial costs are much higher if infrastructures are unable to follow the redevelopment of urban areas, there is no sale and there is a risk that the development itself will fail. Often the reference is to new metro lines with stops inside the conversions; or collective and public centers, all the reconverted underground infrastructures, including traffic, transport, parking and secondary infrastructures. Often, the economic operators within a PPP take charge of redevelopments to guarantee synchronisation and ensure maximum palatability for the sale or use of the new functions. This applied to Porta Nuova and City Life in Milan, and to Paddington in London.²⁵ In such cases, the state would be unable to intervene with traditional public procurement. A huge asymmetry would be created with enormous damage to production, and destruction of the value and competitiveness of global cities. The funds required for physical infrastructure conversions are huge. Urban contexts demonstrate a formidable intertwining between different types of infrastructure: older physical infrastructures increasingly need to be converted due to globalisation. Designed for old urban functions, major works are needed to replace or convert them. Concentrated infrastructures are also those most commonly in need of modifications and conversions in connection with sustainability, ubiquitous technologies and green policies. There is a complex and always lively correlation between greenfield interventions (prevalently D&C - Design and Construction) and brownfield (mainly O&M - Operation and Maintenance) but for urban infrastructure there is no clear division between the two. Until now, most interest in infrastructure has come from greenfield specialists but urban infrastructure has placed a structural emphasis on the complex intertwining of the two types, with brownfield interventions being far from marginal. Urban infrastructure itself is often

²⁵ R. Dalla Longa, "Il vantaggio competitivo della città globale", *Economia e Management (Infrastrutture Italia al crocevia - numero speciale)*, no. 4, October/December 2019.

a continuous transformation of physical infrastructure. For example, in the medium-long term, services that improve the energy efficiency of a city hospital can assume a monetary value comparable to the construction of a new hospital.

On the subject of energy efficiency, with the creation of Energy Service Companies (ESCOs)²⁶ in EPC PPPs,²⁷ economic operators and financiers often make new complexed investments within PPP developments. The intertwining of D&C and O&M within Long-Term Contracts (PPP) has increased the complexity of urban infrastructure and merits autonomous study.

PPPs are presently most common in urban infrastructure, in global cities and large agglomerations.

Physical Infrastructure

These are the more traditional infrastructures, made with different procedures and in different periods, in the construction of which the state often intervened with simplified procedures (public procurement). The life cycle of an infrastructure involves different management formulas and different construction materials that, in many cases, require replacement (especially when there is economic obsolescence). Often the reference to the assembly was only D&C (Design & Construction) did not include O&M (Operation & Maintenance). The fiscal crisis of the modern state and the introduction of the PPP required new, unexplored formulas. In countries like Italy, infrastructure management has shifted from one traditional model to another. The motorways are a typical example in which we limited ourselves only to the management formula (from public procurement to concession). Measurement systems for abatement, obsolescence, constant maintenance and innovative intervention systems have been lacking. The passage did not

²⁶ ESCO - Energy Service Company

²⁷ EPC - Energy Performance Contracting

activate or constrain this with new tools and a new support culture defined *ex ante*. A deep “hole”, an immense amount of public real estate, built over decades with traditional D&C public procurement, was given away in concession. This process led to oversimplification and mismanagement. The most iconic representation is the collapse of the Morandi bridge in Genoa, which killed 43 people in 2018. This, however, is only the tip of the iceberg. We are seeing a recomposition to D&C and O&M formulas and the creation of special purpose companies (SPVs). The best-known model for these is DBFOM, which has attracted project finance for years. This reformulation involves greenfield-infrastructure interventions in which the Long-Term Contract requires *ab initio* the contribution of private capital in the design and construction stages. With the brownfield more attenuated is the capital destined for D&C and it may happen that it is conveyed in the maintenances (M) of the O&M, in which not only the replacement is counted but also the remaking, or the innovative intervention. With the merger of D&C and O&M within PPPs and LTCs and the creation of special purpose companies, we are seeing a transformation of physical infrastructures into medium-large groups of companies, with the complexities that this entails for all operators. New cultures, professions and tools need to be developed, especially considering the special characteristics of these companies compared to traditional ones.

It is no coincidence that world funds have started to allocate an increasing share of their assets to infrastructures in all PPP formulas (with 300 billion coming from the largest 100 funds, equivalent to 10% of the capital managed by the funds).²⁸ In some cases, there has been a gradual transfer of funds from real estate to infrastructure and requests have been made for platforms to be set up for the control, orientation and management of these funds.

²⁸ A. Pike, P. O'Brien, T. Strickland, G. Thrower, and J. Tomaney, *Financialising City Stratecraft an Infrastructure*, Cheltenham, Edward Elgar, 2019.

Conclusion

The PPP model cannot be standardised globally. Standards can be implemented in the field of techniques (e.g. project finance, leasing), formulas (e.g. DBFOM, EPC etc.²⁹) and management and organisational companies (e.g. SPVs, ESCOs, project companies and FMCs³⁰). The key lies in the ability to create a new, integrated, interdisciplinary culture (finance, engineering-architecture, new public management or “governance networks”,³¹ dedicated risk management, law and public budgets). Barriers often prevent the rapid development of PPPs. Breaking down these barriers through interdisciplinary cultural support is the way forward. The shift from a traditional model (public procurement) to a more complex one (such as PPP) is not on its own enough to break through the dividing lines between state and market, contract and risk, or off and on balance sheet. When this has been done, other impediments (stranding) were created and we remained stuck at an early stage of development: the experiment was halted as it was considered too expensive. In some cases, the PPP has been defined as a “playground” for lawyers, and many interpretative holes have indeed yet to be filled.³² The PPP nevertheless represents an important line in global development that can go hand in hand with the segmentation and different natures of states. Acceleration of the old PPP model is still possible in some states (emerging countries) though in others (the developed countries) this model is on hold or at least experiencing a slowdown.

²⁹ R. Dalla Longa, “Il concetto di management del patrimonio immobiliare pubblico e il new PREM”, in R. Dalla Longa and G. De Laurentis (eds.), *La gestione del patrimonio immobiliare pubblico: fondi immobiliari, Public-private partnership, finanza e risk management*, Roma, Bancaria Editrice, 2014.

³⁰ Fund Management Company.

³¹ As it was defined in E.H. Klijn and A.J. Koppenjan (2016).

³² G. Dewulf and S. Wright, “Capital Financing Models, Procurement Strategies and Decision-making”, in AA.VV, *Investing in Hospitals of the Future*, London, EuHPN, Observatory Studies Series, no. 16, 2009.

The PPP presents itself as a possible area (perimeter) on which to draw a broad and in many ways unexplored development. Able to channel the huge mass of unused financial resources with collective beneficial ends into the “saver-user-consumer” chain.

There are new fronts on which to break through with the PPP, one of these is urban infrastructure: not only greenfield (more present in emerging countries and with strong urbanisation), but also brownfields (more present in developed countries and with consolidated urbanization where there is a rapid change of functions within urban structures). In the latter case we are faced with greater complexity, but also with a rapid contamination of different different typologies of infrastructure (physical-existing, all-inclusive-technological, “green deal”).

Finally, if interpreted correctly and with methodological rigor, the PPP could represent an important direction of development. The post Covid-19 (economic phase) will impose a strong investment in support of infrastructure. They are the backbone of economic development especially in the stagnation and crisis phase. The public spending (with or without EU support) will concern welfare (health, assistance); while the PPP may, under certain conditions, be the perimeter within which to organize the financing and assembly of the ‘green-brown-fields’ infrastructures.

PART II
GEOPOLITICS

5. The Support of the EU for the Development of Infrastructure (with Special Reference to Transport)

Carlo Secchi

Introduction

Ever since the Treaty of Rome was signed (25 March 1957) “establishing the European Economic Community based on a Common Market”, special attention has been paid to the development of a common policy for transport, which is considered a pre-requisite for building a gradually unified economic space.

The regulatory context aside, it is evident that this also requires the development of suitable transport infrastructures, especially “cross-border” infrastructures connecting Member States (MS), which are more likely to generate some kind of “European value added”. This also justifies use of the European Union budget to support them. In addition to transport, due attention is also given to energy and telecom infrastructures. Finally, since the EU economy is particularly open to international trade and closely interconnected with the world economy, attention is also paid to developing infrastructural links with neighbouring and third countries in general.¹

¹ Cfr. in this Report: Stefano Paci, “The International Dimension of the EU Infrastructure Strategy”.

After the “White Paper on Completing the Internal Market” was adopted (14 June 1985) and the “Single European Act” passed (coming into force on 1 July 1987), the European Council in Essen (9-10 December 1994) approved the first list of priority transport and energy projects to be commonly supported and developed. These later formed the skeleton (together with telecom projects) of the Trans European Network (TEN).

As far as transport infrastructures are concerned, after the Commission adopted the “White Paper on Transport” (28 March 2011) as a roadmap to a single European transport area and following extensive preparatory work, at the eve of the present Multiannual Financial Framework (MFF) period (2014-2020), the European Parliament and the Council reached an agreement on Regulation (EU) 1315/2013 concerning “Union guidelines for the development of the Trans-European Transport Network (TEN-T)” and Regulation (EU) 1316/2013 “Establishing the Connecting Europe Facility (CEF)”. These items of legislation now form the basis of EU policy for transport and related infrastructures, including, as far as CEF is concerned, energy and telecom.²

Basic Features of EU Financial Support

We shall try to review the basic features of and possible future developments in the financial means available for supporting the development of transport infrastructures. These always require large contributions from public funds, which can be provided by grants partially supporting a project, and/or by loans, guarantees and other innovative financial instruments.³

² The documents referred to in this paper can be found in the website of DG Move (Directorate-general for Mobility and Transport) of the European Commission.

³ In this chapter, the term “funding” refers to grants, while the term “financing” refers to loans, guarantees and other financial products.

In the present MFF (2014-2020), the CEF had a total budget of €30.05 billion, made up of 24.2 billion for transport, 4.8 billion for energy and 1.05 billion for Telecom and digital infrastructures. The amount available for transport infrastructures included 11.3 billion originating from the Cohesion Fund and reserved for cohesion MS with higher co-funding rates than others.

Besides issuing CEF grants, the Commission also helps TEN-T projects secure financing. At EU level, such opportunities include financing by the EIB (European Investment Bank) through its normal activity and also through the European Fund for Strategic Investment (EFSI) launched by President Juncker in 2015, and the so-called CEF Debt Instrument. For the next MFF (2021-2027) both EFSI and the CEF Debt Instrument will be replaced by “InvestEU” as of January 2021.

In the current MFF, around 72% of CEF went to railways, illustrating the focus on decarbonisation and on a modal shift towards more environmentally-friendly transport.

In addition to grants, new financial instruments (like guarantees) and approaches have been developed. In particular, the experience of “blending calls” has proved quite interesting: these are combinations of CEF grants with finance from the EIB, and/or a national promotional bank or private investors.

Equally interesting has been the “CEF transport debt instrument”, managed by the EIB and delivered through the “Cleaner Transport Facility” aimed at accelerating the deployment of cleaner transport technologies. This instrument gives the EIB risk-bearing capacity through a CEF contribution to first-loss tranche. It is estimated that 13 billion of total investment have been mobilised by only 473 million of CEF participation.

Finally, given the novelty and in some cases complexity of these new approaches, an advisory service has to be provided through an “Advisory Hub” for MS and project promoters, operated in cooperation with the EIB, to ensure the correct

functioning of the EFSI. This is in line with earlier efforts to provide advisory support, such as that offered since 2008 by the EIB's EPEC (European PPP Expertise Centre) for public-private partnerships.

Beyond the CEF, financial support is also available through grants from the "Horizon 2020" programme (Directorate-General for Research and Innovation) and from the "European Structural and Investment Funds" (ESIF).

Grants are awarded in a competitive process through "calls for proposals" which are regularly announced and administered by INEA (the Innovation and Networks Executive Agency). All available funding in the current MFF has already been allocated but according to the "use it or lose it" principle, some grants (for works postponed or with long delays) are being cut or reduced. The corresponding amounts flow back into the CEF budget and are used for a "reflow call" (the last one of which will be held towards the end of 2020).

National promotional banks,⁴ commercial banks, insurance companies, private investors etc. also operate alongside EU-level financing sources.

State-Of-Play

Between January 2014 and the end of 2019, EFSI, the CEF Debt Instrument and CEF Blending Calls mobilised around 60 billion euro of investment in transport.

The "delegation agreement" between the Commission and the EIB for the implementation of the CEF Debt Instrument was amended in spring 2019 to strengthen the focus on green innovative investments and to ensure complementarity with the EFSI. Departing from the Cleaner Transport Facility launched in December 2016, it introduces new thematic financing, notably "Future Mobility", to support high-risk deployment of alternative fuel infrastructure (e.g. for electricity and LNG), the

⁴ Like "Cassa Depositi e Prestiti" in Italy.

roll-out of innovative technologies and smart mobility services.

As a follow-up to the 2017-2018 blending calls, the Commission launched a “blending facility” in mid-November 2019. In its initial stages, this will provide up to 20% grants to projects in alternative fuels and ERTMS (the European Rail Traffic Management System) that are able to secure some financing but still need a grant for financial viability (i.e. a sufficient level of rentability). There will be no calls as such and the facility will be permanently open, with submitted projects being evaluated every three months. The implementing partners are currently the EIB and national promotional banks (now in the process of obtaining accreditation), but this role will gradually be opened to commercial banks too.

Prospects for the Next MFF (2021-2027)

Negotiations between the European Parliament and the Council concerning the next MFF are still ongoing, and consequently the amounts available for the next financial period can only be envisaged on the basis of proposals already on the table.

On the basis of the Commission proposal agreed by the Parliament, the new CEF (to be called CEF2) should amount to €30.65 billion, made up of 12.85 for the so-called “general envelope” (i.e. for all MS), 11.3 billion for the cohesion MS and 6.5 billion for a new field of intervention, known as “military mobility”. The latter refers to the adaptation and upgrading of “dual use” transport infrastructures that are also important for security purposes.

The CEF2 Regulation will aim at achieving efficient and interconnected networks together with smart (i.e. digital), sustainable (i.e. alternative fuels), inclusive, safe and secure mobility, in addition to adapting the TEN-T network to military mobility requirements.

Significant amounts will also be made available by ESIF: up to €12 billion for transport from the Cohesion Fund and up to 40 billion from the ERDF (European Regional Development

Fund). The transport share in the latter will be defined with each MS during the planning phase in accordance with the so-called “shared management programmes”.

InvestEU will be a continuation and improvement of EFSI with increased focus on policy priorities and additionality, whereby not only the EIB but also national promotional banks and the EBRD (European Bank for Reconstruction and Development) will benefit from the Union’s guarantee and will deliver financing and advisory services. InvestEU will be divided into several sections or “windows”, including the “Sustainable Infrastructure Window” co-chaired by DG MOVE (the Directorate-General for Mobility and Transport). InvestEU will aim for more ambitious climate and environment targets than EFSI, and require that projects are assessed against sustainability. More specifically, InvestEU will provide a budgetary guarantee of €11.5 billion, likely to mobilise 185 billion of investment in “sustainable infrastructure”.

Finally, “Horizon Europe” (which will replace Horizon 2020 in the next MFF) will make available 15 billion of grants for projects related to climate, energy and mobility in its support for research and innovation.

A More Important Role for Private Financing

It is estimated that the completion of the TEN-T core network by 2030 will require around 500 billion euro of total investment. Although some projects will inevitably encounter delays, it is quite evident that the financial support available at EU level (even if combined with that of the MS) is insufficient. Consequently, in addition to EU sources of financing, it is of vital importance to mobilise private investors, create the right regulatory framework and give strategic advice towards this end to project promoters. In this context, in June 2015, European Coordinator Kurt Bodewig and the author of this chapter (in that same capacity) produced an “Action Plan to make the best use of new financial schemes for European

transport infrastructure projects”, referred to as the “CBS Report”.⁵ It detailed twelve recommendations addressed mainly to the European Commission, MS Governments⁶ and project promoters. A progress report was published in January 2018, while a third report on “Enabling the uptake of the TEN-T project pipeline by the financial market” came out in November 2019.⁷

This last report aims to mature the pipeline of TEN-T projects by defining the criteria projects should meet in order to be “bankable”, i.e. attractive for the financial market either by themselves or with the help of a grant component (to improve rentability). This implies a different (and much more careful) approach to the preparation of a project’s financial features, so far restricted mainly to procedures in the public sector, but now seen as equally necessary to meet the requirements of private investors.

The report also makes additional or strengthened recommendations that can be addressed, on the basis of the latest developments, to the European Commission, the MS and/or the projects promoters, to simplify administrative procedures, reduce delays, and more generally to develop an investment-friendly environment.

There is a growing awareness of the need to progress in this direction and some actions have already been taken. However, continued commitment is essential to make a context designed primarily for public sector interventions attractive to sizeable (and badly needed) private sector involvement.

⁵ This advisory activity was requested by the Italian Presidency of the Informal Council of the Ministers of Transport held in Milano in September 2014, where a first paper was presented. Originally, also the late former European Commission Vice-President Henning Christophersen was among the authors, which explains the acronym “CBS”.

⁶ In particular, through the Council of the Ministers of Transport.

⁷ The reports can be found online (DG Move website) under the download section of TEN-T (https://ec.europa.eu/transport/themes/infrastructure/downloads_en).

Concluding Remarks

CEF is the second largest funding programme in the EU budget after Horizon 2020, but the amounts available are still far below what is needed to implement the TEN plan within a reasonable timescale. While this is due to the limits of the MFF and the annual budget (still stuck at around 1% of EU GDP), CEF's track record is quite impressive.

Firstly, it represents a clear acknowledgement of the importance attached by EU Institutions to infrastructures (especially those related to transport and mobility), in accordance with our remarks in the introduction to this chapter.

Next, the limited amounts available actually stimulate inventiveness in how to make the best possible use of them by closely monitoring the implementation of projects and by introducing innovative forms of support in addition to grants, as described above. This effort in the field of financial innovation has not only increased the number and size of actions, but also represents a "best practice" for national and regional governments facing similar problems of limited resources in comparison to needs.

Finally, it is evident that the ability to benefit from EU financial support has provided a green light to many projects (in particular large and expensive ones) which have long been waiting to move from the planning stage to implementation. Project promoters (both public and private) have found in EU support additional reasons to push for the realisation of their plans. In addition, it has also proved possible to change public opinion for the better and in many cases to overcome "nimbyism" against the completion of works of public interest, with the ultimate aim of improving economic efficiency and competitiveness and the quality of life of European citizens.

6. The International Dimension of the EU Infrastructure Strategy

Stefano Paci

Seamless and effective transport is enshrined in the founding Treaty of Rome and has made a major contribution to establishing the internal market and supporting the free movement of individuals and goods between EU Member States.¹ Transport infrastructure and networks, however, do not stop at frontiers. Transport is inherently cross-border and the EU transport policy plays a crucial role even externally, connecting the EU with other countries. In the Mission Letter to Commissioner Adina Vălean, Commission President Ursula von der Leyen stated that one of the key tasks in the area of transport is to “strengthen cooperation with key partners to enforce existing agreements, open up new market opportunities, promote high safety standards and improve connectivity links, particularly in the neighbourhood and Western Balkans”.²

The Union aims at improving transport connectivity beyond its borders through *(i)* extension of its TEN-T policy and networks, and *(ii)* promotion of international transport agreements (e.g. aviation) and high quality, rule-based standards. There are, of course, other policies supporting the

¹ Transport policy is one of the areas of shared competence listed in Art.5 TFEU. Basic rules applying to a common transport policy covering rail, road and inland waterway as well as sea and air transport are laid out in Articles 90 to 100 TFEU.

² President of the European Commission, Ursula von der Leyen, [Mission Letter to Adina Vălean](#), Commissioner for Transport, Brussels, 1 December 2019.

Union's international connectivity strategy. For example, the EU strives for market access and a level playing field through e.g. open transport services and equipment markets with strategic partners and fast-growing emerging economies. As part of the European Green Deal, the transport sector contributes to a clean, digital and modern economy, notably through smart and sustainable mobility.³

Projection of the TEN-T Beyond the EU

The Trans-European Transport Network (TEN-T) is a key EU programme aimed at achieving effective connectivity. It involves closing gaps, removing bottlenecks and eliminating technical barriers between Member States' transport networks, while strengthening social, economic and territorial cohesion. As transport is inherently cross-border in nature, when the Maastricht Treaty tasked the EU to help establish and develop TEN-T (Art. 170 to 172 TFEU), it also allowed the Union "to decide to cooperate with third countries to promote projects of mutual interest and to ensure the interoperability of networks" (Art.171 §3).

In the early 1990s, the TEN Community engaged with neighbouring central and eastern European countries to prepare jointly for accession even in transport policy areas. Following the latest accessions (2004-2013), the transport component of today's enlargement and neighbourhood policies continues to be based on these treaty articles. It also builds on neighbourhood-related instruments, as required by the Lisbon Treaty.⁴

More than 20 years of TEN-T policy experience has been built on key principles ranging from accessibility and connectivity to common high-level standards on interoperability, safety

³ This article does not address policy areas not exclusively related to transport infrastructure planning and implementation.

⁴ Art.8 TEU, introduced by the Lisbon Treaty: the EU is tasked "*to develop a special relationship, aiming to establish an area of prosperity and good neighbourliness (...)*".

and security for all modes of transport. Work has included the design of network maps based on a common TEN-T methodology, prioritising projects of common interest and guaranteeing sustainable use of finances through harmonised public procurement rules. While TEN-T policy was deployed and implemented within the EU, this consolidated experience and these principles applied in parallel to its external projection.

This was confirmed in 2013, with the adoption of the TEN-T Regulation and its definition of transport networks (core and comprehensive) within the EU. The 2013 Regulation⁵ contemplated the use of indicative maps for TEN-T's extension towards specific third countries in Annex III. It also established the process for including or adapting such maps in Art. 49§6, which provided for delegated regulations based on high-level agreements on transport infrastructure networks between the Union and the neighbouring countries concerned.

On this basis, the EU extended its TEN-T networks by (i) indicative extension of the EU's comprehensive TEN-T maps and (ii) connections between the EU's core networks and those of third countries in agreement with the following neighbouring states:

- European Economic Area and EFTA States: The core and comprehensive networks for Norway, Iceland, Liechtenstein and Switzerland were incorporated in the 2013 Regulation. The comprehensive network was adapted through Delegated Act 2016/758 of 4.2.2016 for Iceland and Norway (following a high-level agreement reached in October 2015, within the framework of the Joint Committee under European Economic Area).
- Western Balkans: The core and comprehensive networks of the six countries in the region⁶ were endorsed on 27

⁵ Regulation (EU) No 1315/2013 of 11 December 2013 on Union guidelines for the development of the trans-European transport network and repealing Decision No. 661/2010/EU.

⁶ Albania, Bosnia and Herzegovina, Kosovo, North Macedonia, Montenegro and Serbia.

August 2015 at the “Western Balkans Six” Summit in Vienna and incorporated in the EU Regulation through Delegated Act 2016/758 of 4.2.2016.

- Eastern Partnership: High-level agreements were signed with Armenia, Azerbaijan, Belarus, Moldova, Ukraine (November 2017) and Georgia (July 2018). The relevant maps were introduced into the TEN-T Regulation with Delegated Act 2019/254 of 9.11.2018.
- Turkey: the current map of the comprehensive network of Turkey was incorporated in the EU Regulation on TEN-T Guidelines adopted in 2013.
- For the Mediterranean region, work with the Southern Mediterranean Partners aimed at identifying a Trans-Mediterranean Transport Network (TMN-T) is still ongoing in light of the mandate received by the Ministers of the Euro-Mediterranean region in 2013. The TMN-T is being prepared in the form of a comprehensive network.

The projection of TEN-T beyond EU borders pursues two overarching objectives: *(i)* ensuring the consistency and effectiveness of integrated multimodal connectivity between the networks of EU Member States and those of immediate neighbours and partners. *(ii)* focusing EU cooperation (including financial support) in these regions.

Soft measures facilitate connectivity with neighbouring regions on safety issues and sustainability solutions in particular and also promote high-level and rules-based standards in all transport modes. The Union actively supports regulatory reforms, convergence and strengthened technical dialogue. These initiatives build on relevant EU instruments and benefit from the active involvement of the European Transport Agencies.

As regards hard infrastructure, along with the connectivity objective, TEN-T extension to neighbouring countries aims at better targeting EU financial support, notably through *ad*

hoc facilities for alignment and technical assistance (such as the “Western Balkans Investment Fund” (WB and Turkey) and the “Neighbourhood Investment Platform”). The existence of commonly identified networks and connections with the EU also provides a stable basis for access to the new European Sustainable Development Fund for private sector development and for interventions by the European Investment Bank. The framework provided by the extended TEN-T networks facilitates the involvement of EU financial instruments, which recognise the same criteria of viability, potential traffic and wider economy and social benefits for projects concerning connections agreed with third countries as it does for TEN-T within the EU. In addition to EU instruments and European financial Institutions, stable infrastructure development strategy and planning also encourages contributions from international financial institutions and instruments.

Two concrete examples illustrate this approach. Since its set up in 2018, the joint EU-Western Balkan international transport organisation (Transport Community with Permanent Secretariat in Belgrade) supports and coordinates the implementation of infrastructure projects in line with indicative maps agreed with the EU. This ensures sound project financing in the region by establishing a level-playing field for investors and by applying transparent and competitive procurement procedures. In line with priorities defined at the highest political level, the Community is committed to actions in the region aimed at rehabilitating the rail network, facilitating trade (particularly at regional border crossings) and, last but not least, promoting road safety in a big way.

In the Eastern Partnership, the indicative TEN-T Investment Action Plan prepared by the World Bank and supported by the European Commission⁷ identifies key projects on the extended core network, agreed with the EU, to be completed by 2030.

⁷ European Union and World Bank, [Indicative TEN-T Investment Action Plan](#), December 2018.

International financial institutions were also consulted as key partners for the delivery of the investments needed. The identified projects will require a total of €12.8 billion and focus on 4,800 km of road and rail construction, rehabilitation and modernisation, projects for 6 ports, 7 aviation projects, 11 logistics centres and 3 border-crossing points.

Connectivity Beyond the EU's Neighbours

In an increasingly globalised world, international transport connectivity is the lifeblood of our economies. A geopolitical European Commission pursues its own connectivity agenda and explores synergies with the connectivity initiatives of its key international partners (beyond neighbouring regions) with a view to strengthening the global role to the EU, defending European interests, promoting European values and principles, and supporting sustainable development.

Building on the experience of TEN-T policy and planning for the EU and its immediate neighbours, the EU's approach to infrastructure connectivity with partners on an international level follows and promotes the principles of transparency, level playing field and sustainability in its broadest sense (including economic, environmental, social, financial and fiscal sustainability). Enhanced infrastructure connectivity must respect environmental rules (aligned with international commitments and the principles of the European Green Deal) and prioritise environment and climate friendly modes. Economic and social benefits should reach all countries (as potential hubs and not mere transit regions). In other words, infrastructure developments in third countries must help them to build their economies and societies and prevent them falling into debt.

Asia

The EU's comprehensive and consistent approach to transport infrastructure was recalled in the EU Strategy on connecting Europe and Asia adopted in 2018. As regards transport,⁸ connecting Europe and Asia requires better land transport links, notably by diversifying trade and travel routes, linking existing and future transport networks and simplifying customer procedures. It also entails arrangements covering other transport modes, such as aviation and maritime. Objectives must be pursued according to the EU's guiding principle of transparency, level playing field and sustainability in its broadest sense.

In terms of transport connectivity with Asia, the Union is already walking the talk. Apart from the above-mentioned TEN-T Investment Action Plan (linked to the extended TEN-T network in the Caucasus, part of the Eastern Partnership countries' network), in 2019 the EU also signed aviation agreements with China and is preparing to sign agreements with Japan and the Republic of Korea. The first ever region-to-region Comprehensive Aviation Transport Agreement (CATA) is being negotiated with ASEAN. Building on the EU-China Maritime Transport Agreement, the two sides are cooperating closely to achieve reciprocity in market access. Comprehensive transport dialogues at the technical level are taking place with several key partners, addressing all modes of transport (rail, road, maritime and aviation) as well as horizontal issues such as decarbonisation and digitalisation.

Specific dialogues address connectivity issues with several key partners. In 2015, the EU-China Connectivity Platform was set up to explore opportunities for cooperation in the area

⁸ The EU's Strategy for Connecting Europe and Asia is not merely confined in transport. It also covers energy, digital and people-to-people connectivity, because for the EU, connectivity is comprehensive and the EU initiative aimed at enhancing connectivity between Europe and Asia considers how to move forward in all those areas.

of transport infrastructure development aimed at enhancing synergies between the EU's TEN-T policy and networks and China's Belt and Road Initiative. As reiterated in the Joint Statements of the recent EU China Summit,⁹ the Platform is a tool for bilateral work towards reciprocity in market access and a level playing field for businesses in the area of transport infrastructure development, taking into due account the respective policy frameworks. In consultation with EU Member States and after exchanges with European stakeholders, the Union is actively promoting open public procurement, fair competition and international standards in investments in transport infrastructure development, to the mutual benefit of both sides of the Platform. One tangible result is a joint study on the most sustainable railway-based comprehensive transport corridors between Europe and China. According to the Terms of Reference agreed by the Chairs of the Connectivity Platform in April 2019,¹⁰ both sides will look at the development of inclusive transport corridors, based on international standards, transparency, level playing field and sustainability in its broadest sense (including economic, environmental, social, financial and fiscal sustainability). Geographically, the study will cover areas beyond the coverage of TEN-T policy and networks (i.e. the EU Member States and the agreed extension to the EU neighbouring partners) and the borders of China. As for transport modes, the focus is of course on railway corridors, but also possible multi-modal connecting points and logistics hubs, which again illustrates the Union's readiness to strengthen cooperation between the EU's TEN-T policy and other infrastructure policies in Asia and to deliver sustainable connectivity for all involved.

⁹ Summits held in 2017 and in 2019.

¹⁰ European Commission, [Terms of Reference of the Joint Study on Sustainable Railway – Based on Comprehensive Transport Corridors between Europe and China](#), Annex to the Minutes 4th Chairs' Meeting.

Africa

Transport plays a key role in the EU-Africa international partnership. In her Political Guidelines for the new European Commission and her mission letters, President von der Leyen announced her intention to propose a Comprehensive Strategy with Africa, “our close neighbour and our most natural partner”. Beyond a well-established agenda for transport cooperation with countries around the Mediterranean already within the framework of the European Neighbourhood policy, an enhanced dialogue on transport infrastructure took place in 2019 under the Africa-Europe Alliance. The Transport and Connectivity Task Force consisting of African and European stakeholders from private and public sectors provided an overall report with recommendations to develop sustainable connectivity and infrastructure within the African continent and with Europe. The Transport Task Force focused on aviation, road safety and infrastructure/connectivity and presented its recommendations in the overall report finalised in July 2019.¹¹ Stakeholders from both sides stressed the importance of launching the Single African Air Transport Market (SAATM, in accordance with the willingness expressed by several African Union countries) and of addressing urgent needs in road safety, in line with the Sustainable Development Goals. The lack of transport infrastructure and inefficient transport services means that, for some landlocked African countries, transport prices represent 15-20% of import costs, three to four times more than in developed countries. Building on the EU’s experience and in line with the commitment already taken by African countries to continue implementing the Programme for Infrastructure Development in Africa (PIDA),¹² joint efforts should promote

¹¹ European Commission, “[Africa-Europe Alliance: Better transport and mobility between Africa and the European Union](#)”, 19 February 2020.

¹² PIDA is a continental strategic framework to address infrastructure impediments through cross-border infrastructure development in the areas of transport, energy, information and communications technology and trans-boundary water management. The Programme was approved by the African

an efficient, sustainable, safe and secure transport system at continental level. Again, as within the EU, efficient and seamless transport in Africa is instrumental to the success of the upcoming African Continental Free Trade Agreement (AfCFTA).

Conclusion

Transport is a necessity for linking economies and peoples in the most efficient manner. It is also a major economic sector in its own right (machinery and transport equipment represents about 40% of total EU exports to most third countries). The EU has always led the field in putting quality over quantity and ensuring the highest safety and security standards. Going forward, the EU is determined to lead and to cooperate closely with other nations in ensuring sustainable connectivity in line with the UN 2030 Agenda.

7. A Geopolitical Perspective on China's Infrastructure Development

Alessia Amighini

Massive investment in infrastructure development has been a persistent element in China's economic growth over the last four decades. Although there is a significant disagreement among scholars about the precise contribution of infrastructure investment to regional growth and development, China's rise as the world factory would hardly have been possible without a massive investment in new infrastructure. Most importantly, regardless of its economic impact, there can be no doubt that economic ends were among many other objectives of China's overall infrastructure investment strategy, as remarkably described in former Chinese President Jiang Zemin's words when commenting upon the Qinghai-Tibet railway under construction in 2001: "Some people advised me not to go ahead with this project because it is not commercially viable. I said: 'This is a political decision'".

China's infrastructure policies have a now widely acknowledged geopolitical significance within the international community, since President Xi launched the Belt and Road Initiative (BRI) back in 2013 – arguably the largest cross-border infrastructure development programme in history – , aimed at improving connectivity between China and a number of partner countries, both in its own neighbourhood and further afield. Reshaping the geography of China's connectivity with the rest of the world, compared to the legacy of past

maritime networks centred on the Treaty Ports (Hong Kong, Canton (Guangzhou), Amoy (Xiamen), Foochow (Fuzhou), Ningpo (Ningbo) and Shanghai) has massive geopolitical motivations and consequences. Yet, the geopolitical dimension was also behind the biggest domestic infrastructure projects that designed all over China long before President Xi's ambition scaled up in 2013. Many, if not all, infrastructure projects in China pursue political ends, from extensive domestic and international political power to particular political control over domestic, neighbouring, contested or foreign territories.

This chapter will provide a geopolitical perspective of infrastructure policies in China, both at home and abroad, focusing mainly on the last two decades. The chapter concludes with some observations on the long-term impact and sustainability of cross-border infrastructure policies that systematically put political objectives ahead of economic ones.

Domestic Infrastructure as a Tool for Geopolitical Control

Railways, the first and most important passenger transport infrastructure in China, have always been a means of solidifying political control over vast portions of land within the country and infrastructure has played a crucial role in China's economic development strategy especially since the 1980s.¹ Based on growth pole theory, three growth poles were built in the eastern regions, i.e., Pearl River Delta, Yangtze River Delta and Beijing-Tianjin-Tangshan areas. The central idea of growth pole theory is that economic growth is centred at the core of a region,

¹ First railways were originally built during the early 20th Century by the Qing government and Western countries. Much of the financing, construction and influence over the placement of the railroads came from Western countries aiming to connect historical cities to colonial cities outside of China. See A. Banerjee, E. Duffo, and N. Qian, "On the road: Access to transportation infrastructure and economic growth in China", *Journal of Development Economics*, vol. 145, 2020.

with core industries around which other industries develop at the periphery. Because of scale and agglomeration economies near the growth pole, regional development is unbalanced. Therefore, transport and logistics help spread the outcome of rapid development in the core to surrounding areas.

Pearl River Delta is the chief example of the double-edged development strategy. In 1979, when the fertile areas north of Hong Kong were primarily agricultural land, the Chinese government led by Deng Xiaoping created four Special Economic Zones (SEZs). The Shenzhen and Zhuhai SEZs were meant to welcome the burgeoning increase of businesses in Hong Kong. Large-scale infrastructure projects for transport and rapid urbanisation were major tools for building a huge integrated area now hosting over 65 million inhabitants, with a GDP equivalent to that of South Korea. As a result, Pearl River Delta benefited the former underdeveloped delta areas, but at the same time diluted the economic power of Hong Kong to a point that eventually overturned the regional balance of power between Hong Kong and mainland China: once 25% of PRC GDP, Hong Kong now accounts for a mere 3% of PRC GDP.

A new development framework has been organised in an enlarged area around the Pearl River Delta, since 2017. Known as the Greater Bay Area (GBA), it encompasses 11 metropolises covering over 56,000 square kilometres, and has 70 million inhabitants and a gross domestic product of over \$1,500 billion. The goal is to transform the area of Hong Kong, Macao and nine cities in the southern province of Guangdong (Guangzhou, Shenzhen, Zhuhai, Zhongshan, Jiangmen, Zhaoqing, Foshan, Dongguan and Huizhou), which already accounts for 12% of Chinese GDP, into the world's top region for technological patents, seeding of start-ups, investments in innovative companies and digitalisation. Beijing wants to transform this cluster of cities, businesses, start-ups, finance and infrastructures into the Silicon Valley of the future.

Again, infrastructure is central: the plan provides for the expansion of Macau airport, the construction of connections for

Hong Kong airport and the strengthening of Guangzhou and Shenzhen as a hub for international flights. Construction sites will open to expand ports, back ports, warehouses and highways to the internal regions, where dozens of multinationals, from Apple to Dell, have data centres. A high-speed rail line will minimise connections between the east and west coast of the mouth. Most significantly, the former colonies of Macao and Hong Kong, which are currently special administrative regions under the “one country, two systems” rule, will be connected to the mainland by the Hong Kong-Zhuhai-Macau Bridge, which comprises 31 miles of bridges, tunnels and three man-made islands, to form the longest bridge system in the world. By signing agreements on economic cooperation, the Beijing government has gained influence over the two former colonies. While fostering integrated economic development, Beijing is increasing its control over territories that are intended eventually to be integrated into the PRC, amid widespread demonstrations and dissent that are already threatening the role of China.

GBA is a triple-edged development strategy: besides economic development and political control, technological innovation is a chief objective. Beijing wants to open the Guangzhou-Shenzhen-Hong Kong-Macao corridor for innovation and technology, with policies that promote the exchange of talent, capital, information and technology, and develop a major regional data centre. The strategy for Guangdong is linked with Made in China 2025, another multi-year plan with which Beijing aims to make its economy more digitally and technologically advanced. The cornerstones are investments in the internet, supercomputers, artificial intelligence, robotics, industrial automation, new materials, railways, aerospace, maritime infrastructure and life sciences. The same priorities dictate the choices of industries to be courted on the Pearl River delta. The GBA plan will finance the creation of co-working, start-up incubators and innovation centres in a region that now has 270 industrial districts and 330 specialised markets. Technological innovation also has a military twist, to the extent that new tech developments have invariably

involved dual-use (i.e. civil and military) technology. The region will be wired in fibre optic and equipped with free ultra-wideband hotspots. To put things into a broader perspective and give a clear idea of the overall geopolitical significance of the PRC's national development plans, the GBA will also be boosted with funds from another Chinese super-project, the BRI. Put side by side, BRI, GBA and Made in China 2025 are the ingredients of an increasingly aggressive long-term recipe to achieve technological leadership and maybe autarky.

As the majority of economic activity became increasingly concentrated in the eastern and south-eastern areas of the country, the government started investing heavily in infrastructure in northern and western areas so as to fuel economic activity in inland provinces and therefore rebalance growth. This is how the "Go West and Central China Strategy" started, based on the same growth pole theory framework. The Pan-Beibu Gulf Economic Zone (2008), Guanzhong-Tianshui Economic Zone (2009) and Chengdu-Chongqing Economic Zone (2011) were planned as three national-level growth poles, in the northern, central and southern areas of Western China respectively.

The Chengdu-Chongqing Economic Zone is particularly interesting as it was designed at a time when the rationale of domestic economic development in the West of China started to intertwine with the need to developed cross-border infrastructure linking land-locked Western China to foreign markets. This economic zone has been recently upgraded to become a new national development area, the Liangjiang New Area (LJNA), the core area of the Chongqing pilot free trade zone and China-Singapore connectivity project. Chongqing, Chengdu and Xi'an form the so called "Triangle of the West" economic region with historically integrated chains of production.² It has important open platforms, such as the

² Y. Lan, (ed.), *The origin of the historical development of Xisanzhia*, Southwest Normal University Press, Chongqing, 2011.

bonded port and Guoyuan Port, and three innovation platforms (the Liangjiang Digital Economy Industrial Park, Lijia Smart Life Experience Park and Liangjiang Collaborative Innovation Zone) forming the Liangjiang International Development Zone (LJIDZ). Half of the Fortune 500 companies have settled in the area. Infrastructure is a central element of the new area.

Yubei district plays host to all the major infrastructure projects in LJNA and four segments of national expressways that connect it to other major cities in western and coastal regions, namely Wuhan (1,000 km), Shanghai (1,800 km), Guangzhou (1,600 km), Xi'an (850 km), and Chengdu (300 km). Besides roads, the major transport infrastructure projects in LJNA include light-rail systems connecting districts with one another and standard railways for longer distances: the Longtousi Railway Station in Yubei connects the new area to other major urban areas. The Youxin Railway is 11,179 kilometres long and connects the urban core area of Chongqing, including LJNA, to Xi'an and Lanzhou (two new development areas), then to Urumqi. It then crosses the border en route to Europe, travelling through Kazakhstan, Russia, Belarus and Poland before reaching the port of Duisburg in Germany. As the journey from LJNA to Germany takes two weeks (20 days less than by sea from the ports of Southern China via the Strait of Malacca, the Indian Ocean and the Suez Canal), the Youxin Railway is an effective means of transport for automobile spare parts, laptops and light machinery manufactured in transnational value chains between China and Eastern Europe. It is a tangible example of how domestic infrastructure policies in China have long-term ends that might well supersede the short-term economic gains of an individual project.

Besides transport networks, whose political purpose might be more prominent, some individual projects may also be pertinent examples of infrastructure development with multifaceted objectives, such as the Daxing Beijing International Airport. The airport's first building was completed for the 2008 Olympics, and further expansion is due for completion

by 2025, when it should surpass Dubai's Al Maktoum International Airport in cost, total square miles and passenger and plane capacity. Yet, the project "has nothing to do with capacity: around three quarters of China's airspace is controlled by the country's military, which has the power to ground civilian flights if any of its planes are in the air".³ This explains the frequent delays to commercial flights, which average 43 minutes at Beijing's existing airport, making it the worst-performing airport in the world for punctuality. "There are no plans to commercialise more of the country's airspace or limit military control, meaning delays will likely be just as common at Daxing Airport".⁴

Infrastructure in China's Growth

Notwithstanding the evident political ends to infrastructure investment, it is not an overstatement to highlight that infrastructure is at the heart of China's economic growth experience over the last 30 years. Transport infrastructure (highways, railways and air transport) is more often mentioned as a key factor in China's growth and development. The types of infrastructure and investment size have differed significantly over time. During the 1980s, investment was relatively low and mainly targeted railway construction. Since the early 1990s, investment in infrastructure has become a major policy priority, which explains the substantial increase of transport as a share of state fixed-asset investment, mainly in roadway construction, which increased the most between 1998 and 2007.⁵ Investment in waterways has only started growing

³ S. Perryer, "How China uses infrastructure as a mean of control", *World Finance*, 2019.

⁴ Ibid.

⁵ Junjie Hong, Zhaofang Chu, and Qiang Wang, "Transport infrastructure and regional economic growth: evidence from China", *Transportation*, vol. 38, 2011, pp. 737-752.

since 2004. Airway infrastructure was improved substantially from 1998 to 2000, then slowed down before starting to increase again.

A variety of different types of physical infrastructure are also essential, such as municipal infrastructure (street lighting, urban roads, bridges and underground infrastructure), utilities (electricity, water and gas) and e-infrastructure, i.e. communication networks. Moreover, social infrastructure such as education, health and housing is also crucial to achieving higher economic growth,⁶ as it promotes better utilisation of physical infrastructure. It is widely acknowledged that infrastructure facilities such as power generation, energy distribution, rail and air transport were the most important infrastructure in China's growth record. More recently, many transnational infrastructure projects have been launched under the umbrella of BRI, aimed at improving connections between China's provinces and the rest of the world. To the extent that it will boost Chinese exports and help reduce the "missing trade" with countries lacking sufficient transport networks, BRI will also foster more economic growth.

However, it is much more controversial to establish a precise link between infrastructure and growth in China. On the one hand, a large number of economic studies have reported on the central role of transport infrastructure as a defining feature of China's growth model since the 1990s.⁷ Those studies argued

⁶ P. Sahoo, D. Ranjan Kumar, and N. Geethanjali, *Infrastructure Development and Economic Growth in China*, IDE DISCUSSION PAPER No. 261, 2010.

⁷ See among others: S. Démurger, "Infrastructure development and economic growth: an explanation for regional disparities in China?", *Journal of Comparative economic*, 2001; S. Straub, C. Vellutin, and M. Warlters, *Infrastructure and Economic Growth in East Asia*, The World Bank, Policy Research Working Paper, no. 4589, 2007; A. Banerjee, E. Duflo, and N. Qian, *On the Road: The Effect of Transportation Networks in China*, Yale University Working Paper, 2009; C. Bai and Y. Qian, "Infrastructure development in China: the cases of electricity, highways, and railways", *Journal of Comparative Economics*, 2010; P. Sahoo, D. Ranjan Kumar, and N. Geethanjali (2010); S. Zhang, Y. Gao, Z. Feng, W. Sun, "PPP application in infrastructure development in China: Institutional analysis and implications",

that investment in transport infrastructure and proximity to transport routes both fuelled economic growth in Chinese cities and provinces. While the East Asian countries were fighting economic crisis in 1997-1998, their investment in infrastructure fell sharply, whereas the Chinese Central government implemented a fiscal stimulus in the form of transfers to local governments and allowed the issuance of state debt to fund infrastructure. Since then, investment in infrastructure has driven rapid growth both directly and indirectly. The direct impact results from infrastructure investment being the largest contributor to fixed capital formation, which more than doubled from 5.7% of GDP in 1998 to over 14% in 2006, when the share of infrastructure in total investment expanded to almost one-third of gross capital formation. It further increased to 16% between 2009 and 2014, when the global financial crisis reduced import demand from all around the world and China needed to boost growth by increasing investment in real estate and physical infrastructure. As a result, China is now the world's largest investor in infrastructure, spending an average of 8.5% of GDP between 1992 and 2011. According to Sahoo et al.,⁸ the magnitude of output elasticity of infrastructure has varied between 0.20-0.41 over the years 1984 to 2008, which is higher than the output elasticity of private investment or public investment. Moreover, beyond the measured effect, a further positive but indirect impact of infrastructure on growth is the spill-over effect on the rate of return of investment in any other economic sector, as a result of improved infrastructure. Increased availability of infrastructure and low labour costs paved the way for successful economic policies designed to attract huge inflows of foreign direct investment (FDI) targeted mainly at the manufacturing sectors, which were the driving force behind the original growth.

A rather divergent perspective has contested the view that infrastructure had positive spill-overs on growth in China. Out of a large number of major transport infrastructure projects completed since the early 1980s (95 between 1984 and 2008, 74 consisting of roads and 21 of railways), 55% had an *ex post* benefit-to-cost ratio of less than 1.0 – i.e. they were economically unviable.⁹ This is due to both cost overrun and benefit shortfalls. As regards cost overrun, in China infrastructure construction costs are systematically underestimated, so that actual costs are on average 30.6% higher than estimated costs. As regards benefit shortfalls, traffic performance ranges from a majority of the routes with insignificant traffic volumes to a few routes that are highly congested, which suggests a severe misallocation of resources.

The fact that the financial viability of a majority of projects is questionable and their economic impact was significantly overestimated suggests that the choice of individual projects, including their geopolitical implications, was dictated by a number of factors of a not strictly economic nature. This view has stressed that only productive infrastructure (i.e. investment with positive net present value) can have long-run positive impact on growth:

increased physical capital accumulation (irrespective of whether the investment has a positive or negative net present value) will increase the GDP in the short run as a natural accounting consequence of piling investments (productive or not) into fixed capital. In fueling economic growth today by excessive capital accumulation, policy-makers risk suffocating the possibility of steadier and more resilient future economic growth that comes from greater efficiency and productivity of using scarce factors of production.¹⁰

⁹ A. Ansar Atif, B. Flyvbjerg, A. Budzier, and D. Lunn, “Does infrastructure investment lead to economic growth or economic fragility? Evidence from China”, *Oxford Review of Economic Policy*, vol. 32, no. 3, 2016, pp. 360-390.

¹⁰ *Ibid.*, p. X

Besides the poor efficiency of the majority of infrastructure projects in China, they also raise a number of additional costs such as debt accumulation and loss of alternative investment opportunities. Therefore, the role of infrastructure in China's growth miracle would appear to be a myth, because "investing in unproductive projects results initially in a boom, as long as construction is ongoing, followed by a bust, when forecasted benefits fail to materialize and projects therefore become a drag on the economy".¹¹ This view is consistent with that of certain China scholars,¹² who have criticised the huge amount of public investment in domestic transport infrastructure after 1990, on the basis of the argument that heavy investment in infrastructure was not an engine of growth, but happened after economic and institutional reforms had made the Chinese miracle possible.

More recent research has tried to disentangle the ambiguous effects of transport infrastructure on China's growth by studying the differential impact of access to transport infrastructure on economic performance in Chinese regions between 1986 and 2006.¹³ Results show that regions closer to historic transport networks have higher levels of GDP per capita, higher income inequality, a higher number of businesses and higher average business profits. However, it does not have a large impact on the growth performance of those areas (the elasticity of per capita GDP with respect to distance from historic transport networks is approximately -0.07). The reason why well connected and poorly connected areas do not perform very differently from one another is lack of labour mobility. Without labour mobility, access to transport infrastructure has not brought about a massive shift of labour from poorly connected to better connected areas, so the differential impact of infrastructure on per capita GDP was negligible.

¹¹ Ibid.

¹² Most notably, Y. Huang, "China Could Learn from India's Slow and Quiet Rise", *Financial Times*, 23 January 2006.

¹³ A. Banerjee, E. Dufo, and N. Qian (2020).

The Geopolitics of Transnational Infrastructure under BRI

China's economic growth is fuelled by its massive export-oriented manufacturing industries, which have to import large amounts of intermediate components, raw materials and energy. As these raw materials and semi-finished goods mainly travel to China by sea, secure and reliable maritime trade shipping lines are crucial to China. At the same time, Western development plans to rebalance growth across the East and West of the country has been accompanied by a growing need to connect the West of China to Europe by land routes.¹⁴ Overall, the need to secure the sourcing of energy and inputs from several locations abroad has inspired a long-term vision to diversify the connectivity networks – by sea and overland – that link China to the rest of the world: the Belt and Road Initiative aimed to build transport infrastructure networks through around 60 countries in Asia, Europe, Oceania and East Africa.

From a global perspective, the BRI is a major international development project from which China is also gaining many benefits. The standard framework of the BRI works through commercial loans given by the Chinese Government to recipient countries where projects are to be carried out. The actual construction of infrastructure in BRI projects is usually assigned to Chinese firms using Chinese labour and suppliers. At the same time, however, the central goal of the BRI is not only economic, but also political and strategic: using cross-border infrastructure, China aims to facilitate business deals and channel aid and commercial loans, thereby increasing its influence on the rest of the world, under the pretext of facilitating economic development. Although officially presented as an infrastructure project for economic development through greater regional and international integration of the country, the BRI in fact has an

¹⁴ A. Amighini (ed.), *China's Belt and Road: A Game Changer*, ISPI, 2017; P. Cai, *Understanding the Belt and Road Initiative*, Lowy Institute for International Policy, 2017.

established link with the People's Liberation Army (PLA) and its naval arm (the PLA Navy). Through BRI projects, China is acquiring the ability to extend its geo-strategic arm beyond regional borders. For example, the construction in April 2016 of the first overseas naval base in Doraleh, an extension of the port of Djibouti, provides China with access to sea routes a long way from Chinese territory, which have enabled the PLA Navy to establish a presence in the Red Sea and thus also approach the Mediterranean Sea. The hard infrastructure provided by the BRI also enables China to support its military power remotely.

According to the White Paper of the National People's Congress of March 2015 (the document outlining the BRI's vision and action plan), the ultimate goal of the project is the establishment of "a stable strategic space conducive to long-term development of the Chinese economy". Due to the growing number of Chinese investments around the world, this stability is closely linked to that of BRI partners and the regions affected by the project. The PLA is therefore called upon to expand its limits of action to face the growing number of threats surrounding China's foreign interests: these threats include, for example, violent opposition to infrastructures and personnel linked to BRI projects, as in the case of Vietnam in June 2018 and Pakistan in August 2018.

One of the flagship BRI projects, and one of its first to start, is the China-Pakistan Economic Corridor (CPEC), aimed at connecting Gwadar Port in south-western Pakistan to China's north-western autonomous region of Xinjiang, via a network of highways, railways and pipelines to transport oil and gas, about 3,000 km from Gwadar to Kashgar. The economic corridor is also a means through which China is providing Pakistan with telecommunications and energy infrastructure, so as to enable China to secure oil supplies from the Middle East travelling overland to China and thus bypassing the Indian Ocean and the South China Sea. The project also includes intelligence sharing between the countries, which is arguably an economic development goal, but has more a geopolitical end.

Furthermore, a special economic zone has been set up within the CPEC for the joint production of fighter planes, navigation systems and military hardware, with the aim of facilitating the military technology exchange between China and Pakistan with potentially serious consequences for regional stability.

Contrary to what is widely perceived, only part of the BRI investment has resulted in the construction of transport networks: 24% of the total, or 301 projects worth \$179.9 billion include both road transport and the rail sector. Out of a total of 1,247 projects carried out worldwide under the BRI, 32% (401) concern the energy sector and aim to increase China's interconnection with the networks of the main suppliers of energy resources, as well as to acquire skills and technology to manage their networks more efficiently. In this context, for example, in 2014 State Grid Europe Limited (SGEL), a company of the State Grid Corporation of China group, acquired a 35% stake in the Italian CDP Reti, a company which controls Snam, Italgas and Terna, the electricity and gas distribution networks. Also in Southern Europe, the Chinese company acquired 24% of ADMIE in 2016, the Greek electricity company, with an investment of €350 million. In July 2018, a similar initiative towards the German distributor 50Hertz was prevented through the purchase of 20% of the company by the German public bank KfW. In Africa, as of 2013, 59 projects related to energy, water and mineral extraction (worth \$21.53 billion) have been carried out, with significant investments in coal mining and the construction of hydroelectric power plants and oil plants.

The telecommunications sector, although still relatively marginal (3% of the total of projects), plays an increasingly important role. 2018 saw the completion of the Pak-China Optical Fibre Cable, a 2,950 km long fibre-optic network between China and Pakistan, which will significantly speed up the exchange of data and information between the two countries. The Chinese interest in the construction of telecommunications infrastructures was already clear in Africa, where 70% of the 4G networks were created by the Chinese giant Huawei.

Investments in telecommunications within the BRI are likely to increase, in view of China's technological leadership in the 5G sector, where Huawei and ZTE currently have the most competitive solutions at an international level. In this sector, China has experienced particularly rapid development thanks to generous public subsidies and an internal market protected from foreign competition.

Conclusion

To counter China's rapidly slowing economic growth, since 2009 and even more so since 2014, the Chinese government has returned to major infrastructure investment as a driver of economic development, but also to achieve the high rate of GDP growth expected by the government. Concerns over debt-fuelled infrastructure investment caused Beijing to stop approving such projects in 2017, but in 2018 the need to stabilise the economy led to the approval of China's top 10 infrastructure projects by expected investment value, each costing over 50 billion yuan (\$7.41 billion). The National Development and Reform Commission (NDRC) has approved 27 infrastructure projects with a total expected investment of 1.48 trillion yuan (\$219.43 billion) since the start of 2018, in an effort to foster growth amid rising trade tensions with the United States.

Some of them are urban transport projects. These include the Shanghai Urban Rail Transit Expansion, nine rail projects, including six subway lines and three intercity railways, to be constructed from 2018 to 2023, aimed at creating better connections between the financial hub's two airports and two major railway stations; the Wuhan Urban Rail Transit, four metro lines plus four urban express lines to ease the city's traffic congestion, from 2019 to 2024; Suzhou Urban Rail Transit, four new urban transit lines in Suzhou (a 41km line will connect the city to Shanghai) expected to be finished in 2023; the Changchun Urban Rail Transit, a group of seven urban rail

transit lines, including the extension of three existing lines and four new lines, are due to be constructed in Changchun from 2019 to 2024. The project is part of the government's strategy to revitalise China's north-eastern provinces and boost the development of the city's new districts. Some others are intercity railways, such as the Guangxi Intercity Railway Network (two intercity railways in Guangxi province, with one from the capital city Nanning to the south-eastern city of Yulin, and the other from Nanning to the south-western city Chongzuo), or high-speed such as the Chongqing-Qianjiang High-Speed Rail, China's first railway tunnel under the Yangtze River – the high-speed rail link between Chongqing and Qianjiang.

In order to understand the increasing capacity of local governments to plan and develop large infrastructure projects, it is also worth noting that the institutional setting that governs the process of funding and developing infrastructure has changed since the very beginning of the reform era in 1978, when projects were mainly small-sized at provincial level. In the late 1990s, the banking and fiscal reforms restructured credit allocation and debt management, which impacted on the process of producing and financing infrastructure. The central government has increased its control over lending and debt management and at the same time reduced the number of counties, while gradually increasing the number of districts, to increase city governments' control over financial resources. As a result, strong city governments with centralised management of capital allocation led to large-scale infrastructure projects, with shorter construction times.

In this quest for rapid domestic growth and growing global dominance, China has been pushing its investment spending over its limits. As regards BRI infrastructure, it has already spent an estimated \$200 billion, but that amount is expected to rise. The most pertinent BRI-related risk derives from the fact that China has lent a vast amount of money to countries well below investment grade, disregarding their ability to repay the debt, whereas recipients have high expectations of repayment out of

the future economic benefits. A chief example here is Pakistan, where eight of the 10 largest hydropower plants have been built under the BRI. China has financed construction costs that have increased much more than expected, thereby putting a heavy debt burden on the country's economy, until Pakistan was forced to seek bailouts from the IMF, Saudi Arabia, UAE and China in 2018.

While disregarding the internal efficiency of individual projects, at the same time Beijing has been seeking non-monetary benefits from some investment. A prominent example is the acquisition of the Port of Hambantota in Sri Lanka, where the government has signed a 99-year lease agreement for the port, which is unprofitable but located along a busy Indian Ocean shipping lane, along with land for the development of a free trade area, to a company controlled by Chinese capital, in an agreement opposed by residents and monks. What started as a 'simple' commercial loan to restructure a secluded port, has now become a means to acquire control over a vast area a few miles from the Indian border: an undisputable example of the geopolitical significance of infrastructure investment.

8. Us Strategy for Global Infrastructure

Daniel Runde

In recent years, the world has seen a drastic shift in the quality, funding and impact of global infrastructure development. Estimates predict global infrastructure demand of \$3.7 trillion a year, with the majority of this demand created in developing nations. Asia alone will require more than \$1.7 trillion per year, through 2030, in order to meet its growing infrastructure needs. As trends of rapid urbanisation, population growth and economic and industrial expansion continue, the requirement for high-quality, effective infrastructure will only increase. With global initiatives like the Sustainable Development Goals (SDGs), recent attention in the G20 Summit and the development of the Ise-Shima Principles for Promoting Quality Infrastructure Investment, the crucial importance of infrastructure has received new attention.

Nearly 15% of the world lives with no electricity and half live with no access to the internet. This lack of basic needs leaves individuals subject to poor health and education, a lack of transportation and economic despair, amongst others. Infrastructure stands at a crucial junction between the success of a nation's economy, and business and commercial centres. High-quality infrastructure and proper connectivity directly increase public safety, efficiency and effective delivery of goods and services, while decreasing environmental impact. Further spill-over effects like job creation, increased foreign direct investment and improved tax revenue speak further to the crucial role of infrastructure in developing nations, as well as provide even further incentives to invest.

Estimations show closing the infrastructure gap would cost \$4 trillion a year until 2040. However, if stakeholders prioritise efforts to create sustainable infrastructure, this cost can be cut down to \$3 trillion a year. In order to accomplish this, issues of poor project planning, environmental impact concerns, traditional cost estimations and public administration must be addressed. Often planning for infrastructure in the developing world happens only after negative impacts on the economy and environment have occurred, such as natural disasters or structural collapses. Through addressing issue areas both procedural and conceptual, stakeholders can craft a system of infrastructure development better equipped to be proactive, rather than simply retroactive.

A common issue that arises when discussing infrastructure development is a definitional one: what is high-quality infrastructure? A definition first emerged in May 2015, when Japanese Prime Minister Shinzo Abe announced a multibillion-dollar infrastructure aid package, which aimed to create durable, environmentally sustainable and disaster-resistant infrastructure in countries across the world. The definition was further refined in the Ise-Shima principles in 2016, which will be discussed further in this paper. High-quality infrastructure utilizes the best available technology in order to be reliable, as well as economically and environmentally efficient. High-quality infrastructure must also adhere to internationally accepted standards and safeguards. Through aligning with the long-term country strategies for economic development, high-quality infrastructure can improve the flow of services, build local capacity and drive job creation.

Challenges Presented by China's Model

At the same time, institutions such as China's Asian Infrastructure Investment Bank (AIIB) present new challenges to the United States, Japan and existing systems of international finance institutions. Previous lending from China to countries

in Africa, Southeast Asia and Latin America often offered financing for infrastructure projects on a concessional basis, with payment secured partially through access to raw materials (such as oil, gas or minerals). There have also been additional claims that China views environmental, social and governance safeguards as impediments to lending. While some of China's rationale behind AIIB serves as a response to genuine need for greater investment to address global infrastructure deficit, such a model sacrifices quality and efficiency for profit and rapidity.

Launched in 2013, China's Belt and Road Initiative (BRI) has financed hundreds of projects¹ including railways, airports, highways, utilities and even new cities. Estimations predict that by 2027, trade generation will total \$1.3 trillion. What benefits China's place in the industry is the country's willingness to invest in unforeseen areas; provide the labour, equipment and technology required; and the rapidity with which teams complete the projects. Although, because initiatives like the BRI focus on the interests and potential geopolitical benefits to China, many of their projects prove unsuitable and hazardous to the recipient country. Many countries, like Sri Lanka, are falling into debt due to unsustainable loan terms; other countries like Malaysia suffer from economic damages and corruption. Due to a dearth of other options, countries continue to accept China's help, but the United States can build a strategy that provides better and safer solutions while also reclaiming its position of leadership.

In recent years, traditional donors have scaled down support for infrastructure development due to concerns about the ability of recipient countries to repay loans and maintain infrastructure and environmental, social and governance issues. Concurrently, US support for infrastructure projects has generally declined. A few exceptions include projects directly financed or guaranteed through the Millennium Challenge Corporation (MCC), the US International Development Finance Corporation (DFC),

¹ J. Stephens, "China's Belt and Road Initiative is tying the world together-but what's the end game?", *The Architect's Newspaper*, 19 November 2019.

the US Agency for International Development (USAID) and specialised support for project preparation, feasibility studies and similar work through the US Trade and Development Agency (USTDA) or sponsored project preparation facilities. Such commitments – as well as large stakes in the World Bank, the Inter-American Development Bank (IADB), the African Development Bank and the Asian Development Bank – guarantee the United States has a voice in the direction, approval and policy formation of important new infrastructure development reforms.

The United States has significant strategic interests in the success of high-quality infrastructure. Beyond the potential to increase safety, create job opportunities, decrease environmental impact and increase efficiency of public goods and services, investing in infrastructure offers the chance to build relationships and alliances with a wide span of countries. With the Chinese BRI carrying an ambitious strategy for infrastructure, it is imperative the US focuses on countering it with structured reforms and high-impact investing. As a result, high-quality projects will have long-term benefits and the United States will begin to see positive effects amongst its economic, social, regulatory and security interests.

Recommendations

Given current levels of investment, the world is projected to face an infrastructure gap of \$15 trillion by 2040. Given the potential consequence for slowing economic growth and human development if such a gap is not addressed, a variety of innovative reforms and partnerships needs be instituted.

Life-cycle cost procurement

The existing system of procurement for infrastructure projects relies primarily on norms favouring low-bid options. Such a system incentivizes recipient countries to choose the projects

with the lowest costs, not necessarily the projects with the highest quality. Prioritising low costs and fast timelines can result in larger costs in the long run as maintenance, malfunction and inefficiencies drive up the total cost of the investment. In contrast, life-cycle cost procurement aims to consider the totality of costs procured in order to deliver a better value for investment.

Training and capacity building

Adjusting from models favouring low-bid options to life-cycle costs can be benefitted from training public sector officials to a more nuanced understanding of value over time. This role could be supplemented by bilateral development agencies and multilateral development banks. Examples include the model of the Japanese International Cooperation Agency (JICA) and the US Global Procurement Initiative spearheaded by USTDA. Because of the scale required, no single country or organisation will be able to implement the training alone, which underscores the necessity for collaboration and pooled resources.

Standards and certification for infrastructure projects and professionals

It is crucial for the global community to come to a shared standard for quality infrastructure, as well as to provide training certifications for public servants managing infrastructure procurement and construction. The Ise-Shima principles in particular represented a stride forward in crafting standards for infrastructure development. These principles include:

1. Ensuring effective governance, reliable operation and economic efficiency in view of life-cycle cost, as well as safety against natural disaster, terrorism and cyber-attack risks.
2. Ensuring job creation, capacity building and transfer of expertise for local communities.
3. Addressing social and environmental impacts.
4. Ensuring alignment with economic and development

strategies, including aspects of climate change and environment at national and regional levels.

5. Enhancing effective resource mobilisation, including through Public-Private Partnerships (PPPs).

In the 2019 G20 Summit, the finance ministers of the G20 Member States agreed to a statement that emphasised sustainable growth and development, life-cycle cost analysis, environmental sustainability, resilience against natural disasters, social considerations and strengthened infrastructure governance. Such progress, alongside that of the Ise-Shima principles, can be strengthened by collaborative efforts between think tanks, multilateral development banks, international organisations and private sector entities.

An important advancement could also be providing training certification for public servants managing infrastructure procurement or construction. Such a program could be modeled off the World Bank's public-private partnership certification program and akin to a certified public account or chartered financial analyst certification system.

Expand and refine project preparation

Often the crucial problem in infrastructure development is not the availability of financing, but rather those which have the resources available for such investment yet are unable to identify “bankable” projects that offer viable investments with reasonable return on investment. Private investors are often dissuaded by high financial risks, low local capacity and lack of feasibility. Bilateral and multilateral donors could play a significant role in helping to improve the quality of support to address this challenge.

Future proof infrastructure assets

New technology presents both a challenge and an opportunity for infrastructure development. If the international community rethinks their conventional infrastructure designs, new designs

can be both adaptive and conducive to changing technology, as well as harness the disruptive potential for rapid economic growth and development. Stakeholders should allocate a portion of investments received towards digital infrastructure in order to ensure that larger investments do not become obsolete.

Recommendations for the United States

With the passage of the BUILD Act, the US launched the International Development Finance Corporation (DFC). Although the DFC is designed to help bring in more private capital to low- and lower-middle income countries, it cannot face the challenges of global infrastructure development on its own. It will take the reconfiguration of old and new development finance organisations' strategies and collaboration methods to sustain the infrastructure to be built over the next 15 years. While unlikely that the United States will drastically shift its approach to infrastructure development in the near future, a number of existing instruments can be refined to better address current issues. These suggestions include:

- Develop a long-term strategy for infrastructure development.
- Provide long-term congressional authorisation for critical agencies.
- Provide greater support to specialised US development agencies.
- Incorporate and prioritize infrastructure support into country-level development strategies.
- Examine existing initiatives for money that can support infrastructure development.

Recommendations for donor countries

There are several ways in which donor countries can provide assistance in closing the infrastructure gap: facilitating project preparation efforts; offering technical assistance; building local government capacity; and using development finance instruments, such as grants, investment capital and guarantees.

While donor countries can also engage in direct lending and loans to sovereign governments, bilateral lending practices have traditionally been subject to less scrutiny and accountability, and donor countries often lack formal bankruptcy mechanisms. This can result in reckless sovereign lending and creation or escalation of tensions. In order to yield constructive and transformative results through bilateral lending, donor countries should strictly adhere to internationally accepted practices governing sovereign lending and borrowing.

Recommendations for recipient countries

Recipient countries are crucial to global development and can have significant effects and influence over financial flows to projects. The following recommendations emphasise fiscal independence, self-reliance, and sovereignty, while also inviting new, self-sufficient, and modernised channels for private capital:

- **Project Preparation Efforts:** Recipient governments must identify a nodal government that can prioritize mandatory project assessment and preparation prior to procurement processes.
- **Procurement Reforms:** As previously discussed, countries should transition from a procurement system which examines only the initial cost of projects to a system which emphasizes life-cycle cost analysis.
- **Increase Tax Collection:** Tax revenue remains the largest source of financing for infrastructure investments; tax collection and public funds in Africa finance more than 40% of infrastructure. Countries should prioritise efforts to expand tax bases through reviewing tax exemptions, reducing tax evasion and adopting e-filing systems.
- **Use of Municipal Bonds:** Municipal bodies or subnational governments should consider developing, or expanding their use of, local currency-denominated municipal bond instruments. Such bonds can achieve an investment-grade rating with the aid of credit

enhancements, monoline bond insurance or partial guarantees. These guarantees can transfer the political and credit risks of the debtor, therefore making the local currency bond attractive to investors in capital markets who can then fund the public infrastructure project.

Conclusion

The scale and the consequences of not addressing the infrastructure gap are enormous. Without significant investment, strategic reforms and continued attention granted to the importance of infrastructure, we will have slower economic growth, as well as productivity and human development decreases. In order to combat potentially harmful infrastructure practices, like that utilised in China's Belt and Road model, stakeholders should focus on achieving high-quality infrastructure. It is likewise important to focus on shifting to a life-cycle cost analysis model, expanding training for public officials, crafting standards and certifications for infrastructure projects and professionals and focusing on project preparation.

PART III
NEEDS AND FUTURE TRENDS

9. Does Europe Need Continental Champions in Construction To Cope with Global Competition?

Stefano Riela

In 2020, the global construction market will account for around 3% of world GDP, more than Italy's forecast GDP. Even factoring in headwinds, the investment trend is upward, especially for large infrastructure projects. Globally, this market is a playground largely shared by Chinese and European firms, with the former flourishing domestically, and the latter displaying their strength in projects located beyond the borders of their respective countries.

However, the prominent role played by European firms might be eroded soon primarily because of anti-competitive practices adopted by Chinese authorities – domestic market protection and domestic firm subsidisation – in this industry, which is heavily characterised by economies of scale.

The European Union and its Member States should set the conditions for continental champions to thrive in internal and external playing fields. The EU should continue its original project of both boosting the creation of a European single market for construction and promoting free and fair trade with multilateral and bilateral agreements.

Recent calls for a more robust industrial policy and a more lenient competition policy should not trigger a “race to the bottom” that violates the market economy principles the EU has promoted since its inception. In pursuing the consumer

interest, EU competition policy has been shown to be no obstacle to the competitiveness of European firms, especially in the construction sector.

Construction Sector: Many Small Firms and a Few Giants

The construction sector, in its broad sense, is highly fragmented since most firms are of small and medium size; in the EU-27, for example, 94% of construction firms employ less than 9 people and 98% less than 19 people.¹ Such fragmentation means markets are locally defined and it can probably be explained by the significant weight of transaction (*e.g.* different rules aimed at protecting health, safety and environment) and transportation costs (to move workers, materials and machinery) relative to the value of construction projects.

Public procurement projects, however, are complex and extensive in nature and size, so only a few firms can compete. Such concentration can be self-perpetuating due to economies of scale and other entry barriers that turn firm size into a competitive advantage.

Big firms are better able to absorb the high fixed costs of capital-heavy projects; they can invest to meet the challenges of resource-efficient and low-carbon activity; they can efficiently allocate resources among different projects – especially because the industry is very cyclical – thus reducing the overall risk; they have higher bargaining power *vis-à-vis* subcontracting firms and suppliers; and they can more easily meet any pre-qualification requirements that are based on track record and financial capacity.

¹ ‘Construction’ is section F in NACE Rev. 2 classification. It includes general construction and specialised construction activities for buildings and civil engineering works. It includes new work, repair, additions and alterations, the erection of prefabricated buildings or structures on the site and also construction of a temporary nature.

Global Champions Thanks to a Rich and Protected Domestic Market

On a global scale, European firms are in general smaller than firms in other countries, such as the US.² But in the construction sector, European firms are among the big global players, just behind Chinese ones.³ The left side of Figure 9.1 ranks firms according to their total construction contracting revenue. The nationality of the leading quintet emerges by reading their names: China State Construction Engineering Corp., China Railway group, China Railway Construction Corp., China Communications Construction Group and Power Construction Corp. of China. The French Vinci⁴ and the Spanish Actividades de Construcción y Servicios (ACS) follow in sixth and seventh before leaving room for a Chinese duo.

Chinese dominance of the global scenario (left side of Fig. 9.1) is diluted somewhat when the revenues earned by firms in their domestic markets are taken out of the calculation of total construction contracting revenue (the right side of Fig. 9.1). Taking the top ten international constructors, seven are based in the EU-27 led by ACS and its controlled Hochtief⁵.

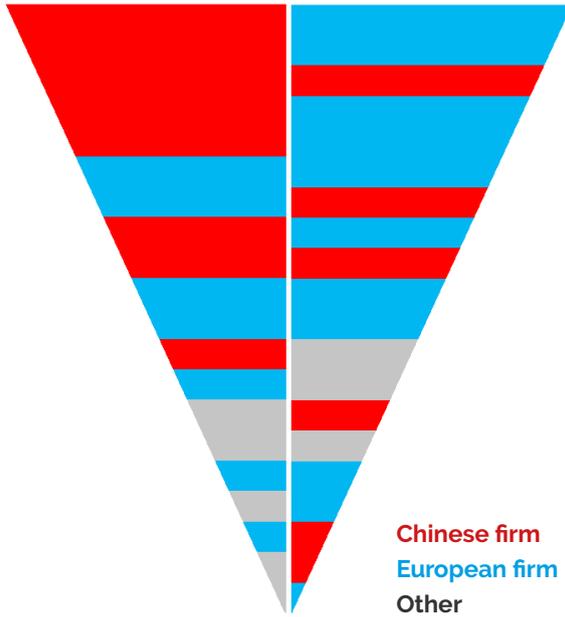
² See T. Philippon, *The Great Reversal. How America gave up on free markets*, Belknap Press, 2019; M. Bajgar, M. et al., *Industry Concentration in Europe and North America*, OECD Productivity Working Papers, no. 18, 2019; and IMF, “[World Economic Outlook, Chapter 2 - The Rise of Corporate Market Power and its Macroeconomic Effects](#)” April 2019.

³ Source: [Engineering News-Record – Top Global Contractors](#), 2019.

⁴ Vinci SA is headquartered in France but the majority of its shareholders are Institutional investors [outside France](#).

⁵ Since 2011, ACS is the largest shareholder of Hochtief (headquartered in Germany) with 50.4% of the equity ([15 April 2020](#)).

FIG. 9.1 - GLOBAL (LEFT) AND INTERNATIONAL (RIGHT) CONTRACTORS IN 2019



Source: Author's calculations based on Engineering News-Record data

Part of this relative international strength of European firms is explained by cross-border activity in the EU that allows, for example, Austrian firms to work in Germany and vice-versa. However, as we note below, the effect of the European single market for European firms is less significant than the effect of the Chinese market for Chinese firms; it is this “domestic market” effect that explains the difference between Chinese global and international rankings.

Unlevel Playing Field

The Chinese market for construction is almost 20% larger than the EU-27 one⁶ and less penetrable. Foreign firms have invested considerably in the Chinese market but there are still restrictions for wholly foreign-owned firms and qualification requirements are applied on a national-treatment basis.⁷

The lack of reciprocity between the EU and China emerges by looking at the OECD's FDI restrictiveness index for construction: the biggest EU countries – such as Germany, France, Italy and Spain – are completely open (their score is zero) while China's score is still positive (0.170 in 2018). Thus European firms operating in China do not benefit from the same levels of transparency and fair competition as those enjoyed by Chinese companies in the EU market.

The scaled back international performance of Chinese firms is more notable if we consider the proactive policy adopted by public authorities to promote domestic firms abroad, in particular through heavy subsidisation and the preference granted to many of the projects under the umbrella of the Belt and Road Initiative (BRI).

The BRI, practically a catchword that describes every aspect of China's engagement abroad, is a push factor for the Chinese construction and infrastructure sectors⁸ especially when the projects are China-funded. According to the Center for Strategic and International Studies,

⁶ In 2018, the size of the sector was \$909 billion in China and \$764 billion in the EU-27 (source: Statista, Eurostat and IMF).

⁷ See WTO described the regime of construction services in China in the 2014 [Report WT/TPR/S/300/Rev.1](#), 7 October 2014, Section 4.2.3.2.

⁸ The BRI is a push factor for the Chinese construction and infrastructure sectors. See Shu Yu, Xingwang Qian and Taoxiong Liu, "Belt and road initiative and Chinese firms' outward foreign direct investment", *Emerging Markets Review*, vol. 41, 2019.

out of all contractors [...] 89% are Chinese companies, 7.6% are local companies (companies headquartered in the same country where the project was taking place), and 3.4% are foreign companies (non-Chinese companies from a country other than the one where the project was taking place).⁹

Chinese firms not only enjoy preferential treatment in the captive market of China-funded projects, but also an advantage in competitive tenders thanks to subsidies, i.e. financial contributions from public authorities conferred on a selective basis. Subsidies are generally used to pursue social policies, to help research and development and to foster the development of peripheral territories. However, in market economies subsidies follow strict conditions to keep the playing field level and to avoid anti-competitive effects.¹⁰ For China – viewed as a non-market economy by big World Trade Organization (WTO) members such as the EU, US, Japan and India¹¹ – subsidies are used to further government policy objectives, such as enlarging China’s engagement abroad¹² and keeping employment stable, especially in times of a slowing economy¹³ and excess capacity fuelled by debt-driven investments.

For example, in the steel sector, a key construction material, according to the European Commission,¹⁴ the government

⁹ J.E. Hillman, *China’s Belt and Road Initiative: Five Years Later*, Center for Strategic and International Studies (CSIS), 25 January 2018 ([link](#)).

¹⁰ The EU, for example, generally prohibits State aid to firms (art. 107 par. 1 of the Treaty on the Functioning of the European Union). However, public aid to undertakings may be compatible with the internal market if it promotes general economic development and the objectives of the TFEU.

¹¹ See the WTO case DS 516, “[European Union - Measures Related to Price Comparison Methodologies](#)”, 10 July 2017.

¹² See for example “The EU’s battle against China subsidies is being played out in Egypt”, *Financial Times*, 14 February 2020.

¹³ See for example, T. Hancock and Y. Jia “China paid record \$22bn in corporate subsidies in 2018”, *Financial Times*, 27 May 2019.

¹⁴ European Commission, “[Significant distortions in the economy of the People’s Republic of China for the purposes of trade defence investigations](#)”, Staff Working Document SWD (2017) 483 final/2, 20 December 2017.

of China provides numerous forms of state support such as: preferential loans, credit lines and preferential interest rates; direct tax exemption and reduction programmes; and government provision of goods and services for less than adequate remuneration including: inputs, land use rights, water and electricity.

Call for European Competitiveness

The current leading international role of European firms might be at risk if economies of scale are coupled with anti-competitive practices, such as domestic market protection and subsidisation of domestic firms by Chinese authorities. So, what should the EU do to preserve and nurture European competitiveness?

Since the EU is a market economy,¹⁵ it should put in place the conditions for continental champions to thrive through: a horizontal industrial policy, level playing fields and an effective competition policy that allows internal and external growth through agreements, mergers and acquisitions.

Horizontal industrial policy

The instruments public authorities adopt to support national competitiveness form the “industrial policy”. If the measures are targeted to develop specific sectors (e.g. shipbuilding, automotive), the industrial policy is dubbed “vertical”; if instead the measures are transversal, across sectors (e.g. support R&D, programmes and small businesses), industrial policy is “horizontal”.

A horizontal approach is usually preferred in market economies. Public authorities admit they are no better placed

¹⁵ The Treaty on EU (art. 3, par. 3) states that the EU is a social market economy based on the experience that the market mechanism is the most efficient way to meet consumer demand for goods and services. However, public intervention is necessary to set the “rules of game”, to support poorer regions, to protect vulnerable people and the environment.

than private firms to predict which sectors will boost the country's economy in the years ahead. This humbleness is especially welcome when a losing bet is made with citizens' money, who pay either as taxpayers (in the case of public funds) or as consumers (in the case of tariffs and other trade restrictions).

Moreover, a vertical approach in the EU would be a difficult bargain between countries. The single market and the single currency, by integrating national markets and fostering competition, have enabled the growing specialisation of Member States.¹⁶ As such, a vertical industrial policy in which sectors are increasingly heterogeneously distributed would essentially favour specific countries. Other EU policies have a geographic bias (e.g. agricultural and cohesion policies) and it is well-known how tough it is to hammer out a consensus for the EU budget.

Consistently with the considerations above, EU industrial policy is mainly horizontal, since it seeks to create the conditions that favour business without differentiating how firms are treated according to their sector or, if there is sectoral designation (e.g. artificial intelligence, robotics, renewable energies, pharmaceuticals), the relative support should be awarded through competitive procedures.

The Commission recently confirmed this approach in its communication "A New Industrial Strategy for Europe".¹⁷ This will be encouraging for the construction industry because, as underlined by the Commission,¹⁸ the transition to a resource-efficient and low-carbon economy will also bring major

¹⁶ See F. P. Mongelli, E. Reinhold, and G. Papadopoulos, *What's so special about specialization in the euro area? Early evidence of changing economic structures*, ECB Occasional Paper Series no. 168, February 2016.

¹⁷ European Commission, "A New Industrial Strategy for Europe", COM(2020) 102, 10 March 2020. This strategy is a key part of President von der Leyen's Political Guidelines and responds to a request from the European Council (21-22 March 2019).

¹⁸ European Commission, "Strategy for the sustainable competitiveness of the construction sector and its enterprises", COM(2012) 433, 31 July 2012.

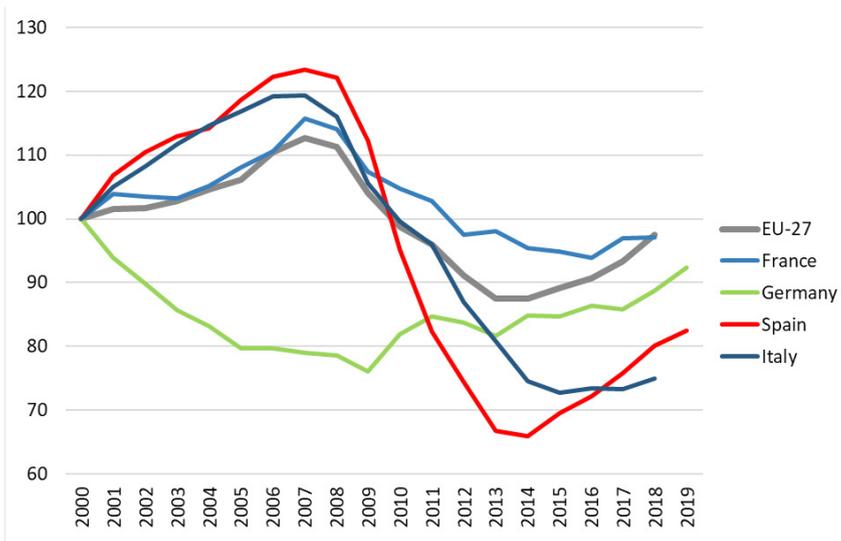
structural changes in the sector, which will have to invest in R&D and to predict the need for skills and expertise in these areas.

Effective European market

The EU market is not only smaller than the Chinese market, but it is also more sluggish. Using constant prices, it has not yet returned to pre-crisis levels (Fig. 9.2), with the four biggest EU-27 members among the worst performers.

Nevertheless, the Chinese and the European construction markets are hardly comparable. The European market remains heavily divided along national borders, thus reducing the opportunity for efficient firms to achieve economies of scale and to increase their cost advantage.

FIG. 9.2 – GROSS VALUE ADDED OF CONSTRUCTION IN CONSTANT PRICES (2000 = 100)



Source: Eurostat

The low cross-border activity in the construction sector is such that the European Commission has focused a thematic objective of the European Construction Sector Observatory (ECSO)¹⁹ on “strengthening the internal market for construction”. Among the findings, ECSO found most intra-EU cross-border construction is in neighbouring countries due to a common language, traditional trade connections and established logistics networks (e.g. Belgium and the Netherlands, Belgium and France, or Austria and Germany).²⁰

This low cross-border activity is confirmed by data on public procurement.²¹ Figure 9.3 shows that only 3.4% of award value is cross-border, works and services are less traded, and the trend is worryingly downward.

Such low cross-border activity might be due to certain conditions that are monitored by the Commission using the Single Market Scoreboard for public procurement.²² Figure 9.4 shows two indicators – single bidder and publication rate – as the average of the last two years available for the twelve EU-27 members with the largest national markets for construction. These indicators do not refer specifically to construction but they provide a general picture of member-state performance in this sector, which accounts for over 14% of EU GDP.

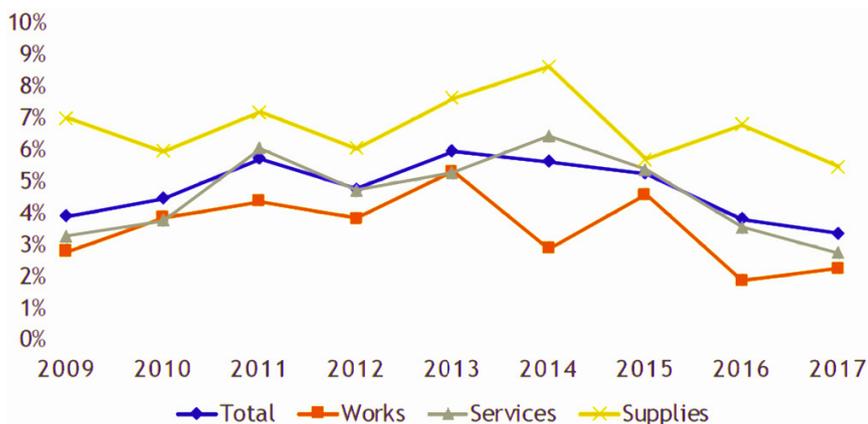
¹⁹ ECSO carries out comparative assessments on the construction sector in the EU aiming to keep European policymakers and stakeholders up to date on market conditions and policy developments. European Commission, “[Internal Market, Industry, Entrepreneurship and SMEs](#)”, ECSO.

²⁰ European Commission, “[Strengthening the internal market for construction](#)”, ECSO, Analytical Report, November 2018.

²¹ European Parliament, “[European Public Procurement. Delivering Economic Benefits for Citizens and Businesses](#)”, study requested by the IMCO Committee, January 2019.

²² Available [here](#).

FIG. 9.3 – PUBLIC PROCUREMENT IN THE EU: SHARE OF CROSS-BORDER AWARD VALUE



Source: European Parliament

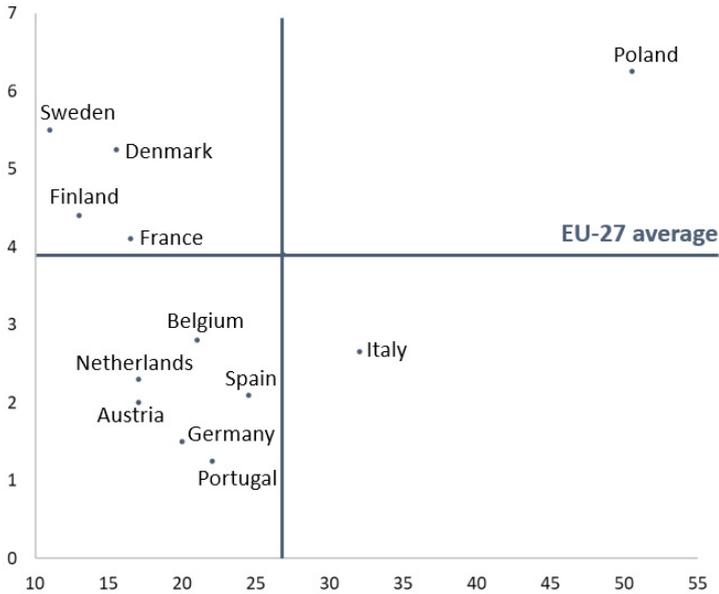
The single bidder is the percentage of contracts awarded where there was just a single bidder (excluding framework agreements, as they have different reporting patterns.) The publication rate is the value of procurement advertised on Tenders Electronic Daily (TED)²³ as a proportion of national GDP.

For the first indicator (on the horizontal axis), the lower the score the better, since with more bidders, public buyers have more options. For the second indicator (on the vertical axis), the higher the score the better, as the publication allows more companies to bid.

Figure 9.4 shows a heterogeneous situation where Sweden, Denmark, Finland and France have a higher probability of getting better value for money in public procurement.

²³ TED is the online version of the “Supplement to the Official Journal” of the EU, dedicated to European public procurement.

FIG. 9.4 – CONTRACTS AWARDED TO A SINGLE BIDDER (HORIZONTAL AXIS) AND PUBLICATION RATE (VERTICAL AXIS)



Source: European Commission

To reduce cross-border friction and progress in the single market for construction, the ECSO²⁴ invites EU Member States, among others: to complete the transposition of relevant directives, to guarantee compliance with the EU regulatory framework on services and professional qualifications, and to increase transparency and simplify procedures, including through the use of electronic platforms.

Reciprocity based on EU rules

With 20% of World GDP, the EU-27 has significant bargaining power that can be used to shape multilateral and bilateral

²⁴ See footnote 18.

agreements to promote “*free and fair trade*”,²⁵ consistently with the aim set for the internal market.

Turning to subsidies are concerned, the Commission has committed to making proposals in 2021 to “*address distortive effects caused by foreign subsidies within the single market*”.²⁶ In the meantime, on the multilateral side the EU, along with the US and Japan, promoted a new initiative in January 2020 to strengthen WTO rules on industrial subsidies²⁷ by enlarging the list of prohibited subsidies to also cover:

- a.* unlimited guarantees; *b.* subsidies to an insolvent or ailing enterprise in the absence of a credible restructuring plan; *c.* subsidies to enterprises unable to obtain long-term financing or investment from independent commercial sources operating in sectors or industries in overcapacity; *d.* certain direct forgiveness of debt.

The joint statement indicates subsidisation is a severe problem in “*certain jurisdictions*”, but of course the implicit reference is to China. China is, clearly, the other big country the proponents would like to involve in a “*plurilateral agreement*” that would only bind participating countries and would not require the unanimous support of all 164 WTO members.²⁸

On the bilateral front, the EU is negotiating a Comprehensive Agreement on Investment²⁹ with China to ensure European companies can compete in China on a level playing field:

- This includes avoiding forced technology transfers, removing discriminatory authorisation procedures, ensuring that state-owned enterprises compete on equal terms and act on the basis

²⁵ Art. 3, par. 5 of the Treaty on EU.

²⁶ See footnote 15.

²⁷ [Joint Statement of the Trilateral Meeting of the Trade Ministers of Japan, the United States and the European Union](#), 14 January 2020.

²⁸ See J. Brunsden, “[US, Japan and EU target China with WTO rule change proposal](#)”, *Financial Times*, 15 January 2020.

²⁹ European Commission, [EU-China Comprehensive Agreement on Investment](#), 14 February 2020.

of commercial considerations, and improving transparency regarding subsidies to Chinese companies.

China is also negotiating its entry into the Government Procurement Agreement (GPA),³⁰ a plurilateral agreement within the WTO which the EU, US and Japan are part of. The aim of GPA is to promote non-discrimination, transparency and procedural fairness in public procurement. The EU is warmly supporting this process as stated in the EU-China Summit held in April 2019.³¹

Competition policy is to promote competition

Even if it might sound tautological, it is worth recalling the aim of EU competition policy. Soon after the European Commission stopped Siemens acquiring Alstom,³² France and Germany published a “manifesto”³³ to promote a new industrial policy and to demote competition policy, with a rebalancing of power between the Commission and Member States in favour of the latter. Updated versions of the manifesto were subsequently endorsed by Poland³⁴ and Italy;³⁵ the four governments see competition policy – and in particular horizontal merger³⁶ control – as a potential obstacle to EU competitiveness.

³⁰ See, for example, China’s 6th revised market access offer in the context of its negotiations to join the GPA (23 October 2019), WTO, “[China submits revised offer for joining government procurement pact](#)”, 23 October 2019.

³¹ European Council of the European Union, “[Joint statement of the 21st EU-China summit](#)”, 9 April 2019.

³² Commission decision of 6 February 2019 (Case M.8677), European Commission, “[Mergers: Commission prohibits Siemens’ proposed acquisition of Alstom](#)”, 6 February 2019.

³³ “[A Franco-German Manifesto for a European industrial policy fit for the 21st Century](#)”, 19 February 2019.

³⁴ Modernising EU Competition Policy, 4 July 2019 ([link](#)).

³⁵ Letter to Mrs Margrethe Vestager, 4 February 2020 ([link](#)).

³⁶ In this article “merger” is used to encompass any type of concentration operation.

The latest version of the manifesto, which has become an open letter to the Competition Commissioner Vestager, opens with an analysis according to which “European companies now have to compete with foreign companies that sometimes benefit from substantial state support or from protected domestic markets”.

They then call for a revision of the Commission’s guidelines on the assessment of horizontal mergers,³⁷ with a specific reference to the definition of the relevant market “in order to ensure fair and undistorted competition and introduce more justified and reasonable flexibility, to take better account of third countries’ state intervention”.

Thus, they propose to smooth the market power of European firms that are about to merge by defining the relevant geographic market more broadly and to lower the standard according to which potential competition is an effective competitive constraint.

First, is there any evidence the Commission is an obstacle to mergers? As shown in Table 9.1, since 1990,³⁸ out of the 7,803 notified merger proposals only 30 have been prohibited (the Siemens-Alstom case among them), while 449 have been approved with “conditions and obligations”.³⁹ In the construction sector, out of 207 cases, no merger proposal has been prohibited and only three were approved with conditions and obligations.

³⁷ Guidelines on the assessment of horizontal mergers under the Council Regulation on the control of concentrations between undertakings. *Official Journal C 031*, 5 February 2004.

³⁸ The first EU merger regulation (4068/89) entered into force on 21 September 1990.

³⁹ Even if the Commission finds that a proposed merger could distort competition, the parties may commit to correct this likely effect by, for example, selling part of the combined business or to license technology to another competitor. If the Commission is satisfied that the commitments would maintain or restore competition in the market, it gives conditional clearance for the merger to go ahead.

TAB. 9.1 – MERGER CASES AND EUROPEAN COMMISSION DECISIONS

Sector (NACE rev. 2)	Cases	Approved with conditions and obligations	Prohibited
F - Construction	2071	3 (1.5%)	0 (0%)
F41 – Construction of buildings	76	2 (2.6%)	0 (0%)
F.42 – Civil engineering	94	2 (2.1%)	0 (0%)
F.43 – Specialised construction activities	58	1 (1.7%)	0 (0%)
Total	7,803	449 (5.8%)	30 (0.4%)

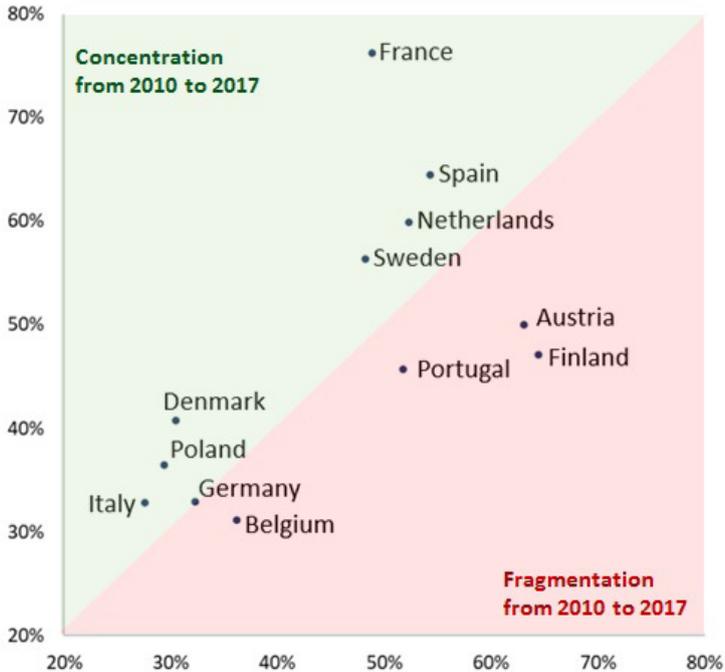
Source: European Commission – DG Comp

Second, there are different degrees of concentration at national level. Concentration in the construction sector is an ongoing *phenomenon* in the EU,⁴⁰ but at national level the market structure is relevant due to the low cross-border activity described in the paragraph “Effective European market” in this chapter.

By focusing on civil engineering (NACE F.42) for the twelve EU-27 members with the largest national construction markets, Figure 9.5 shows the turnover of firms with more than 250 employees as a percentage of turnover of all civil engineering firms. The heterogeneity is considerable: in 2017, for example, big firms made up 76% of the sector’s turnover in France and 31% in Belgium. Moreover, by comparing 2017 to 2010, Figure 9.5 shows where the recent trend was towards concentration (France, Spain, Netherlands, Sweden, Denmark, Poland and Italy) and towards fragmentation (Austria, Finland, Portugal and Belgium).

⁴⁰ See for example data provided by Deloitte in “[European Construction Monitor 2017–2018: A looming new construction crisis?](#)”, July 2018.

FIG. 9.5 – TURNOVER OF CIVIL ENGINEERING FIRMS WITH MORE THAN 250 EMPLOYEES (% TOTAL) IN 2010 (HORIZONTAL AXIS) AND IN 2017 (VERTICAL AXIS)



Source: Eurostat

Finally, the concerns of the four signatories of the manifesto according to which the Commission defines, or might define, the relevant geographic market restrictively are realistic; this is due to low cross-border activity in construction and also due to the fact that non-European construction firms, such as Chinese ones, are not an immediate threat. Those concerns will be swept away as soon as the EU progresses in levelling the playing field intra-EU and with other non-EU countries. With a reduction in entry barriers and the subsequent increase in

market contestability, post-merger firms⁴¹ will be less capable of jeopardising consumer interest. This will reduce the likelihood of the Commission blocking merger proposals, especially those in one country.

Conclusion

Europe has global champions in a few sectors and construction is one of these. The current position of European champions in the construction sector is at risk due to China's heavy intervention in protecting the national market and in subsidising its firms. Notwithstanding the commitment of China in progressing towards a market economy model similar to the one found in other big players – such as the US and EU – the global market is far from being level and providing opportunities for the most efficient firms.

However, China's anti-competitive behaviour should not eclipse the urgency of what the EU should and should not do at home to facilitate the success of European champions.

First, the EU should make progress in completing the single market for construction where Member States maintain effective protections for national firms. Second, the EU should not fall into the trap of following non-market economies in a “race to the bottom” by relegating competition policy as a bendable tool in the hands of those governments that are ready to sacrifice consumer interest on the altar of economic chauvinism wrapped in the European flag.

⁴¹ According to the EU merger regulation “[emphasis added] A concentration which would significantly impede effective competition, in the common market or in a substantial part of it, in particular as a result of the creation or strengthening of a dominant position, shall be declared incompatible with the common market”. Art. 2 par. 3 of the Council Regulation (EC) 139/2004 of 20 January 2004.

10. Transitioning Towards More Sustainable and Quality Infrastructure

Daniel Taras

The Need for Sustainable Infrastructure Solutions

Approximately 70% of global greenhouse gas (GHG) emissions are caused by the construction and operation of infrastructure.¹ Infrastructure projects can have a lifespan of multiple decades, even centuries, meaning that any project built today will bring with it significant lock-ins for the climate change trajectory.

Given the significant infrastructure needs, for climate considerations alone, it is crucial that infrastructure solutions are designed in the most sustainable way. However, the concept of sustainable infrastructure goes beyond climate change impacts; it also includes other environmental considerations (including climate resilience), economic and financial aspects, governance issues and social considerations.²

Taking sustainability seriously makes sense not just for societal reasons. It also makes business and economic sense. For instance, it has been shown that most infrastructure projects that were cancelled or postponed, often at considerable

¹ A. Bhattacharya et al., *Aligning G20 Infrastructure Investment with Climate Goals & the 2030 Agenda*, Foundations 20 Platform, a report to the G20, 2019a.

² A. Bhattacharya et al., *Attributes and Framework for Sustainable Infrastructure*, Inter-American Development Bank (IDB) Technical note No IDB-TN-01653, 2019b.

financial cost, had faced social conflicts,³ i.e., they lacked a social licence to operate. Investing in climate resilience may also pay off handsomely. In Ho Chi Minh City, Vietnam, direct infrastructure damage from a 100-year flood may be as high as \$300 million today, but may rise to \$1 billion by 2050.⁴

Despite the compelling evidence in favour of making infrastructure more sustainable, there are still significant challenges that prevent existing infrastructure from being turned into a more sustainable one and future infrastructure from being designed more sustainably and making better use of natural infrastructure. These challenges tend to be more pronounced in the developing world than in the developed world, but in both cases they apply to varying degrees. They span the entire project cycle, the upstream environment for infrastructure projects, financing considerations, but also definitional questions as well as political economy issues nationally and internationally.

Indeed, transitioning to a world in which sustainable infrastructure is the new Business As Usual is itself a policy challenge that requires careful consideration of its social implications and policies designed to ensure a just transition that puts citizens, not infrastructure projects, centre-stage. For instance, the European Green Deal applies this principle by highlighting that “above all, [it] sets a path for a transition that is just and socially fair. It is designed in such a way as to leave no individual or region behind in the great transformation ahead”.⁵

The aim of this analysis is to delve into some of the main issues, challenges and initiatives related to sustainable infrastructure, so as to provide recommendations on how to drive the sustainable infrastructure agenda forward, while also highlighting some future trends to watch.

³ Inter-American Development Bank (IDB), [What is Sustainable Infrastructure](#), Technical Note No IDB-TN-1388, March 2018.

⁴ McKinsey Global Institute (MGI), *Climate Risk and Response*, January 2020.

⁵ European Commission, [“Communication on the European Green Deal”](#), 11 December 2019.

What Is Sustainable Infrastructure?

Sustainable infrastructure as a concept has evolved over the years, with first mentions of the concept around 2006 in major international conferences.⁶ While the jury is still out on the precise labels and the detailed elements of it, sustainable infrastructure may be considered to consist of the following four dimensions:⁷

- economic and financial sustainability;
- social sustainability;
- environmental sustainability (including climate change and resilience);
- institutional sustainability.

Infrastructure projects are sustainable if they are planned, designed, constructed, operated and decommissioned sustainably, i.e. if they are sustainable across the entire project life-cycle.⁸ Bhattacharya et al. (2019b) further break down the four dimensions of sustainable infrastructure into fourteen sub-dimensions and altogether sixty-six attributes that provide further details on how sustainability can be understood.⁹ They range from more traditional measures of economic and financial success, such as growth and productivity spillovers, job creation, operating profitability and debt/fiscal sustainability, to reduction of GHG emissions, avoiding impact on biodiversity and water pollution, waste management and recycling, resettlement and displacement, cultural preservation, alignment with global and national strategies and capacity building.¹⁰

While the framework provided by Bhattacharya et al. is probably the most comprehensive exercise in pulling together various details of what sustainable infrastructure constitutes, it

⁶ A. Bhattacharya et al. (2019b).

⁷ Ibid.

⁸ Ibid.

⁹ Ibid.

¹⁰ For details see *ibid.*

does not go as far as providing precise indicators or measurements for sustainable infrastructure. This is what various (private) sustainable infrastructure standards and rating systems seek to provide, such as the ENVISION™ rating scheme by the Institute for Sustainable Infrastructure (ISI), SuRe® by Global Infrastructure Basle (GIB), IS Rating by the Infrastructure Council of Australia (ISCA) and CEEQUAL® by BRE Global.

However, the various sustainable infrastructure standards partially overlap, partially cover similar items that are labelled differently and partially provide additional aspects of sustainability. This makes it difficult for external users of these standards – normally investors in sustainable infrastructure – to differentiate between different types of sustainable infrastructure. This, in turn, impacts on their ability to make investment decisions based on the degree of sustainability of a given infrastructure asset.

In fact, the precision with which sustainability can be measured is an issue of general concern beyond the world of infrastructure. *The Economist* highlights that different ESG (Economic, Social and Governance Risk) standards, a measure of sustainability, are poorly correlated with one another: “ESG-rating firms disagree about which companies are good or bad”.¹¹

To address the issue of lack of alignment in the sustainable infrastructure sphere, there are ongoing efforts among the standard setters together with some multilateral development banks (MDBs) aimed at agreeing on a core set of indicators. The goal is to reduce complexity and thereby promote the attractiveness of sustainable infrastructure as an asset class.

Furthermore, the above definitions as well as the standards implicitly focus on the project level.¹² However, for policy purposes, it is important to also look at sustainable infrastructure

¹¹ “Poor scores - Climate change has made ESG a force in investing. But the figures behind ESG rating systems are dismal”, *The Economist*, 7 December 2019.

¹² United Nation Environment (UNE), “Integrated Approaches to Sustainable Infrastructure”, 2019.

as a set of interconnected systems.¹³ This integrated approach considers the interplay of various infrastructure systems,¹⁴ sectors, levels of governance, spatial scales as well as the environmental, social and economic aspects of infrastructure systems.¹⁵ Connected to the integrated approach is also the need to go as far upstream as needed and necessary to design high quality sustainable infrastructure systems. The definitions and some of the standards do consider the upstream, but not as yet comprehensively. For instance, in its sustainable infrastructure framework, the Inter-American Development Bank¹⁶ explicitly refers to the upstream context, and the ENVISION™ rating system is intended to also support integrated approaches to planning infrastructure, but mainly at the municipal level.¹⁷

Adding to the complexity, the label sustainable infrastructure is not alone in claiming the space for infrastructure that is economically and financially viable, socially inclusive, environmentally sound, resilient to catastrophes and well set up institutionally. Building on the G7 Ise-Shima Principles for Promoting Quality Infrastructure,¹⁸ under Japan's 2019 Presidency, the G20 issued the Principles for Quality Infrastructure Investment, which rests on six pillars:¹⁹

- Maximising the positive impact of infrastructure to achieve sustainable growth and development;
- Raising economic efficiency in view of life-cycle costs;
- Integrating environmental considerations in infrastructure investments;
- Building resilience against natural disasters and other risks;

¹³ Ibid.

¹⁴ For instance, energy, transport, water and sanitation; as well as natural infrastructure, such as ecosystems and landscapes, often referred to as Nature-based Solutions (NBS) (Ibid.).

¹⁵ Ibid.

¹⁶ IDB (2018).

¹⁷ UNE (2019).

¹⁸ See *G7 Ise-Shima Principles for Promoting Quality Infrastructure Investment*

¹⁹ *G20, G20 Principles for Quality Infrastructure Investment*, 2019.

- Integrating social considerations in infrastructure investments;
- Strengthening infrastructure governance.

Despite the different labels, in terms of their respective detailed attributes, there is considerable overlap between sustainable infrastructure on one hand and quality infrastructure on the other. Economic efficiency includes items such as life-cycle costs, cost-overruns and innovative technologies, and is by and large covered by the concept of economic/financial sustainability. Environmental considerations cover ecosystems, biodiversity and climate, and are largely equivalent to environmental sustainability, except that the G20 Principles separate resilience as an additional principle. Social considerations are broadly in line with social sustainability, and infrastructure governance with institutional sustainability.²⁰

There are also some subtle but noteworthy additional features brought in by the concept of quality infrastructure. For example, among the G20's quality infrastructure principles, there is a stronger focus on the economic and engineering qualities of a project such as focusing on innovative technologies.²¹ Meanwhile, the sustainable infrastructure label as exemplified by the sustainable infrastructure framework presented above focuses more on societal dimensions,²² highlighting a wider range of social and environmental issues, and seeks not just to minimise any damage but also, ideally, to improve and restore existing issues (for example, redeveloping brownfield sites into green infrastructure for flood prevention).²³

Yet by and large, sustainable infrastructure is equivalent to quality infrastructure. The challenges in promoting either of them are ultimately the same.

²⁰ D. Taras, "[Sustainable Infrastructure and Quality Infrastructure are two sides of the same coin](#)", Blog, Inter-American Development Bank (IDB), 2019.

²¹ D. Taras (2019).

²² A. Bhattacharya et al. (2019b).

²³ D. Taras (2019).

Challenges in Driving the Sustainable Infrastructure Agenda Forward

The reasons why sustainable infrastructure is not taking off as much as needed and wanted are manifold.

Bhattacharya et al. highlight the need for agreement on a shared definition and understanding of sustainable infrastructure to ensure alignment of efforts for scaling up infrastructure. The other challenges for what label an “integrated framework for the delivery of sustainable infrastructure” are:²⁴

- Strengthening the upstream framework conditions for sustainable infrastructure. This will be covered in more detail in Section 4 below.
- Supporting country coordination platforms for project preparation. This involves providing platforms at the country level (including national and sub-national levels) and beyond to systematically build pipelines of sustainable infrastructure solutions, engaging all stakeholders and to attract private sector investors.
- Ensuring the quality and sustainability of individual projects. This would be achieved by further developing and applying high-quality and – ideally aligned – sustainability standards and tools as already briefly outlined in the previous section.
- Developing better structures to mobilise more financing from the private sector. While the public sector plays an important role in infrastructure funding, mobilising all sources of finance is crucial, especially private capital from institutional investors. Green finance, including green bonds, may play an increasingly important role here.²⁵

²⁴ A. Bhattacharya et al. (2019b).

²⁵ For further details, please refer to *ibid.*

To these challenges, the following can be added:

- A (national) political economy dimension that may interfere with the transitioning process towards the new desired state of sustainable infrastructure – broadly synonymous with the “just transition” debate surrounding climate change policies, but not limited to climate change as the sole primary goal.
- A geopolitical dimension, which affects – potentially both positively and negatively – the international processes surrounding sustainable/quality infrastructure and related funding efforts for sustainable infrastructure globally. For instance, significantly scaling and speeding up infrastructure funding in developing countries is often associated with a race to the bottom in terms of sustainability standards; but dynamics may change in the face of increasing public pressure, and the race may turn into one that is increasingly about quality and sustainability.

The Importance of Strengthening the Upstream Framework Conditions

At the outset of the decision on what type of infrastructure (system) to put in place, stands the question of what is the right solution for the problem that needs to be tackled for the benefit of citizens, rather than what type of project to build or even just how to make an already chosen project more sustainable at the margin.

This can only be done if decisions on sustainable infrastructure are taken as early as possible and as necessary in the upstream process. In doing so, sustainability opportunities can be integrated without requiring significant modifications or causing cost overruns.²⁶

²⁶ T. Serebrisky et al., *IDBG Framework for Planning, Preparing, and Financing Sustainable Infrastructure Projects*, Inter-American Development Bank (IDB),

The upstream policy and institutional framework for sustainable infrastructure can be understood to include the policies, plans, legislation, regulations and organisational capacities that enable projects to be sustainable.²⁷ This includes the (i) business and policy environment, consisting of the general investment climate, sustainability policies and the regulatory framework for infrastructure investments; (ii) for the specific upstream stages of the project cycle growth and investment strategies, infrastructure investment plans, investment frameworks and project prioritisation, initial design and feasibility analysis, procurement, detailed design and project preparation; and (iii) leadership and coordination; ensuring integrity, transparency and openness; and capacity building.²⁸

The elements of the institutional framework need to be coherent and well-integrated with one another to be fully effective. There needs to be a long-term strategic vision²⁹ and planning related to sustainable infrastructure, strongly linked to both sub-national goals and international commitments, such as the Nationally Determined Contributions (NDCs) or the SDGs and reflected in multi-year sector budgets.³⁰ Policy needs to be ambitious in promoting sustainable infrastructure and to be aligned both horizontally and vertically (sub-national level). The right legislation and regulations need to be in place to support implementation of policies, and they need to be consistent with one another. Enforcement is crucial and is often the main issue in developing and emerging economies, even if suitable policies, laws and legislation are in place.

Underlying all this is the capacity of the government, at the level of the individual public servant or political decision-maker,

Technical Note no. 1385, 2018.

²⁷ IDB (2018).

²⁸ Brookings/Inter-American Development Bank (IDB), *Conceptual Framework for analysis of Sustainable Infrastructure*, 2018, unpublished.

²⁹ OECD, *Getting Infrastructure Right*, 2016.

³⁰ IDB (2018).

at the institutional level of a ministry or other public entity, and at the level of the governance system as a whole, horizontally between ministries or between other entities at the same administrative level, and vertically between the national and sub-national levels. Given the interdisciplinary nature of sustainable infrastructure – which touches upon a wide range of administrative competencies such as general planning, public finance, the economy, the social sphere, statistics (data) and the environment –, coordination and leadership is key to ensure a coherent upstream framework for sustainable infrastructure.

Much remains to be done. For instance,³¹ in their analysis of the institutional capacity of Latin American countries for sustainable infrastructure planning and delivery, found that there was a lack of integrated, multi-sector infrastructure planning and of inter-sectoral and inter-ministerial coordination, and that infrastructure plans and strategies covered only short periods and specified unambitious sustainability goals, leading to the conclusion that “strong gaps exist in the capacities for effective national and sectoral infrastructure planning and delivery”.³²

The Transition Path Toward More Sustainable Infrastructure – Political Economy Considerations

While overall, sustainable infrastructure is by design intended to benefit everyone, the transition towards more of it will create winners and losers, economically, socially and otherwise. In other words, the upstream policy and institutional setting is not only about a miraculous switch from one sub-optimal BAU state to one that is perfectly suited for promoting sustainable infrastructure but also about the path which leads to that new state.

³¹ A. Georgoulas et al., *Assessing the Institutional Capacity of Latin American Countries for Sustainable Infrastructure Planning and Delivery*, Inter-American Development Bank (IDB), Technical Note No IDB-TN-1393, 2018.

³² Ibid.

For instance, with the introduction of more efficient sustainable public transport systems, such as a metro line, residents in urban centres may experience lower levels of exhaust fumes and noise from combustion engines. This will make living in cities more attractive and most likely lead to a further population influx into cities, pushing up property prices in the process. The improved situation is likely to benefit everyone in terms of better transport services and pollution levels. However, the increase in property prices and rent levels redistributes income and wealth.

Another potential consequence of new transport infrastructure, which is quite common in developing countries, is that owner-operators of small buses currently filling gaps in public transportation may lose their economic existence, as public transportation services increase coverage and become more efficient and more socially acceptable to use.

At the macro level, the large scale introduction of sustainable transport systems is likely to reduce the demand for fossil fuels. As a result, economies that are heavily dependent on oil and/or on industries servicing this sector may experience significant economic decline and job losses.

Other examples include wind-turbines, which may bring clean energy but for residents nearby may mean a decrease in their quality of life; the cutting of fossil-fuel subsidies, which may affect citizens economically and even socially reliant on individual transport; and public utilities in the energy sector, which may have to lay off staff as self-generated renewable energy production goes up and energy provision becomes more decentralised.

In principle, these are nothing but classical political economy challenges, in which losers need to be compensated by winners. Otherwise the potential losers may block reforms, at the local, regional, national or international level. Fiscal policy has an important part to play in this. For instance, a land-value capture tax is one example of how the additional value created for private property owners through a new metro line can be levied for potential use to compensate losers.

An integrated approach to sustainable infrastructure should take into consideration possible policies to address this, bearing in mind that monetary compensation may not be sufficient in all cases, especially when elements of personal dignity and human relationships are involved. For instance, the owner-operators of mini buses could be offered both monetary compensation and an option to work with the entity running the new metro line. However, they may not find this attractive, simply because they would lose their entrepreneurial autonomy, and therefore may vent their frustration via public action.

In other words, sustainable infrastructure solutions are in principle technologically, economically/financially, socially, and even politically feasible, but the key challenge is their political acceptability.³³

Achieving that political acceptability at the very least requires foresight, stakeholder engagement and carefully crafted policies along with well-sequenced compensation schemes.³⁴ However, what is crucial is that any such measures are not just seen as an expensive price tag but that there is effective communication of the fact that the benefits by far outweigh the costs, and that some benefits may not be measurable in economic terms alone.

Key Initiatives and Players Driving the Sustainable and Quality Infrastructure Agenda

To make things more complex, driving the sustainable infrastructure agenda forward is not only a matter of national policy but is also intermeshed with what goes on internationally and the dynamics between the different stakeholders.

³³ See, for example, A. Vogt-Schilb, *Effective and politically feasible decarbonization pathways*, Inter-American Development bank (IDB), 2018.

³⁴ See, for instance, Michael Jakob et al., with respect to green fiscal reforms. M. Jakob et al., “Green fiscal reform for a just energy transition in Latin America and the Caribbean”, *Economics E-Journal*, 2019.

This section briefly outlines some of these players and their initiatives.³⁵ It is beyond the scope and intention of this analysis, however, to look at the dynamics between the different players and/or any geopolitical aspects related to sustainable/quality infrastructure.

The G20. The shaping of the international agenda on sustainable/quality infrastructure is largely taking place within the framework of the G20 and its Infrastructure Working Group (IWG) in particular. Thus, the IWG has led the work resulting in the release of the Quality Infrastructure Principles at the G20 Osaka Summit in 2019. Much of the international technical discussions surrounding sustainable infrastructure take place within and at the margins of the IWG.

The OECD. The OECD plays a strong role in a think tank and quasi-secretarial role for the G20. Among other things, the OECD has set up a Task-Force on Long-term Financing, with broad participation from MDBs, governments, international organisations, the private sector and NGOs, focusing on a wide array of issues related to sustainable and quality infrastructure, including data issues and infrastructure as an asset class.

The UN. Within the UN system, the United Nations Environment (UNE) has led the way in driving the sustainable infrastructure agenda. On 15 March 2019, the fourth United Nations Environment Assembly (UNEA-4) adopted a resolution on sustainable infrastructure which among other things encourages Member States to take a range of actions addressing many of the challenges outlined earlier in this section.³⁶ UNE also has been convening stakeholders from the policy arena, academia and NGOs working on flagship reports and guidelines aimed at policymakers.

³⁵ While highlighting most of the key players, this list and the descriptions provided are not exhaustive and omissions, if any, are not intentional.

³⁶ UN (2019); Resolution adopted by the United Nations Environment Assembly on 15 March 2019; 4/5. Sustainable infrastructure; United Nations Environment Assembly of the United Nations Environment Programme; 28 March 2019; <https://research.gsd.harvard.edu/zofnass/files/2019/04/Sustainable-Infrastructure-resolution.pdf>

Multilateral development banks. While all MDBs are represented within the IWG and many also participate in task forces convened by the OECD or UNE, the MDBs also individually engage in driving sustainable infrastructure forward. Notably, the Inter-American Development Bank (IDB) has published a sustainable infrastructure framework,³⁷ which serves both to drive the internal change process within IDB to operationalise sustainable infrastructure and to promote and apply the concept with its clients, as well as internationally. The Public-Private Infrastructure Advisory Facility (PPIAF), meanwhile, has been pivotal to bringing together different sustainable infrastructure standards (see above).

The EU. The European Green Deal may be considered the EU's key initiative in the context of sustainable infrastructure.³⁸ With its ambitious goal to become the world's first climate-neutral continent by 2050, the European Green Deal, among other things, includes building blocks directly or indirectly related to the ambitions of sustainable infrastructure.³⁹ Of note is also the decision of the European Investment Bank (EIB), a major financier of infrastructure and the EU's lending arm, to phase out its multibillion-euro financing for fossil fuels to become the world's first "climate bank" after 2021.⁴⁰

China and the Belt and Road Initiative (BRI). One of the main pillars of the BRI is infrastructure development. China highlights the global public goods character of BRI, in which all countries are welcome to participate. Projects in sectors already being executed, in implementation or planned along the seventy BRI "corridor economies" (there is no official list of participating countries) are estimated to amount to \$575 billion.⁴¹ In line with the key argument of this analysis that

³⁷ A. Bhattacharya et al. (2019a); IDB (2018).

³⁸ European Commission (2019).

³⁹ Ibid.

⁴⁰ "European Investment Bank to phase out fossil fuel financing"; *The Guardian*, 15 November 2019.

⁴¹ The World Bank, *BRI at a glance*, 2018, <https://www.worldbank.org/en/topic/>

the way infrastructure is designed and implemented has a major bearing on the sustainable development trajectory, the BRI equally has substantial potential to shape the future by supporting sustainable infrastructure. As the World Bank (2018) puts it:

BRI [...] projects have the potential to substantially improve trade, foreign investment, and living conditions for citizens in participating countries – but only if China and other corridor economies adopt deeper policy reforms that increase transparency, expand trade, improve debt sustainability and mitigate environmental, social and corruption risks.⁴²

The United States, Australia, Japan and the Blue Dot Network. US Commerce Secretary Wilbur Ross announced the launch of the Blue Dot Network – led by the US Overseas Private Investment Corporation (OPIC), the Japan Bank for International Cooperation (JBIC) and the Australian Department for Foreign Affairs and Trade (DFAT) – on the sidelines of the 35th Association of Southeast Asian Nations (ASEAN) Summit held in Bangkok, Thailand, in November 2019.⁴³ While many commentators see it as a response to China’s BRI, not much about it is known yet, but it is to include countries committed to “sustainable infrastructure development” and will “promote high-quality, trusted standards for global infrastructure development”.⁴⁴

Other donors. Various national donors support sustainable infrastructure efforts. They do so explicitly, as, for instance, does the German Federal Ministry for Economic Cooperation and Development (BMZ) via numerous support projects executed by Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH globally (for example, to the IDB and through

[regional-integration/brief/belt-and-road-initiative](#)

⁴² Ibid.

⁴³ “China’s ‘Belt and Road’ strategy has a new competitor - enter America’s ‘Blue Dot Network’”, *ABC*, 5 November 2019.

⁴⁴ Ibid., 2019, referring to OPIC.

global networks such as the Emerging Market Sustainability Dialogues⁴⁵). But most of the time, they do so implicitly, supporting individual elements of what makes up sustainable infrastructure, for example, through in-country support for renewable energy policy, decarbonisation strategies, transport advisory projects and governance reform.

Sustainable infrastructure standard setters. Private sustainable infrastructure standard setters are keen to expand their ambit. While seeing the need for collaboration in the form of alignment with other standard setters and international players, sustainable infrastructure standards are only likely to go as far as to align their efforts, but not to harmonise them. While the existence of different standards increases complexity, it also helps to drive innovation and push the knowledge frontier.

Investors. In their constant search for yield and alternative asset classes, institutional investors have long been interested in investing more in infrastructure, and – with the recent rise in interest in sustainable investments and more evidence that sustainability may be linked to superior financial performance – sustainable infrastructure assets. However, they are still held back by the general problems faced by investors in infrastructure as well as by the uncertainty as to what sustainable infrastructure is and how it can be measured.

Infrastructure industry. The range of businesses involved in infrastructure construction, operation and maintenance is extensive. Associations such as the American Society of Civil Engineers (ASCE) and the Institution of Civil Engineers (ICE) have been engaged in international discussions surrounding sustainable infrastructure and have contributed to the conceptual development of sustainable infrastructure.⁴⁶

⁴⁵ www.emsdialogues.org

⁴⁶ See for example Institution of Civil Engineers (ICE), *Enabling better infrastructure*, 2019.

Conclusions and Outlook

Sustainable (or quality) infrastructure is the infrastructure of the future. Concern for the environment and the impact of climate change and environmental destruction on humankind has entered the mainstream. Based on a global multi-stakeholder survey, the World Economic Forum's (WEF) Global Risk Report, for the first time since its inception, lists exclusively environmental risks as its top five global risks in terms of likelihood, including extreme weather, climate action failure, natural disasters, biodiversity loss and human-made environmental disasters.⁴⁷ Three of these (climate action failure, biodiversity loss and extreme weather) are also considered to be among the top five in terms of impact.

The global grassroots pressure to do more for climate change may be one of the most important drivers for more sustainable infrastructure, even if to date it is still mainly focused on climate and environmental aspects and more likely to focus on highly visible energy infrastructure projects.⁴⁸

As initiatives such as the European Green Deal show, governments are reacting to this. These initiatives are best understood in the context of the climate change debate and go beyond infrastructure. However, given the major role played by infrastructure in generating GHG emissions, making infrastructure more sustainable will be the linchpin for success. What is more, as the New Climate Economy has highlighted, accelerating investment in sustainable infrastructure also brings enormous opportunities for a new growth path, which will “deliver higher productivity, more resilient economies and greater inclusion”.⁴⁹ The NCE (2018) estimates that what it

⁴⁷ World Economic Forum (WEF) (2020), *Global Risk Report*, 2020.

⁴⁸ For instance, protestors have recently occupied “Datteln 4”, a modern coal-fired power plant in Germany, that is due to start operations, after it was exempted from a national plan to exit from coal power by 2038 that was approved by the German government.

⁴⁹ New Climate Economy (NCE), [Unlocking the Inclusive Growth Story of the](#)

calls the transition to a climate economy,⁵⁰ which encompasses but goes beyond infrastructure, “could yield a direct economic gain of \$26 trillion through to 2030 compared with business-as-usual”, would generate over 65 million new low carbon jobs in 2030, and generate, through subsidy reform and carbon pricing alone, an estimated \$2.8 trillion in government revenue p.a. in 2030.⁵¹

In these efforts, it is crucial that the framework conditions are in place to ensure that infrastructure solutions can be designed, planned, constructed, operated and decommissioned in a sustainable way. This requires strengthening government capacities (and also the private sector and civil society), including at the individual (leadership, managerial and technical capabilities), institutional (ministries, sub-national level, regulations, monitoring and implementation) and system level (long-term vision, coordination, planning and laws).

Beyond upstream institutional frameworks, innovation (products, services, processes and administration) has a strong role to play in making infrastructure more sustainable. While not the only sector relevant for infrastructure, the construction industry has been a slow innovator and its labour productivity has stagnated or even decreased over the past 50 years.⁵² Examples of recent promising innovations include cross-laminated timber, which allows the use of wood in high-rise buildings, with reduced use of GHG-intensive building materials like concrete and steel, while the wood sequesters carbon;⁵³ the use of Building Innovation Modelling (BIM); 3-D printing, autonomous construction equipment, pre-fabrication;⁵⁴ and the use of drones for inspection and maintenance.

21st Century, 2018.

⁵⁰ Ibid.

⁵¹ Ibid.

⁵² World Economic Forum (WEF), *Shaping the Future of Construction*, 2017.

⁵³ See D. Roberts, “[The hottest new thing in sustainable building is, uh, wood](#)”, *Vox*, 15 January 2020, for a good overview.

⁵⁴ WEF (2017).

More generally, digitalisation and big data play an important role in making infrastructure more sustainable,⁵⁵ for example by contributing to better transportation demand management (TDM) or to promote Mobility as a Service (MaaS) instead of personally-owned modes of transportation. Other examples include sensors embedded in buildings, bridges and other constructions, which allow many performance levels to be monitored, and big data sets, with building designs, environmental data, stakeholder inputs and social media discussions determining what to build and how to build it.⁵⁶

Unfortunately, the discussions surrounding sustainability are still somewhat disjointed from the discussions on innovation (and vice versa), despite the apparent benefits of innovation for sustainability and the potential of sustainability to drive more innovation. The terminological battle between sustainable infrastructure and quality infrastructure (see above) in parts reflects this, and at the same time is an opportunity to weave the two strands of thought together.

But the latest trends in – and best solutions to – driving sustainable infrastructure forward can be found not only in fancy technology and big data-enabled innovations. They are also about going back to basics. Indeed, much attention has been focused on the systematic use of natural infrastructure, either on its own or in combination with human-built infrastructure, to provide Nature-Based Solutions (NBS), delivering better service at lower cost.⁵⁷ For example, mangroves reduce wave height by one third, stabilise shorelines, elevate soil, can be two-to-five times cheaper than comparable breakwater, and additional benefits include forest products, biodiversity,

⁵⁵ See for instance W. Escudero, *Infrastructure, public policy and the challenge of big data*, Inter-American Development Bank (IDB), January 2020, Technical Note no. 1847, although focusing on efficiency aspects rather than explicitly sustainability.

⁵⁶ See “[Big Data has a crucial role in the construction industry](#)”, *CIORReview*, 18 March 2018.

⁵⁷ World Resources Institute (WRI) and The World Bank Group (WB), [Integrating Green and Grey](#), 2019.

long-term carbon sequestration and tourism. Other infrastructure services provided by natural systems include water purification and storage, flood management, irrigation and electricity generation.⁵⁸

Furthermore, while much of the attention has been focused on climate change aspects, there are other environmental considerations that are likely to feature more strongly on the global agenda surrounding sustainable infrastructure, notably biodiversity. Infrastructure, unless completely natural, does have an impact on biodiversity.⁵⁹ Expect more on this at the COP15 of the Convention on Biological Biodiversity (CBD) in Kunming, China, this year.

Also expect discussions surrounding sustainable infrastructure to be embedded in the broader question of transition pathways, and an increasingly stronger push for social justice and the just transition more generally, both in international and national discussions and in the streets. How can people who do not benefit socio-economically from a switch towards more sustainable infrastructure be compensated? What are the economic and job opportunities that come with more sustainable infrastructure? How can the transition path be designed to be palatable for all and to be citizen-centric?

Last but not least, infrastructure is not just about supply. It is also about demand. One of the burning questions and future trends will also be about how to change user demand patterns. Big data will have to play a role in this as will behavioural economics.

⁵⁸ Ibid.

⁵⁹ World Wide Fund for Nature (WWF) & International Institute for Sustainable Development (IISD), *Infrastructure at odds with biodiversity*, 2017.

11. Finance for Sustainability: A Useful Tool for Policymakers

Matteo Rivellini

Time To Invest for a Better World Despite Uncertainties

Today's global context indicates that disparities and inequalities in human development are widespread across the world.¹ In 2019, “the world's billionaires, only 2,153 people, had more wealth than 4.6 billion people. The richest 22 men in the world own more wealth than all the women in Africa”.² The availability of natural resources is limited and global warming, linked to human activity, is putting the survival of forests, cities and people at risk.³ UNICEF recently reported that “poverty, inequality, discrimination and distance continue to deny millions of children their rights every year, as 15,000 children under 5 still die every day, mostly from treatable diseases and other preventable causes”.⁴ Multilateral institutions are

¹ See UNDP, *Human Development Report 2019. Beyond income, beyond averages, beyond today: Inequalities in human development in the 21st century*, 2019.

² OXFAM, *Time to care Unpaid and underpaid care work and the global inequality crisis*, January 2020.

³ See IPCC, *Choices made now are critical for the future of our ocean and cryosphere*, 25 September 2019.

⁴ See UNICEF, Levels & Trends in Child Mortality, *Child Mortality Report 2019*, Estimates Developed by the UN Inter-agency Group for Child Mortality

appearing to struggle with current challenges ranging from migration pressure and trade wars, to the dichotomy of global models between supremacy imposing dependency on the one hand and democracy allowing for individual rights on the other. Geopolitical implications prompt policymakers to look at existing and new connectivity infrastructure more as a proxy of their sovereignty than as an opportunity for inclusive economic growth. Yet, economies and societies are still so interconnected that a virus, first identified in China, has significantly impacted economic growth on a global scale.

Against this rapidly changing and uncertain backdrop, there are reassuring signs of increased awareness of global interdependencies and calls for global solutions to address common issues. As Pope Francis stated in *Laudato Si'* "Interdependence obliges us to think of one world with a common plan".⁵ In 2015, world leaders marked an important consensus on both the United Nations Sustainable Development Goals ("SDGs") and the Paris Climate Agreement COP21 ("COP21") that could lead to fairer, more sustainable and more inclusive use and distribution of the world's natural resources.

Achieving SDGs and COP21 goals requires policymakers as well as public finance institutions to act rapidly and seize the unique opportunity to benefit from historically low interest rates to support much-needed connected investments.

Europe, for example, should invest (i) to sustain the digital revolution and enable European firms to compete and leapfrog globally; (ii) to lead by example in fighting climate change towards a carbon-neutral economy, first within its own borders and then worldwide; and (iii) to re-build social inclusion to reduce economic and geographical disparities. There is, however, a risk of deceleration of investments amid a growth slowdown, despite the current advantageous financing conditions, as underlined by the recent 2019-2020 Investment Report of the

Estimation, 2019.

⁵ Encyclical Letter *Laudato Si'*, 164 – 24 May 2015.

European Investment Bank (EIB),⁶ which builds on data from a survey of 12,500 firms in Europe focusing on their assessment of investment and investment finance conditions. Therefore, structural investments are more urgent than ever to cope with the transformation of economies and societies, as well as to achieve the ambitious European goals to speed up the zero-carbon transition, support sustainable and inclusive growth and reap the upside of the technological transformation.

Sustainable Investments Based on Big Data, Ethics, Economics and Common Terms

Currently available technologies can gather enormous amounts of data that track the preferences and habits of people in every area of the world concerning what they eat, how they move and how they communicate. Big data can show what people need, and can help policymakers and public finance institutions make the right choice in relation to existing and future infrastructure for them to be long-lasting and to serve the target community appropriately.

Decisions on mobility infrastructure, for example, are more rational and efficient if based on previously collected data that allow for flexibility to adapt to future technological developments. Means of transport for a given community should be safer, cleaner, integrated and dependent on actual and measured needs, while bearing in mind the foreseeable development of digital and automation technologies (e.g. Connected and Automated Vehicles) that is expected to occur during the life of the investment.

Along these lines, an interesting investment concluded by the EIB in the mobility sector concerns the Free Flow Tolling System in the most congested sections of the Slovenian motorway network. In 2017 the EIB issued a €51 million

⁶ See European Investment Bank Bank (EIB), *EIB Investment Report 2019/2020: accelerating Europe's transformation*, 2019.

loan for the design, supply, installation and operation of an Electronic Toll Collection Service system for vehicles over 3.5 tonnes, replacing the previous open tolling infrastructure and its physical barriers with a free-flow, distance-based charging digital infrastructure on the 610 km national motorway network. The project supports the lower-emission mobility strategy set by the European Union and by removing physical toll barriers, it will eliminate the local pollution and congestion caused by these barriers, and thus form part of the sustainable and intelligent mobility solutions set down in EU policy.⁷

More generally, there is an inevitable call for policymakers to strive for sustainable infrastructure that generates a long-term positive impact and inclusive growth, while addressing current economic and social disparities. In particular, public financial institutions are called to support sustainable infrastructures on both ethical and economic grounds.

On the one hand, from a more ethical viewpoint, public financial institutions should be aware that the only just function of money is to generate wealth as depicted by Aristotle in his First Book of Politics, where he states that “money was intended to be used in exchange, but not to increase at interest”. Furthermore, SDG 17 holds everyone accountable to (i) “Mobilize additional financial resources for developing countries from multiple sources”; and (ii) “Assist developing countries in attaining long-term debt sustainability through coordinated policies aimed at fostering debt financing, debt relief and debt restructuring, as appropriate, and address the external debt of highly indebted poor countries to reduce debt distress”.

On the other hand, from an economic and sound banking viewpoint, decisions of public finance institutions concerning infrastructure to be built or maintained should take “backward

⁷ This first direct investment to the Slovenian motorway company DARS was possible thanks to the Investment Plan for Europe (the so-called Juncker Plan). See European Commission, “[First direct financing under EFSI in Slovenia](#)”, Press Release, Ljubljana, 16 November 2017.

planning” into consideration. This involves focusing on the end of the lifecycle rather than on the present, as well as the dynamic development of both needs and available technology. The objective is to concentrate financial efforts on quality infrastructures that guarantee the desired social and economic impact at the lowest cost, while ensuring the flexibility to integrate future digital technologies and accommodate future demands.

In this respect, it is worth noting the recent achievement of G20 Ministers of Finance and Central Bank Governors under the Japanese Presidency.⁸ The meeting stressed the importance of “maximizing the positive impact of infrastructure to achieve sustainable growth and development while preserving the sustainability of public finances, raising economic efficiency in view of life-cycle cost, integrating environmental and social considerations, including women’s economic empowerment, building resilience against natural disasters and other risks, and strengthening infrastructure governance”. With this aspiration in mind, the meeting endorsed the common G20 Principles for Quality Infrastructure Investment.⁹

Regarding the attempt to define internationally agreed terms on sustainable investment, it is also worth noting the Action Plan on Financing Sustainable Growth that was adopted in March 2018 by the European Commission.¹⁰ One of the plan’s aims is to “reorient capital flows towards sustainable investment in order to achieve sustainable and inclusive growth”. It has also triggered a number of initiatives, including a proposal for a regulation¹¹ establishing a unified classification system (“taxonomy”) on what can be commonly considered as an

⁸ Ministry of Finance, Japan, “[Communiqué, G20 Finance Ministers and Central bank Governors Meeting, Fukuoka.\(Jun.8-9,2019\)](#)”.

⁹ Ministry of Finance, Japan, “[G20 Principles for Quality Infrastructure Investment](#)”.

¹⁰ <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52018DC0097>

¹¹ European Commission, “[Commission legislative proposals on sustainable finance](#)”, Proposal, 24 May 2018.

environmentally sustainable economic activity. The regulation is expected to enter into force by the second half of 2020 after completing the ongoing legislative process, as well as incorporating suggestions from the Technical Expert Group on Sustainable Finance.¹² Once adopted, the regulation will be a significant step forward in terms of clarity of European benchmarks and requirements for what can be called sustainable and green finance.

EIB as the Climate Bank of the European Union

The call for sound finance for sustainable infrastructures is possibly even more applicable to a policy-driven and not-for-profit financial institution such as the Bank of the European Union, the EIB.

Financing projects that prove to be sustainable in the long term has always been a key driver for the EIB. For over 60 years, the Treaties of the European Union have required the EIB to provide competitive, long-term funding for investment projects that contribute “to the balanced and steady development of the internal market in the interest of the Union”.¹³ Since the Treaties of Rome, the EIB has supported economically sound projects that serve the European common market and European policy objectives, with particular reference to social, economic and territorial convergence across the EU Member States.

In addition, the EIB has consistently applied the principles of sound banking, which, among other things, require banks to carefully assess project risks and to finance assets that remain productive for at least their expected economic lives and until the required funding is fully reimbursed. If, alternatively, financed assets become obsolete during the life of the loan,

¹² The EIB is part of this group and is expected to be represented also in the subsequent and permanent EU Platform on Sustainable Finance.

¹³ Article 309 (ex Article 267 TEC) of the Treaty on the Functioning of the European Union.

there are higher chances of insolvency of the Bank's borrowers, hence defaults on the loans granted. Conversely, the performing portfolio of the EIB since its establishment displays how successfully and sustainably the Bank has financed assets over time.

Concerning green finance, the importance attached by the EIB to the environment and the effects of climate change are all but new. Over time, the Bank started to assess and report on the greenhouse gases produced by its investments (which also involved undergoing an external audit) and committed itself to dedicating at least 25% of its global activity to projects aimed at tackling climate change. More recently, and in the context of COP21, the Bank has committed to granting \$100 billion of Climate Finance worldwide during 2016-2020 and to increase the proportion of its lending in support of climate-related investment in developing countries to 35%. Both objectives are being achieved.

Therefore, it became natural for the EIB to listen to the calls of President Emmanuel Macron and other EU Heads of State, as well as the President of the Commission, Ursula von der Leyen, to step up its climate role and ambition. In November last year, the EIB Group approved its new energy lending policy,¹⁴ which, as one of the Group's initiatives to contribute to delivering the ambitious European Green Deal and its Sustainable Europe Investment Plan as announced by the Commission, will unlock €1 trillion of green investments until 2030. In this respect, the EIB will leverage resources of the next Multi-Annual Financial Framework of the European Budget (InvestEU) and provide a special facility within the Just Transition Mechanism aimed at supporting the European regions that are most affected by the ambition to move Europe towards carbon-neutrality.¹⁵

¹⁴ European Investment Bank (EIB), "[EIB energy lending policy: Supporting the energy transformation](#)", 15 November 2019.

¹⁵ For more info on the European Green Deal Investment Plan and the Just Transition Mechanism see the memo at: European Commission, "[The European Green Deal Investment Plan and Just Transition Mechanism explained](#)",

As the new Climate Bank of the European Union, the plan is (i) to dedicate 50% of total EIB financing to climate action and environmental sustainability as of 2025 (current target 25%); (ii) to finance only projects aligned with COP21;¹⁶ and (iii) to stop financing fossil fuels by the end of 2021, making the EIB the first international financial institution to make such a commitment

This ambitious plan will provide an additional opportunity for promoters willing to invest further in Europe's competitiveness, new technologies and innovation. Moreover, the EIB will support environmental projects (e.g. water, waste water, waste management, hydrogeological risk management and disaster recovery) and cleaner transport and social infrastructure (e.g. health and education). There will also be a focus on developing housing for low and middle-income families with a focus on energy efficiency to reduce running costs and CO₂ emissions, while also building in resilience to flooding and extreme heat. Such investments will be particularly critical to create additional jobs and ensure alternative opportunities and a just transition, particularly in regions and rural areas that have a longer way to go to achieve carbon-neutrality and are still heavily reliant on fossil fuels. Climate action, however, does not mean the EIB is doing less in cohesion or development finance both within and outside Europe. On the contrary, climate presents an opportunity to channel additional investments into a more sustainable and inclusive future that leaves no one behind in Europe and beyond.

Questions and Answers, Brussels, 14 January 2020.

¹⁶ With a view to strengthening the global response to the threat of climate change, Article 2.1.(c) of the Paris Climate Agreement require to make “finance flows consistent with a pathway towards low greenhouse gas emissions and climate-resilient development”. See the full Paris Agreement at: http://unfccc.int/files/essential_background/convention/application/pdf/english_paris_agreement.pdf.

The Climate Bank Outside the European Union: The Case of the Western Balkans

The region of the Western Balkans is historically, culturally and geographically part of Europe. In this respect, it is inevitable that pollution generated in the region would affect the air conditions of European Member States. Indeed, air pollution knows no borders, and countries like Romania, Italy, Hungary, Bulgaria, Greece and Croatia, but also Poland, Germany, Czech Republic and Austria suffer from the pollution cloud generated by the old, inefficient and sub-standard coal-fed power plants in the region. As reported by a number of NGOs led by Health and Environment Alliance,¹⁷ “in 2016, 16 coal power plants generating 8 GW in five Balkan countries emitted more sulphur dioxide pollution than the entire fleet of European coal power plants (250 equal to 156 GW), combined with equally worrying levels of particulate matter and nitrogen oxides”. The same study indicates that “while governments in the EU struggle to reduce air emissions to keep air quality standards, additional and harmful pollution travels into the EU from five neighboring Western Balkan countries: Bosnia and Herzegovina, Macedonia, Montenegro, Kosovo*¹⁸ and Serbia, a fact that is often overlooked”.

As such, there are no chances of success for the new European Green Deal without encompassing the Western Balkans in the ambition of making Europe carbon-neutral by 2050. In addition, the countries in this region¹⁹ are committed to joining the European Union in the near future and in their approximation process are striving to adopt and enforce all EU rules (the “acquis”), including on environment and climate action.

¹⁷ V. Matkovic Puljic and R. Gierens, *Chronic coal pollution. EU action on the Western Balkans will improve health and economies across Europe*, February 2019.

¹⁸ This designation is without prejudice to positions on status, and is in line with UNSCR 1244 and the ICJ Opinion on the Kosovo Independence Declaration.

¹⁹ Serbia, Montenegro, Albania, Bosnia and Herzegovina, North Macedonia and Kosovo.

The region of the Western Balkans is in any case in urgent need of transition towards a low-carbon society, primarily to benefit its citizens. Walking on the streets of Sarajevo, Pristina or Skopje in wintertime is sufficient to understand how polluted the air is. A study funded by the Norwegian Government and supported by the United Nations Environment Programme²⁰ reports that “more than 60% of people living in the Western Balkans use solid fuels such as coal and firewood to heat their homes, with only 12% of buildings connected to district heating systems”. The same study focuses on the impact on health diseases and indicates that air pollution is responsible for up to one in five premature deaths in several cities of the Western Balkans.

Moreover, preliminary information on the recent casualties due to Covid-19 worldwide seems to indicate that pre-existing respiratory diseases significantly increase the fatality rate of the virus, thereby making the goal of reducing smog, dust and air pollution more important than ever for the Western Balkan countries in order to safeguard the lives of their citizens.

The European Union and its Climate Bank will not turn their backs on this urgent issue, which also requires a fair and just transition, in line with areas of the European Union that rely heavily on fossil fuels. In particular, it is essential to seek synergies between a green and a digital agenda for the region and to support investments that facilitate its digitalisation and more efficient use of energy. This will improve living standards and support sustainable economic growth that is increasingly decoupled from increased energy consumption.

Leveraging the commitment of Western Balkan governments to implement COP21, the EIB will support investments that contribute to the transition to a low-carbon economy in the region. Certain countries have already started moving rapidly in the right direction. Montenegro has cancelled its plan to add a

²⁰ UN Environment, *Air Pollution and Human Health: The Case of the Western Balkans*, May 2019.

254 megawatt (MW) unit at the Pljevlja coal-fired power plant site, and is planning to decommission the existing Pljevlja coal-fired power plant within the next two decades (in line with Germany's timeline for decommissioning its coal-fired plants) and has introduced a carbon price on new investments to finance the cost of decarbonisation. North Macedonia has approved a national energy strategy that considers the hypothesis of a coal phase-out before 2030. The Climate Bank will support these ambitious plans, particularly insofar as green electricity generation is concerned. For example in Bosnia and Herzegovina, the EIB will partner on electricity generation from renewable sources to demonstrate that European finance is dedicated to green investments rather than to a new Chinese-financed and Chinese-constructed 450MW thermo power plant, which, by contrast, raises several questions as to its long-term sustainability.

The EIB will also further support less-polluting district heating networks, cleaner transport and the environment sector, which is particularly underdeveloped in the region. In this respect, the Climate Bank has already stepped up its efforts in the context of the Economic Resilience Initiative (ERI),²¹ which since 2016, has enabled the EIB to deploy additional financial resources, in the form of loans and grants, particularly to address long-awaited investment needs in the water, waste water and waste management sectors at municipal level. Along these lines, in December last year, the EIB concluded the very first deal as the Climate Bank in the Western Balkans with a €68 million loan and a €10 million ERI investment grant to finance the first waste water treatment plant in Skopje, North Macedonia. The plant will serve the needs of the approximately 500,000 inhabitants of Skopje, vastly improving the city's sustainability and putting an end to the direct discharge of untreated water into the Vardar River, which will also provide cross-border benefits, as the Vardar flows through Northern Greece as well.²²

²¹ European Investment Bank (EIB), "[The EIB's Economic Resilience Initiative](#)".

²² See European Investment Bank (EIB), "[Environmental and Social Data](#)".

Fighting pollution caused by untreated waters is at the core of EIB investments in the region, as witness similar projects supported in Gijlan²³ and Mitrovica in Kosovo*, where only 1% of the population are provided with waste water treatment. Waste water, waste management and pollution represent a challenge to be addressed across the entire region of the Western Balkans.

Concerning support for cleaner transport, the EIB has provided €100 million to facilitate a more integrated system designed to encourage a modal shift from road to waterway transport, through the rehabilitation and upgrading of existing fluvial infrastructure to improve the navigability of the Danube and Sava rivers.²⁴

More immediately, there is an even more urgent need for the European Union and all the European financial institutions to support the Western Balkans in addressing the needs triggered by Covid-19 both to save lives and to help firms emerge from the crisis stronger than before.

The consequences of this virus clearly indicate the importance of having efficient civil protection mechanisms, equipment and infrastructure, including public health infrastructure with the capacity to deal swiftly with epidemic crises in terms of intensive care units and testing labs. In Europe, as in the Western Balkans, healthcare has not always received the necessary attention of policymakers. In the Western Balkans, scientists, doctors and nurses have often fled their home countries for the prospect of a better salary, better equipment and infrastructure as well as a better family life elsewhere. Covid-19 now demands that authorities be better prepared in the future, and the EIB could be of help in this respect.

Sheet”, Luxembourg, 31 May 2019.

²³ See European Investment Bank (EIB), “[Environmental and Social Data Sheet](#)”, Luxembourg, 12 December 2018.

²⁴ See European Investment Bank (EIB), “[Environmental and Social Data Sheet](#)”, Luxembourg, 3 September 2018.

The EIB has so far extensively supported the healthcare sector in the region, with more than €400 million already committed to financing new hospitals and laboratories in Serbia and Bosnia and Herzegovina. New investments for a better healthcare system granting equal access to all citizens are currently being assessed in Kosovo, Montenegro and North Macedonia. Pandemic preparedness and response capacity will need to be upgraded, and the EIB is ready to contribute to this with a view to safeguarding public health and human lives first.

Covid-19 has also hit hard the region's already fragile and export-oriented economy. Precise estimates on the real impact on the economy both in the short term and the medium to long-term are impossible to make at this point in time. The most pessimistic scenarios envisage major economic downturns at least for 2020 in a region that was already growing too little to be able to catch up with European macroeconomic standards within a generation. The countries' lockdowns have strongly impacted the productivity of firms in the region. Companies, utilities, municipalities and other entities are experiencing a sudden halt in their revenue streams and have no liquidity to pay salaries, due invoices, and so on, let alone taxes. A relaxation of rules by public authorities combined with liquidity injections is unavoidable to keep the system alive and capable of running again as soon as the freeze is over. In this respect, the Bank is ready to increase its financial support, particularly for small and medium-sized enterprises, to enable them to keep workers and navigate safely through such an unprecedented crisis and become more resilient and better performing than before.

The EIB has operated in the region of the Western Balkans for more than forty years and is prepared to do even more in the future to contribute to making the lives of the citizens of the Western Balkans at least as good as, and possibly better than, that of the citizens of the European Union.

In conclusion, the Climate Bank of the European Union is ready to build on its capacity and expertise to support the extension of the Green Deal for Europe to the Western Balkans.

The EIB looks forward to the upcoming adoption of a new Green Deal for the Western Balkans, if possible by May 2020 at the EU-Western Balkans Summit in Zagreb, and is eager to engage with the relevant stakeholders to enable the region to transition away from a carbon-intensive economy towards a fully European carbon-neutral environment in the near future.

12. The Role of Technology in Future Infrastructure

Luca Milani, Stefano Napoletano, Nicola Sandri

Traditionally, capital projects and infrastructure have been seen as predictable, engineering-driven, often labour-intensive, and not at the cutting-edge of technology. But the reality is changing, and fast. A wide array of disruptive, breakthrough technologies are rapidly transforming the way infrastructure is built and operated, reshaping the way the infrastructure industry operates, especially using big data.

Impacting nearly every major economic sector, the infrastructure industry's output is a powerful force in a country's long-term economic growth and stability. Yet the infrastructure industry faces unprecedented challenges, such as energy transition, the mobility revolution, and infrastructure projects growing in size and complexity, to mention only a few. Further, while facing these headwinds, infrastructure lags behind other industries in critical ways, including the lowest productivity gains, degree of digitisation and investments in IT.

With so much to gain, the infrastructure industry is on the brink of a productivity revolution. Advanced analytics may be one of the biggest drivers of change with increasing investments in disruptive technologies. Leading industries in advanced analytics, such as retail and ecommerce, banking and insurance, and healthcare show that aggressive first-movers create competitive advantages while fast-followers with excellent implementation skills are just able to keep up.

It is fundamental to understand how infrastructure players can leverage advanced analytics in their operations to keep ahead of the competition and how to build advanced analytics capabilities. The following themes are fundamental:

- **Analytics is no longer optional in infrastructure** - The industry is facing different trigger points, including regulatory changes affecting data considerations, lagging business performance, new levels of public scrutiny, and rapidly expanding technology capabilities that require leaders to make analytics part of the way forward. Starting an analytics journey is of critical importance, with the caveat that having a clear purpose in mind is key. For example, companies should pursue data-driven approaches to specific business questions or operational challenges, rather than “analytics for analytics’ sake.”
- **Focus digital efforts on enhancing productivity** - The infrastructure sector has experienced low productivity gains over the last decade compared to the global economy. Advanced analytics and digitalisation can significantly help improve productivity and have the potential to reduce project costs.
- **Integrate data science into decision-making processes** - There are major disruptions across the value chain which will lead to shifts in the value pool and new archetypes of successful players using new working methods such as BIM (Building Information Modeling), modularisation, etc. Companies will need to understand how to leverage data effectively to drive decisions across the entire value chain.
- **Build analytics efforts on proven successes** - Advanced analytics pilots have been used to improve the efficiency of infrastructure projects, reduce injuries for transportation operators, improve customer experience in airports, digitally enable a major dam construction and more. Studying these proven cases will help companies understand how advanced analytics can be deployed and identify use cases for their needs and investment capacity.

- **Drive innovation through a Digital Factory** - Companies should embrace the potential of digital disruption and drive innovation through new ways of working that are nimble and efficient. This can be accomplished with a Digital Factory – a “virtual” organisation with few dedicated resources organised around digital rooms with cross-functional teams. Adopting an agile approach to guarantee the progressive roll-out, the concurrent efforts of such rooms scale-up digital transformation.
- **Analytics do not replace people in infrastructure, but rather expand their capabilities with new tools** - Some industry leaders fear the rise of advanced analytics might lead to the elimination of jobs. Rather than replacing them, analytics provides the opportunity to empower people to do their jobs more effectively by providing new and insightful ways of looking at a particular project or the business as a whole.

The case histories below provide examples of relevant cases in which technology was used to deliver impact for infrastructure and construction projects or companies in the ecosystem (i.e. infrastructure users such as transportation companies) and, as such, make the aforementioned points clearer.

Case 1: Project Risk Management Optimisation and Predictive Maintenance Strategy in a Major Infrastructure Project

How can we transform the efficiency and safety of delivering a major infrastructure project?

This case involved a £15 billion infrastructure project in a capital city. The focus was to enhance risk management and implement a predictive maintenance strategy. The objectives

were to predict ground movement and optimise sensor set up and then use the data from the 250,000 sensors to optimise time use by engineers. Both senior leadership and on-the-ground engineers were having a hard time trying to make sense of the volume of data from so many sensors and needed to consolidate and clarify the process. The approach used was the following:

- Ground movement models were built in order to understand what should happen when a particular tunnel was dug;
- Sensor data was analysed, and the traditional Gaussian models were extended with spatiotemporal correlation derived from machine-learning techniques;
- Predictive models were built to distinguish between anomalies in the data and simple sensor failures;
- The trade-off between monitoring intensity and accuracy of knowledge was analysed and a more efficient sensor array / monitoring regime was designed.
- The company was facing two major challenges:
 - Risk management (How do you ensure nothing is missed?)
 - Cost (How do you keep monitoring costs to a minimum?)

The available data sources were:

- Sensor data
 - Readings (time series with set frequency)
 - Locations (coordinates)
- Excavation data
 - Tunnel Boring Machin (TBM) location
 - Tunnel sizes
- Other interesting data sources
 - Machine descriptors
 - Processes
 - Teams
 - Other data (past tunnel collapse events)

Monitoring costs were reduced by 20%, worth an estimated \$20 million. The company could now predict adverse events 7 days in advance and had automated basic analysis, enabling engineers to focus on value-adding interpretation rather than just spotting issues. This was successfully deployed in two stations. The ability to hunt for patterns between sensors is changing the industry by enabling real-time anomaly detection, event forecasting and monitoring regime optimisation.

Case 2: Risk Driver Analysis and Improvement of Employee Safety in a Transportation Company

How can a transportation company understand, predict and intervene to reduce employee injuries?

The transportation company was falling behind its peers on employee injuries, and thus it had improving workforce safety as a key strategic goal. In particular, the two objectives were to understand the risk drivers of injuries and to predict how to intervene to reduce the injuries. The following approach was used:

- Five factors driving injuries were identified using explanatory modelling (random forest) providing the company with a fact-based view of injury drivers;
- A predictive model (XGboost) was developed, identifying the 10% of employees working at high risk on a daily basis;
- The company's IT team focused on the development plan of data pipelines, enabling the safety team to improve and refresh the models;
- Based on the insights, the company defined a 12-18-month intervention plan to improve employee safety.

The explanatory model identified five key drivers of injury (i.e. hours worked in the last 24, 48, 120, 168 hours and number of shifts worked in the last 24 hours), with all of them related to employee fatigue. Many myths were also disproved by the model (e.g. higher risk due to jet-lag).

The predictive model flags 60% of the total employees injured. Completing this project has made it possible to flag these employees before the shift. However, how much in advance depends on the specific risk drivers (e.g. employee experience can be known months in advance, the weather can only be forecast days before).

Overall, the company was able to reduce personal injuries by up to 45%. The advanced analytics approach made it possible to understand risk drivers behind personal injuries and to start addressing them by going beyond a classic 2-dimensional HSE approach focused on root cause analysis of an injury. The company used the work done to start designing actions to address key injury drivers and was able to meaningfully reduce the injury ratio.

Case 3: Digital Tools Deployment To Enable Lean Construction in a South African Mining Company

How can we digitally enable a major lean construction project?

The mining company in South Africa was developing the first digital mine in its portfolio. The Group started to implement the lean construction methodology and was investigating the deployment of digital tools. An agile approach was used, identifying the highest value opportunities to:

- Provide real-time tracking and monitoring of progress in the field;
- Identify high-risk areas that required management interventions to stay on track;

- Enhance transparency and efficiency of information flow between workers;
- Provide insights about priority areas and root causes of delays.

Three integrated pilots were launched:

1. Task scheduling application

A digital task management tool was tested with one team to manage daily construction activities and provide real-time task management and progress updates. The platform had several functions:

- Push activities directly to the relevant foreman;
- Provide real-time production updates and root cause updates for potential delays;
- Offer a platform to enable real-time communication about challenges;
- Minimise time to prepare daily production updates with root cause reports;
- Refine the minimum viable solution.

Communication of daily work schedules: the task scheduling application pushed daily check in/outs to the devices of foremen. The impact was a reduction of ~1 hour of production delays and ~3.5 hours of meeting time per week.

Flagging delays/issues experienced on-site: the task scheduling application had a digital task confirmation programme and a chat. The impact was having real-time feedback from site foremen on blockers, logged message data per task, free issue reporting (direct feedback between foreman and team) and real-time task completion tracking.

Tracking performance and visually representing data: the task scheduling application could automatically generate excel sheets with infield data captured and PPC digital dashboards. The impact was the elimination of ~1.5 hours dedicated every week to updates and having production data automatically available and ready to be verified.

Adjustment of schedules to re-plan based on infield progress: the task scheduling application had automatic progress feedback so plans could be updated in real-time on the phones of foremen, allowing them to know new targets immediately. The impact was the elimination of ~1.5 hours dedicated to the preparation of the PPC dashboard and the possibility of sharing dashboards with the entire team.

2. Digital twin

Automated progress measurement and planning for construction was introduced to provide real-time progress updates and enable better decision making. The applicability of the tool to other areas for real-time progress monitoring was also analysed.

The project involved a partnership with Veerum with an agreement to launch a pilot for a single location (the dam construction). The site was created as a digital twin and made viewable. The imagery was provided by a third-party drone company with uploads at set intervals (twice a week). Veerum was able to ingest and refresh the model in less than 12 hours.

The impact was the creation of an operational digital twin with progress measurements available in less than 2 weeks (including the time to setup the schedule with the drone provider). Automated tracking progress on individual dam lining layers (less than 10cm of thickness) was achieved by differentiating the progress by texture and colour. All the existing reports used in planning sessions were recreated automatically by the twin. The team was able to use the tool for automated and *ad hoc* progress tracking (providing a foundation for planning meetings) and transparency measurement.

3. Advanced analytics

The company's data sources (e.g. Primavera, Aconex, Costrac, Gate, Weather, etc.) were assessed defining a set of use cases. The use of advance analysis for the identification of project risks in construction was explored creating a real-time early warning ML model. An AA roadmap was also created for the company

with prioritised use cases and recommendations on additional data sources and a data architecture blueprint.

The result was a cross-functional data cube containing and linking previously siloed databases. An end-to-end data pipeline was developed to process the raw data. Clear requirements for data collection were defined to create additional future use cases and a model was developed to estimate the potential of no delay vs long delay (>80% accuracy). The company was able to replicate the effort with more data with the objective of creating a more statistically relevant and robust model enhancing day-to-day decision making.

Conclusion

The importance of advance analytics in the capital project and infrastructure world is becoming increasingly important. Advanced analytics can help improve productivity, reduce project costs and drive “smarter” decisions across the entire value chain. The cases shown above are concrete examples of the impact advance analytics investments can have:

- Case 1 – Reduction of monitoring costs by 20% and ability to predict adverse events in advance.
- Case 2 – Identification of injury drivers and reduction of injuries up to 45%.
- Case 3 – Project risk identification, definition of leading delay and cost indicators, creation of model to verify accuracy and validity of data.

Companies in the capital project and infrastructure world will need to build/acquire advanced analytics capabilities and understand how to leverage data effectively to improve their core businesses and potentially create new potential business adjacencies, such as data monetisation models. For example, users of transportation infrastructure, such as highway, railway and airport companies, have the potential to access data (e.g. traffic data) that is useful for local authorities.

Conclusions. The Imperative of International Cooperation for Quality Infrastructure

Infrastructure has emerged as one of the trending issues in the last decade. However, its progressive transformation from a tool of economic development to a source of power and international leverage has triggered some important consequences. First, decisions on infrastructure investments today are driven not only by economic rationality but also by geopolitical considerations: major powers have started a global competition to finance and build infrastructure in countries and markets deemed as strategic. The shift in focus from the economic to the geopolitical dimension has often proved inefficient, with suboptimal allocation of the available financial resources. In some cases infrastructure has been built where politically strategic to gain influence in the recipient countries, mostly at the expense of economic rationality. The race for global infrastructure leadership has somewhat distorted the infrastructure market, and some projects undertaken in recent years have proved inadequate, financially and environmentally unsustainable and often of poor quality.

The most emblematic example is the Belt and Road Initiative (BRI). After years of huge Chinese investments in South and Central Asia, the Middle East and North Africa, some host countries have experienced problems in dealing with Chinese investments. China's infrastructure initiative has been criticised

for poor standards and wasteful spending, and the lack of adequate pre-project viability analysis has been identified as one of the most important factors in failed projects. Further elements include the lack of stakeholder engagement, the low level of local worker participation in the infrastructure initiatives and the barriers hindering local and foreign contractors from bidding for contracts. Last but not least, Chinese projects in host countries have in some cases proved oversized compared to the real needs of these countries and have exacerbated debt vulnerabilities where situations of high-indebtedness were already in place, resulting in a growing fiscal risk.¹ China has recognised some of the major shortcomings, and adopted the so-called BRI 2.0 at the Belt and Road Forum in April 2019. The second phase has formally included some new pillars: increased transparency, enhanced sustainability, open procurement with competitive bidding and better risk assessment in project selection.

In this sense, Chinese authorities are moving towards a more cooperative and coordinated approach in project realisation: in March 2019, the Chinese Ministry for Foreign Affairs signed a Memorandum of Understanding with the Asian Development Bank (ADB), the Asian Infrastructure Investment Bank (AIIB), the European Bank for Reconstruction and Development (EBRD), the European Investment Bank (EIB) and the World Bank to establish the Multilateral Cooperation Center for Development Finance. According to the Memorandum, the Center will serve as a platform to foster high-quality infrastructure and connectivity investments for developing countries, taking into account debt sustainability in mobilising finance. The main purpose is to boost information sharing across the Parties in order to avoid duplication and enhance collaboration.²

¹ See World Bank, *Belt and Road Economics: Opportunities and Risks of Transport Corridors*, June 2019.

² See *Memorandum of Understanding on Collaboration on Matters to Establish the Multilateral Cooperation Center for Development Finance*, 25 March 2019.

The quest for coordination and the urgency to set up regional and global frameworks to avoid overlapping and duplication in infrastructure investment are gaining momentum, and an increasing number of initiatives have been established for this purpose. In 2018, the European Commission developed a new Strategy for Connecting Europe and Asia, with proposals to enhance connectivity according to emerging principles such as sustainability and digitalisation. The EU has committed to engaging with Asian partners to create efficient connections and networks between the two continents, promoting partnerships for connectivity based on commonly agreed rules and standards. In transport, the EU's main goal is to connect the Trans-European Network for Transport (TEN-T) with networks in Asia. The rationale behind this is to speed up interconnections to avoid the overlapping in the EU – and in the EU neighbourhood – of the existing network with projects financed through the BRI, thus containing the flow of Chinese investments into the EU and its main partners.³ In April 2019, the EU and China agreed to step up their cooperation and the synergies between TEN-T and the BRI, recognising the importance of the economic, social, fiscal, financial and environmental sustainability of Europe-Asia connectivity and interoperability. It seems to be the first – necessary but not conclusive – step in moving towards a level playing field in infrastructure competition and the development of shared norms and standards.⁴ A proposed field of cooperation and coordination has been the setting up of a joint study on establishing a new EU-China transport corridor through the Balkans designed to identify the missing links and the main bottlenecks, thereby allowing smooth freight transport.⁵

³ European Economic and Social Committee, *Connecting Europe and Asia - Building blocks for an EU Strategy*, JOIN(2018) 31 final, September 2018.

⁴ See *EU-China Summit Joint statement*, in particular paragraph 17, Brussels, 9 April 2019.

⁵ European Commission, *China-EU Connectivity Platform 2019 Annual Action Plan*, April 2019.

The European Union has also stepped up its coordination efforts with Japan with the clear purpose of containing Chinese investments worldwide. In September 2019, the two Parties signed a “Partnership on Sustainable Connectivity and Quality Infrastructure”, in which they committed to working together both bilaterally and multilaterally on all aspects of connectivity in order to create synergies and coordination in their respective cooperation on infrastructure with third countries.⁶ They identified the regions of Western Balkans, Eastern Europe, Central Asia, Indo-Pacific, as well as Africa. The partnership is underpinned by the principles of a free, open, rules-based, fair, non-discriminatory and predictable investment framework in order to ensure adequate standards of economic, fiscal, financial, social and environmental sustainability. The EU and Japan have recognised the importance of establishing tools to foster private investments, including the possibility of starting joint projects in third countries with the engagement of the private sector. The signing of a Memorandum of Understanding (MoU) between the European Investment Bank (EIB) and the Japan International Cooperation Agency (JICA) goes in the same direction. The Memorandum is intended to strengthen cooperation between the two financial institutions in order to meet the increasing demand for private investments in developing countries.⁷

Another forum of regional coordination in infrastructure development is the Quality Infrastructure Partnership within the Indo-Pacific Strategy. In November 2018, Japan and United States, alongside Australia, established a Partnership for Quality Infrastructure with a focus on the South-Asian region and Africa. The original aim was to counteract Chinese infrastructure investments in the region and create financial firepower to give third countries an alternative source for

⁶ See Ministry of Foreign Affairs (Japan), *The Partnership on Sustainable Connectivity and Quality Infrastructure Between the European Union and Japan*, 27 September 2019.

⁷ European Investment Bank (EIB), *EIB expands its partnership with Japan's JICA*, 27 September 2019

financing their infrastructure needs. To that end, the Japanese have made available about \$116 billion to fund infrastructure investments in East Asia. On the other side, the United States has enforced the BUILD Act, with the establishment of a new United States International Development Finance Corporation (USIDFC) tasked with financing new infrastructure projects in East Asia with a financial pool of \$60 billion. However, the bulk of US-Japanese investments seems unable to counteract the massive Chinese investments in Belt and Road 2.0.

Furthermore, over the last few months the Chinese and Japanese governments appear to have been moving towards a de-escalation of competition in infrastructure investments in third countries, amid an overall improvement of bilateral ties. The Japanese government seems eager to avoid a direct economic confrontation with China over infrastructure investment, also in view of the modest US financial support to the Partnership for Quality Infrastructure Initiative. As part of the forthcoming visit of Chinese President Xi Jinping to Japan, the two countries have agreed to hold a forum on infrastructure investments in third countries, potentially leading to agreements in Southeast Asia and elsewhere. Public financial institutions such as the Japan External Trade Organization, the Japan International Cooperation Agency and the Japan Bank for International Cooperation will be represented, as well as the China Development Bank and China Export and Credit Insurance.⁸

The most pressing problem, however, i.e. the economic, social and environmental sustainability of infrastructure projects, can hardly be tackled bilaterally. The multilateral arena is the most appropriate to assess the real global needs for infrastructure. In this respect, a key role should be played by the multilateral and regional development banks as these financial institutions

⁸ *The Japan Times*, “Japan and China to open talks on foreign infrastructure projects amid warming ties”, 23 March 2019; D. Suzuki, “Japan and China to hold infrastructure forum during Xi visit”, *NIKKEI Asian Review*, 16 September 2019.

have privileged knowledge of existing needs and gaps in member countries, as well as the technical expertise to evaluate the economic rationale of a given infrastructure project and its social and environmental feasibility. Developing countries in particular – lacking a transparent and sound regulatory framework, an effective rule of law, consistent regulatory norms and the capacity of public officials to plan and manage large-scale infrastructure – require the intervention of multilateral institutions to ensure the overall quality of the infrastructure and the attraction of private investments. Bilateral development agencies and multilateral development banks must play a major role in providing technical assistance, training and capacity building to help officials in this regard.

However, the main international political fora, such as the G7 and G20, should lead cooperative efforts and agree on global standards for the construction of quality connectivity infrastructure worldwide. In 2016, the G7 Ise-Shima Principles for Promoting Quality Infrastructure Investments were the first attempt to coordinate the efforts of advanced industrial economies and bridge the growing gap between infrastructure demand and investments, at the same time ensuring the highest social and environmental standards.⁹ The five principles were:

- Ensuring effective governance, reliable operation and economic efficiency in view of life-cycle cost as well as safety and resilience against natural disaster, terrorism and cyber-attack risks.
- Ensuring job creation, capacity building and transfer of expertise and know-how for local communities.
- Addressing social and environmental impacts.
- Ensuring alignment with economic and development strategies, including the aspect of climate change and the environment at the national and regional levels.
- Enhancing effective resource mobilisation, including through PPP.

⁹ G7 2016 ISE-Shima Summit, *G7 Ise-Shima Principles for Promoting Quality Infrastructure Investment*, May 2016.

The Japanese government also took the lead in promoting quality infrastructure at the 2019 G20 forum, which endorsed the G20 Principles for Quality Infrastructure Investment. The main goal, which summarises all the other principles, is to maximise the positive impact of infrastructure in order to achieve sustainable growth and development. To this end, it is essential to improve economic efficiency in view of life-cycle costs. Strategies to mitigate the risks of delays and cost overrun, alongside innovative technologies that improve data availability to monitor infrastructure building, use, performance and safety are thus essential. The third principle focuses on integrating environmental considerations into infrastructure investments through the entire life-cycle of infrastructure projects, with the utmost transparency for all the stakeholders involved. Strictly linked with this principle is the imperative need to build resilience against natural disasters, with a well-designed risk management when designing infrastructure. Furthermore, the inclusion of social considerations in infrastructure investments should be ensured throughout the project life-cycle. Finally, when it comes to quality infrastructure, effective infrastructure governance plays a crucial role: openness and transparency of procurement should be top priorities to ensure that infrastructure projects are value for money, safe and effective, and that investment is not diverted from its intended use. In this respect, well-designed and well-functioning governance institutions should be in place to assess the financial sustainability of individual projects and prioritise potential infrastructure projects. Macro-level debt sustainability needs to be transparent, given that infrastructure investment can have a significant impact on public finance. This will be crucial in promoting fiscal sustainability, saving fiscal space for future potential projects and crowding in more private investments. To this end, anti-corruption procedures are essential to safeguard the integrity of infrastructure investments.¹⁰

¹⁰ G20, *G20 Principles for Quality Infrastructure Investment*, Osaka, 29 June 2019.

The OECD has taken up the challenge and established the OECD Long-term Investment Project, aimed at facilitating long-term investment by institutional investors such as pension funds, insurance companies and sovereign wealth funds, addressing both potential regulatory obstacles and market failures. Long-term investments are deemed essential to ensure sustainable growth, job creation and stability, and as a key tool to reduce infrastructure gaps, especially when public financing is difficult due to fiscal constraints. The G20/OECD Taskforce on Long-Term Investment is an example of cooperation between the two multilateral institutions, with the final goal to foster private investments in member countries.

High-quality infrastructure is a long-term process that goes beyond finance. Procuring, building and maintaining this type of infrastructure requires a cooperative approach among a large number of stakeholders. Local governments, bilateral development agencies, multilateral development banks and private companies have a critical role to play in promoting high-quality infrastructure, especially in developing countries. High-quality infrastructure ensures direct positive impacts: higher efficiency, increased safety, reduced environmental impact and, above all, increased GDP, FDI attractiveness and job creation. On the other hand, low-quality infrastructure generates lasting negative spillover effects. Lack of transparency and economic rationality in planning and building infrastructure may lead to long-term fiscal deterioration and increased public debt, accidents and environmental damage.¹¹ The transition towards a Quality Infrastructure Paradigm is a long-term challenge that requires an international cooperative effort to coordinate national and often competitive plans. Considering the impact that infrastructure has on climate change is not just a necessity, but a real imperative: a swift transition towards a sustainable approach and standards in this sector is more and more urgent.

¹¹ See D. Runde, *Quality Infrastructure: Ensuring Sustainable Economic Growth*, Center for Strategic and International Studies (CSIS), January 2017.

This is the most important contribution that the infrastructure sector can give to the global efforts to enhance sustainability, also by complying with the UN Sustainable Development Goals.

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