FINANCING SUSTAINABLE AND RESILIENT INFRASTRUCTURE BY CREATING A NEW ASSET CLASS FOR INSTITUTIONAL INVESTORS

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Global Infrastructure Basel Foundation (GIB) is a Swiss non-profit foundation working to promote sustainable and resilient infrastructure globally.

GIB engages with a wide range of stakeholders to build links between infrastructure projects and sources of finance.

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ABSTRACT

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Financing sustainable and resilient infrastructure, which effectively manages environmental, social and governance (ESG) risk, while supporting the delivery of the United Nations' (UN) Sustainable Development Goals (SDGs), is not only attractive from an investor perspective to mitigate various forms of financial risks. It also serves as a valuable strategy from a policy making perspective for host nations, especially from emerging and developing economies, to attract external funding capable of generating both strong economic, as well as a high social and environmental returns. As opposed to conventional infrastructure, which is characterised as "Alternative Investment", combining sustainable and resilient infrastructure equity and debt into a Hybrid Sustainable Infrastructure (HSI) Asset Class, does make for a very compelling argument to draw a much larger pool of private capital, including institutional investors to bridge infrastructure equity investor interests and debt holder interests under one umbrella. HSIs, which may come in tradable and non-tradeable forms, make the added value of sustainability and resilience accessible to capital markets, without impairing traditional infrastructure returns.

WHY INFRASTRUCTURE MATTERS

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1. WHY INFRASTRUCTURE MATTERS

Infrastructure represents the backbone of our economies. It powers our machines, creates networks that connect people, helps to transport goods and enables services such as trade, health care and education. In short: Infrastructure largely determines our livelihoods today and in the future; it is key for safeguarding our environment; and represents the seams of our societal fabric. These are the reasons that infrastructure also lies at the core of achieving the UN's Sustainable Development Goals (SDGs). Conventional infrastructure will not enable us to achieve these objectives. Instead, policy-makers and strategic asset allocators must acknowledge the irreplaceable contribution of sustainable and resilient infrastructure to achieving the SDGs.

1.1.Conventional Infrastructure

Infrastructure has no single universally agreed definition. Nevertheless, it is being increasingly recognised through time as the backbone of the world's economy. Infrastructure often comprises multi-faceted systems of both physical and non-physical elements ranging from tangible assets to management systems. This paper focuses primarily on physical assets that provide services to the public, such as water, sanitation, energy, housing, transport, health, education, recreation, protection from natural hazards, information and communication technologies. In the sense described in this paper, infrastructure typically possesses the following characteristics: 1. Provision of public services; 2. Low elasticity of demand; 3. Often creating a quasi-monopoly; 4. Subject to particular regulation; 5. Long service life; 6. Revenues protected from inflation; 7. Regular, stable, yet late cash flows; 8. Being relatively illiquid investments (these characteristics are described in more detail in Annex 1). In addition, from an investor's perspective it is relevant that infrastructure investments are 9. localised (you cannot walk away with a metro system or a sewage plant); and 10. asset heavy (high proportion of capital cost, when comparing to other asset classes).

1.2.The Reliance of the Sustainable Development Goals on Infrastructure

In September 2015, 193 nations endorsed the Sustainable Development Goals (SDGs), replacing the Millennium Development Goals whose prerogatives had come to an end. The SDGs set the global development agenda for 2030 amid global trends that see government expenditures, putting the financial achievability of the SDGs into jeopardy shrink (see chapter 2.5 The Gap's Causes). The achievement of at least 5 out of 17 Sustainable Development Goals does directly or indirectly hinge upon the expansion and improvement of infrastructure, requiring a significant financial investment (see Annex 2).

Although the United Nations (2005) have long stressed the need for expanding and improving

existing infrastructure[1], doing this in a conventional way will inevitably entail serious drawbacks. Indeed, conventional infrastructure tends not to optimize social or environmental benefits. This is partly due to civil society being hardly involved in the decision-making process. Moreover, the environmental impacts of conventional infrastructure are often underestimated, as are its exposure to environmental variations through time, such as climate change. Such planning can have adverse consequences not only on the environment or social coherence, but also on the profitability of a project.

The Grand Inga Dams in Democratic Republic of Congo substantiate to some extent the adverse effects often caused by conventional infrastructure. According to Brunn (2011), *"Grand Inga's power has never been considered for rural electrification and domestic use"*, indicating that the social benefits of the project are questionable, at least for some local populations. Furthermore, since the river Congo feeds deep oceanic currents in the Atlantic Ocean, any disruption of flow is likely to have dramatic consequences on regional – and potentially even global – hydrological cycles. Finally, there might be economic drawbacks for both the owners of the dams and the surrounding businesses: indeed, substantial sediment loads have been recorded that would represent a major threat during the operational phase of the dams. At the same time, agriculture downstream would undergo painful and irreversible change caused by salt water intrusion anticipated for a distance of 50km upstream (Brunn 2011). Taking measures to improve the Sustainability and Resilience of infrastructure may not be able to address all of these issues. However, such measures can mitigate a large part of them, or at least aid in making potential social and environmental consequences more transparent.

1.3.Sustainable and Resilient Infrastructure[2]

One aspect of "Sustainable and Resilient Infrastructure", as compared to conventional infrastructure, is that it minimises such unintended social, environmental and governance (ESG) risks. Secondly, sustainable infrastructure offers additional benefits, which are related to achieving the Sustainable Development Goals (SDGs). Examples are job creation, poverty alleviation, participation, gender, biodiversity, or financial benefits for the public, such as economic development. Thirdly, the resilience feature of "Sustainable and Resilient Infrastructure" systematically addresses three distinct features: a) More effective preparedness and higher resistance against damages caused by natural or manmade disasters; b) Lower human and animal suffering as well as material loss from such disasters; and c) Faster recovery from the damages caused (GIB 2017).

Sustainable infrastructure minimises specific ESG risks, for example by involving local stakeholders on the governing boards of infrastructure design, construction and operating companies. This is one way taking public opinion, expertise and needs into account during all phases of an infrastructure lifecycle, leading to higher acceptance and better public understanding of an asset's importance and framework conditions. Moreover, in sustainable infrastructure, high priority is shown to sound economic management, accountability,

1 "Investments in infrastructure – transport, irrigation, energy and information and communication technology – are crucial to achieving sustainable development and empowering communities in many countries. It has long been recognized that growth in productivity and incomes, and improvements in health and education outcomes require investment in infrastructure." (United Nations 2015b)

2 For the purposes of brevity, this text uses the term "Sustainable Infrastructure" to refer to "Sustainable and Resilient Infrastructure". The more comprehensive term "Sustainable and Resilient Infrastructure" is, however, described in detail in this chapter.

transparency, and to protecting working conditions. From an environmental perspective, risk management of sustainable infrastructure differs from conventional infrastructure by striving to avoid harming biodiversity and ecosystems, and by implementing measures to drastically reduce its greenhouse gas emissions.

The SDGs can be summarised into three key focus areas: 1. The resilient and sustainable extension of the economy; 2. The cultural, political and educational development of societies; and 3. The preservation and protection of the environment and its biodiversity. Sustainable infrastructure incorporates these three aspects. Through addressing a wide range of opportunities, which are all related to livelihoods, it has large potential impacts on the stability of the economy as a whole. Moreover, it contributes to social cohesion, for example through the accelerated delivery of (renewable) energy and energy efficiency technology, water, sanitation and communication networks. Sustainable infrastructure also plays a key role in conserving biodiversity, for example by reducing impacts on migration pathways and habitats (see Annexe 3).

With a notable rise in catastrophic outcomes of man-made climate change over the past few decades, the concept of resilience has taken on much greater significance on the built. Resilience is defined by Global Infrastructure Basel (2017) as the ability of individuals, communities and systems to withstand disruptions. In addition, resilience in infrastructure offers specific benefits to the daily operations of a project and its surrounding environment before, during and after disruptive events. These benefits can be described as "resilience dividends", which can be categorised as financial, human, natural, physical, political and social dividends. Financial dividends relate to the avoided economic losses in daily operations and minimisation of potential reconstruction costs or lost revenue during disruption. Human dividends have primarily to do with the avoidance of losses of human lives and injuries. Natural dividends relate to the minimisation of damage to natural capital and biodiversity in areas surrounding the project. Physical dividends occur when there is uninterrupted access to critical infrastructure. Political dividends relate to handling of response efforts in the aftermath of the disruption and their impact upon political processes. Social dividends relate to improvements in people's livelihoods and societal cohesion. Thus, the resilience dimension of sustainable infrastructure contributes to the long-term de-risking of infrastructure projects (and of the underlying investment) by minimising impacts due to external shocks and stresses, including financial losses.

For infrastructure to be sustainable, it is also important that it is contextualised within its social, economic and environmental surroundings. From systemic perspective, this means that sustainable infrastructure fits into the existing fabric of its particular natural, social and economic environment and, moreover, strengthens the ties between these spheres in a holistic way. A sustainable and resilient approach to building a new school, would take into account multiple benefits apart from simply providing a roof for students and their teachers to deliver classes. A prototype sustainable and resilient school for example, would be integrated in its surrounding neighbourhood by design and participatory planning, provide space for extracurricular indoor and outdoor recreational activities (e.g. in a park around the school, or rooms for clubs to meet in the evening); constructed with healthy and energy saving materials, including a solar roof, which help to protect the environment; offer shelter in case of emergencies (e.g. floods or earthquakes, depending upon the specific exposure); and host a local medical and social dispensary with additional advisory services, which can in turn also be used by the members of the school.

Through undertaking sustainable infrastructure projects, the gains would be substantially multiplied. Systemic benefits

exceed the sum of specific benefits. This is also true on a larger scale. For example, the Silk Road Fund, linked to China's Belt and Road Initiative (BRI), does not only aim to connect particular towns, but also to establish an entire rail, road, air and maritime network that boosts economic development across Eurasia and enrich cultural exchanges. In this respect, appropriately contextualised projects along the BRI represent a great opportunity to provide multiplied added value and overall sustainability. In the first years of the BRI project, from 2011-2019, the Chinese government has, however, focussed on just one aspect of sustainability, namely the economic effects. By applying such a narrow lens, Chinese developers tended to miss the environmental and social potential of a more holistic project design. Through this short-sighted view, the BRI became much more controversial than if it had taken good sustainability and resilience practise more seriously. Failing to apply internationally accepted sustainability and resilience standards in executing the BRI spurs both local and global distrust. It will eventually also threaten the economic efficiency of the initiative.

Case Study 1

The Medieval "Belt and Road Initiative" of the Swiss House of Zähringer

A historical case of a contextualised sustainable infrastructure development can be seen in the achievements of the medieval house of Zähringer. The House demonstrated an early model of integrated development. Within a few years they founded a number of Swiss and German Black Forest cities, like Zurich, Bern, or Freiburg im Breisgau. Thanks to the high efficiency and co-ordination of the initial "greenfield infrastructure" implementation, the cities' economy soared. Bern, for example, became a Freie Reichsstadt (autonomous city) in 1218, only 27 years after the first buildings were constructed. Such rapid development could not have occurred without integrated planning: it is only because the Zähringer settlements fit into a structured network that they could benefit from each other and initiate the dynamics that saw them blooming (even to this date). Similarly, sustainable infrastructure exploits all the available resources to deliver the best possible service while ensuring that its operation is long lasting, that is: it enhances the productivity of the whole network that it relies on.

From the bottom-line point of view of investors, it would be desirable to have tools and products that make the added value of ESG-, SDG-, resilience- and context-aware, future-proof planning and operations of sustainable infrastructure accessible to capital markets (see chapters 4-5).

THE INVESTMENT GAP

2. THE INVESTMENT GAP

Despite tremendous investments in the development of infrastructure, the infrastructure investment gap remains enormous: USD 0.8-1 trillion will be missing globally every year through 2030 according to McKinsey (2016).

2.1.Public Infrastructure Investment in Decline

According to a recent G20 report (2018), USD 35.47 trillion will have been invested by 2030, equivalent to USD 3 trillion in average annual spending. Of this amount, the vast majority is currently expected to come from the public sector. Indeed, there has been a long tradition of states planning, financing and developing their infrastructure. Adam Smith maintained, in the Wealth of Nations (1776), that it was the state's duty to construct and maintain the main infrastructure that would benefit the entire society. At that time, it was unrealistic for a private business to bear the initial cost of these heavy investments such as the construction of a bridge or the excavation of a canal. Today, privately developed infrastructure is forming an increasingly important proportion of infrastructure investment, alongside public private partnerships (PPPs).

2.2.Spatial Infrastructure Needs

The considerable financing needs for infrastructure vary spatially across the world. According to Mainelli and von Guten (2015) the total infrastructure financing needs amount to USD 2.256 trillion every year. The annual regional infrastructure financing needs in Africa amount to USD 93 billion, while they are as high as USD 750 billion in Asia per year between 2010 and 2020 and USD 560 billion in Europe annually until 2030. Moreover, they estimate that the infrastructure needs reach USD 23 billion in Australasia, USD 320 billion in Latin America and USD 510 billion in North America. This represents a significant regional variation in anticipated infrastructure financing needs, demonstrating a range of factors including population density, state of existing infrastructure and development trajectory.

2.3.Sectorial Infrastrucure Needs

Financing needs also vary between infrastructure sectors. In the transport sector, the Organisation for Economic Cooperation and Development (OECD, 2011), forecasts that aggregate investment in airports, ports, rail (inclusive maintenance) and oil & gas distribution from 2010-2030 will amount to USD 8,815 billion. By 2030, the annual global road and rail new construction requirements are estimated to amount to USD 292.3 billion and USD 58.1 billion (OECD 2011) respectively. The energy sector faces global electricity investment needs of about USD 9.789 trillion from 2003 to 2030, while the annual water infrastructure in OECD countries and BRIC 5 require investments in the region of USD 1 trillion by 2025 (OECD 2006). The OECD cost estimations are by no means comprehensive, but they highlight the extraordinary and specific demands for infrastructure across several sectors. Infrastructure financing needs are dramatic and concern all parts of the world as well as all sectors.

2.4.Missing Investments - 'The Gap'

Despite the large public and private funds already allocated to infrastructure construction and maintenance, the future infrastructure needs exceed the available finance. This missing finance is known as the infrastructure investment gap ('The Gap' for brevity). The Gap threatens the world's ability to meet international development objectives, including the Sustainable Development Goals. Forecasts by McKinsey (2016) indicate that the equivalent of USD 0.8-1 trillion in infrastructure investment will be missing globally every year until 2030. This Gap could be three times as large if the investment to meet the SDGs were also be taken into account. S&P estimate that the costs required to adaptation to climate change up until 2030 would require approximately six to thirteen times all international public finance available today (S&P, 2018).

2.5.Causes of 'The Gap'

The reasons for this gap are numerous, however, the lack of available finance is a clear and central barrier. Public support to reduce the "Gap" is insufficient in the developed world, as governments are increasingly strained by their efforts to alleviate public debt. Aside from a few exceptions, such as the nascent New Development Bank (NDB), or the Asian Infrastructure Investment Bank (AIIB), multilateral development banks are also not expected to dramatically increase their expenditure in the next decade.

In addition to the lack of available funds for infrastructure, investments are hampered by inefficiency and ineffectiveness which further discourages future allocation. A G20 analysis blames poor project selection and planning as a cause of this ineffectiveness (G20, 2015). Since Public Private Partnerships (PPPs) are a relatively recent development in most countries, governments often lack the expertise to present bankable projects likely to attract private investors in a PPP arrangement. The G20 also attributes the investment gap to inefficient delivery caused by time-consuming regulatory approvals and the absence of design-to-cost and design-to-value principles (G20, 2015). Indeed, according to Albino-War *et al.* (2014), strong institutions and better management are crucial to improve the efficiency of oil exporters in Mideast, Caucasus, and Central Asia. Lastly, the G20 attributes unnecessary increases in overall infrastructure costs to the systematic preference for greenfield projects instead of the renovation and optimisation of existing assets.

THE PORTFOLIO BOTTLENECK

3. THE PORTFOLIO BOTTLENECK

Since governments endeavour to reduce the debt/GDP ratio, they are unlikely to sufficiently contribute to bridging this gap. Thus, private investment is also required, however, private investment is currently limited by the rigidity of their allowed asset allocation: infrastructure debt and equity are dissociated in mainstream portfolios while their respective shares are technically and legally required to remain marginal. This is discussed further in the following sections.

3.1.The Necessary Private Contribution

The gap in infrastructure investment has reached a volume at which it cannot be met alone by government investment, Multilateral Development Banks (MDBs), or other philanthropic or impact investors. To bridge the gap, private capital must be mobilised from institutional investors, such as large pension funds, sovereign wealth funds, private capital managers, family offices, grant-making foundations and insurance companies.

3.2.The Allocation Potential of Sustainable Infrastructure

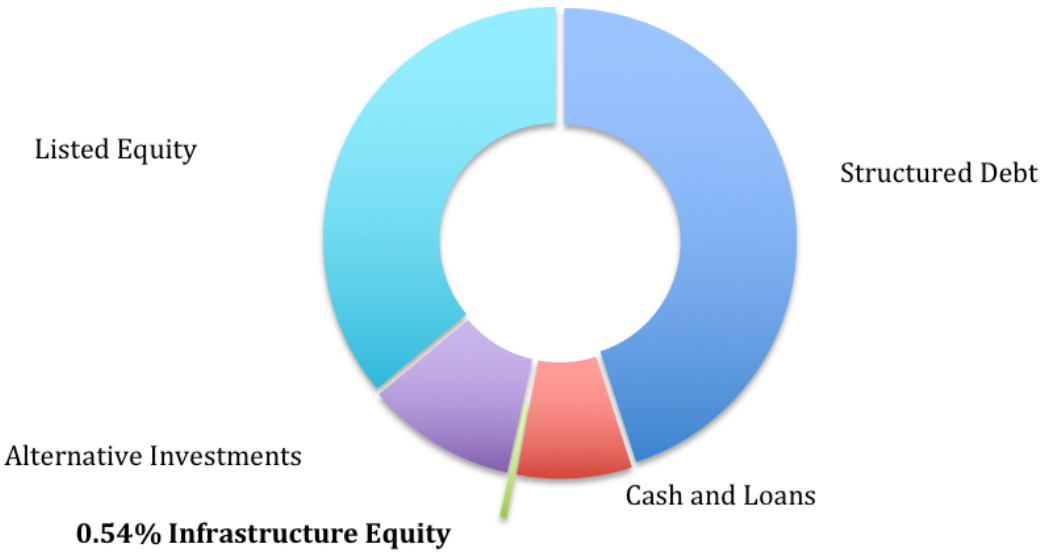
Private institutional investors manage phenomenal wealth and seek to invest in robust projects that offer significant returns with predictable and manageable risk. Duvall *et al.* (2015), for example, maintain, *"the pool of capital available is deep. Across infrastructure funds, institutional investors, public treasuries, development banks, commercial banks, corporations, and even retail investors, we estimate that more than USD 5 trillion a year is available for infrastructure investment."*

Since governments in developed countries have reacted to the slowdown of the financial crisis with expansionary monetary policies, Central Banks have increased the demand for bonds by lowering interest rates, thereby lowering public interest rates, which in turn form the benchmark for other interest rates. As a result, institutional investors which face short term payments – monthly pensions for example – track the opportunities that offer better return than structured debt and less risk than listed equity. Since sustainable infrastructure normally meets such expectations, large amounts of capital should flow towards the infrastructure investment gap and help to narrow it. However, a 'portfolio bottleneck' hinders this flow.

3.3.The Portfolio Bottleneck

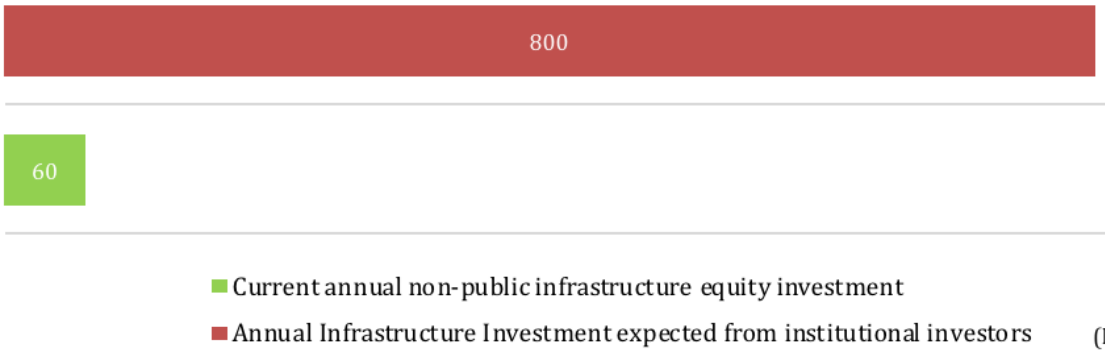
Infrastructure assets currently only make up 0.54% of total Assets under Management (AuM). In fact, infrastructure assets represent USD 425.72 billion (Preqin, 2017), while total AuM are estimated to have reached USD 111.2 trillion in 2020 according to PwC (2017). Since the annual infrastructure investment gap amounts to USD 800 billion (McKinsey, 2016), Infrastructure Equity within Alternative Investments would have to scale up at least 13 times in order to cover it. An expansion in portfolio allocation to infrastructure equity or debt is very unlikely due to the technical constraints and legal requirements described in the following sections.

Figure 1. Current Share of Infrastructure Equity in Total Assets under Management



(Preqin, PwC 2017)

Figure 2. Current Investments vs. Infrastructure Gap (USD Billion)



(Preqin, 2017)

3.4.Technical Constraints

The technical constraints concern the conventional dissociation of infrastructure debt and equity management in the institutional investor's portfolio. Infrastructure debt often belongs to the "Structured Debt" Asset Class while infrastructure equity constitutes a small share of "Alternative Investments". Such hermetic separation can be explained by the discrepancy of time horizons for equity providers and debt holders. While the first seeks to maximise the cash flows over comparatively shorter periods, the latter tries to minimise risks in the longer term, sometimes holding debt over the entire life span of the infrastructure. These two objectives are often antithetical and therefore hamper the mutual management of infrastructure debt and equity. As a result, within conventional asset management, infrastructure allocation is likely to remain divided and to forgo the benefits that could be derived under a common management.

3.5.Legal Requirements

Legal requirements pose a second hurdle to the expansion of portfolio allocation to infrastructure. Quantitative portfolio restrictions in several countries indeed restrict the share of total assets that an institutional investor, such as a pension fund, can allocate to infrastructure investments. For example, BVV 2 in Switzerland requires that domestic pension funds do not to allocate more than 15% of their assets to alternative investments, which include infrastructure equity (BVV 2 Art. 55).

In the absence of such legal requirements, other serious hurdles continue to disallow investments. In fact, such absence often speaks of an infrastructure allocation that is currently too minuscule to represent an immediate threat to portfolio performance. In such cases, only equities and foreign assets are considered worth the regulatory effort (Leape and Thomas, 2011). Hence, regulation authorities hardly take Alternative Investments into account, and infrastructure equity to an even lesser extent. However, the fact that there is currently no quantitative portfolio restriction on infrastructure equity does not mean there will not be one in the future. Such possibilities further threaten the necessary increase of funds needed to be allocated to sustainable infrastructure.

3.6.Urgently Looking for Innovation

Innovative financial mechanisms are urgently required to liberate the portfolio allocation to infrastructure. Both infrastructure equity and debt allocations face tight technical and legal constraints to effectively achieve this goal. Laurence Fink, the President of Blackrock (2013) thus argues that, *"we need to juggle out infrastructure from that crazy box called 'Alternative Investments' and establish it as a new asset class, somewhere between debt and equity"*.

Case Study 2

Natixis Manages the First European Project Bond for Digital Infrastructure in 2014

In support of France's superfast broadband plan (France Très Haut Débit), which is "the Government's biggest infrastructure programme", Axione Infrastructures was helped by Natixis in conducting the very first issue in Europe of "project bonds" in digital infrastructure, an innovative form of finance launched by the European Commission and the European Investment Bank (EIB) in 2012, the aim of which is to speed up the mobilisation of private capital for European infrastructure projects, in particular the roll-out of fibre optics in sparsely populated areas ("public initiative areas").

Acting as financial advisor, rating advisor and market access advisor for Axione, Natixis structured the operation and managed the rating process with Moody's. As sole bookrunner, lead manager, agent and account bank, Natixis arranged and successfully placed, these project bonds with institutional investors, which aim at refunding Axione Infrastructures' existing senior debt. The operation provided Axione Infrastructures with €189.1 million in bond finance (European Investment Bank 2014). The success of the bond issue shows investor interest for this new asset class. It also confirms Natixis' leadership in advising and structuring infrastructure finance and its ability to set up innovative operations.

THE EMERGENCE OF A NEW ASSET CLASS: SUSTAINABLE INFRASTRUCTURE

4

4. THE EMERGENCE OF A NEW ASSET CLASS: SUSTAINABLE INFRASTRUCTURE

Only the emergence of a new Hybrid Sustainable Infrastructure Asset Class can help fill the investment gap. Sustainable Infrastructure has the potential to become more profitable and accessible for investors than conventional infrastructure. The latter does not seem to appeal to their appetite, in spite of wide-spread dialogue on the topic. To the contrary, an integrated long-term management of infrastructure assets that are sustainable and resilient, maximises the overall cash flows, because there is so much value that can be only captured by applying a life-cycle, quality-oriented lens on cost and benefits. However, the traditional opposition between equity providers (project sponsors) and debt holders renders such an approach impractical. On the other hand, the long-term, asset heavy, localised and relatively illiquid nature of infrastructure investments correspond with the long-term and localised risk mitigation and value creation by sustainability and resilience hedges. When these features are integrated in an investment approach, they are able to capture that value and transfer it to both the equity and the debt holder. Sustainable infrastructure assets require a life-cycle view, because they are based on a multi-stakeholder profit and loss model without giving preference to any shareholder, investor or stakeholder. Therefore, a Hybrid Sustainable Infrastructure (HSI) Asset Class should be created, which synchronises the interests of equity and debt holders. Such an Asset Class would make the added value of sustainability and resilience systematically accessible to capital markets. In turn, the HSI Asset Class would also considerably increase the interest of institutional investors in infrastructure investments.

4.1.Bridging the Conflict Between Equity and Debt

The risk-return model of Infrastructure in "Alternative Investments" naturally prioritises equity holders' profits over debt providers' returns, resulting in-very limited risk appetite.

Conventionally, it is considered a financial aberration for strategic asset allocators to possess equity and debt in the same infrastructure project, the main reason being the opposing views on the level of debt return the infrastructure project can offer. Debt holders, of course, desire the highest levels; the equity providers, though, want them to be as low as possible as they directly reduce the volume of dividends. Indeed, dividends correspond to the remaining turnover that is left once all charges, including returns, are paid. Hence, the larger the returns, the lower the dividends; there is a clear trade-off between the interests of both the debt and equity holders.

Moreover, financial hardships result in contrary positions by debt and equity holders. Mark Gillgan (Head of Infrastructure Europe at UBS) reaffirms this view by arguing that, *"if a company should come under financial strain then equity and debt interests cease to be aligned"*. In other words, equity holders may wish to maximize cash flows even if it means the infrastructure defaults on its loans; debt holders, on the other hand, want to prevent such a situation by all means. Their priority is to minimise default risk, so they endeavour to keep the business afloat. Here again, the perspectives diverge, and it makes little sense for a traditional asset allocator to invest in the debt and equity of a single infrastructure project.

In a nutshell, strategic asset allocators do not possess equity and debt in the same infrastructure project. Infrastructure equity investors can be seen as debtors, while infrastructure debt holders correspond to creditors. However, since debtors seek low interest rates and creditors the opposite (i.e. high interest rates in relationship to their risk exposure), infrastructure equity investors and debt holders will have potentially opposite interests.

Such a situation is far from optimal because overall returns are not maximised. Indeed, since infrastructure projects and the associated investment cycles stretch over the long term, a coherent and integrated approach is needed to achieve maximum returns. Given that strategic asset allocators have divergent interests when investing in infrastructure equity or debt, they will adapt their strategies to fit the management of their specific position in infrastructure projects. As a result, it appears that the only way to attract massive investments from strategic asset allocators is to combine infrastructure equity investor interests and debt holder interests.

The equity-debt conflict can only be overcome by solving the debt return conflict of interest. In practice, this means gathering Sustainable Infrastructure debt and equity into one product, a Hybrid Sustainable Infrastructure (HSI) Asset Class. This HSI approach would connect the overall financial needs of sustainable infrastructure with the money investors wish to allocate. The infrastructure developers and managers would still need to finance their activities through issuing debt and offering equity, but the investors would not choose between them. In fact, HSI Vehicles (e.g. Funds, Banks or Facilities) would pool these financial needs into one product. Their mix of debt and equity would not necessarily have to be known by asset allocators. They would only be concerned about the risk-return profiles of the different HSI Vehicles – derived from their holistic sustainable standards (see chapter 4.2 further down).

Case Study 3

Meridiam's Integrated Development of Residential Facilities at the University of Hertfordshire

The Project is a £214m transfer of the University's existing residences and comprises the design, build, finance and operation by Meridiam of 2,511 new student accommodation bedrooms and the associated social spaces and infrastructure works (Bouygues Development 2014).

The scheme is obtaining from BREEAM, a world leader in design and assessment method for sustainable building, outstanding and True Zero Carbon ratings, making it among the first student accommodation schemes in the UK to achieve such accreditation.

The innovative long-term bond financing of this project is a first-of-its kind in Europe for infrastructure. Funding has been arranged by the Meridiam Europe II Fund through an index linked unwrapped private bond placement (Meridiam). This innovative project bond financing maximizes the financial efficiency of the project for the benefit of the University.

The concession period being 50 years, Meridiam will have covered all of the social infrastructure's phases, from the identification of infrastructure needs and project design to the operation and management of the infrastructure asset over the long term, working jointly with the University. This integrated approach not only benefits the infrastructure, whose good construction and perennial operation are contractually guaranteed, but also Meridiam, the investor, who can best anticipate the cash flows. The project therewith becomes both useful for the University's students and profitable for asset allocators.

Regarding the performance, Sustainable Infrastructure is a hybrid Asset Class. Since the HSI Vehicles combine debt and equity, they are less risky and yield lower returns than equity, but they offer higher returns than debt for they are riskier than pure debt. Compared to risks and returns of equity and debt investments, HSI therefore represents a middle ground. Investing in HSI Vehicles is a long-term engagement. Indeed, there is little interest in owning the asset for a short time. The financial benefits only substantiate in the longer run.

There are several reasons that the integrated approach of asset managers who would oversee HSI Vehicles could be expected to deliver superior overall returns as opposed to adding the risk adjusted returns of separate debt and equity infrastructure allocations. When strategic asset allocators superimpose their investment time horizon over the life span of the infrastructure, this infrastructure's potential is best fulfilled while the gains collected by the investors are at their apex. The reason is that maximising the overall levels of dividend and return should be greater than the sum of their short-term maximisation.

Taking a long-term view, as it is not only encouraged, but also stipulated by Holistic Sustainability Standards, discourages the equity holder from maximising short-term profits and walking away with it in an opportunistic manner. S/he will be encouraged to regularly re-invest into maintenance and stakeholder management – focussing on the functionality of the asset as opposed to its short-term exploitation. Taking such a long-term view may result in lower short-term profits. However, it would reduce default risk for obvious reasons, while keeping potential returns of debt holders (and the associated validation of their bond) relatively stable. By integrating the interests of both the equity and the debt holder into one HSI Asset Class, the overall superior and more stable returns replace the traditional trade-off for equity holders and investors.

Mark Wiseman, the CEO of Canada Pension Plan Investment Board, maintains that, *"we don't actually build in exit assumptions. Literally, when we buy an asset, we assume that we will hold it indefinitely or until the end of the concession."* (Kirkland, 2013). The existence of sustainable infrastructure stretches over the long term by nature. Hence, it needs long-lasting and comprehensive management so as exploit its entire potential and deliver the maximum benefits. A clear and long-term vision enhances the efficiency of resource allocation and the effectiveness of any business operation.

4.2.Future Proofing and De-Risking with Sustainability

Such long-term analysis can only be reliable if based on the future proofing and de-risking capacity of holistic Sustainability and Resilience Standards. In its outcome document of the Third International Conference on Financing for Development: Addis Ababa Action Agenda in July 2015, the UN clearly stresses the importance of establishing such standards: *"We call on standard-setting bodies to identify adjustments that could encourage long-term investments within a framework of prudent risk-taking and robust risk control."* One of these bodies, the Global Infrastructure Basel Foundation (GIB), developed the Sustainable and Resilient Standard for Infrastructure ("SuRe®-Standard" for brevity) under ISEAL-methodologies, for precisely this reason.

Such Standards enable and secure the long-term performance of sustainable infrastructure. The clear dashboard provided by the standards gives managers the necessary information to lift the infrastructure to the highest performance level. The more accurate the data, the lower the uncertainty regarding the expected evolution and hence, the better the allocation of internal resources. The overall result is a better understanding of the infrastructure particularities and enhanced management.

The SuRe® Standard, as an example, is designed to build trust between asset allocators, investment agencies, NGOs and governments by evaluating environmental, socioeconomic and corporate governance (including financial) criteria. Within corporate governance, the standard assesses aspects of the bankability and management quality, the level of transparency and accountability, the stakeholder engagement and the sustainability and resilience management of the infrastructure project. When looking at the socioeconomic impact of infrastructure, several themes are taken into account such as human rights, working

conditions and labour rights, job creation, customer focus and community impact. The SuRe® Standard also evaluates the environmental effects of the infrastructure project, including biodiversity, environmental protection, impacts on the climate and the availability of natural resources, modification of land use and landscape. The SuRe® Standard and other standards thus represent the tools needed to synchronise infrastructure debt and equity interests by developing a long-term and deeper understanding to optimize the management of the asset.

3 Dimensions	14 Themes	61 Criteria	+ 2
Governance	Management and Oversight	19	Materiality Assessment / Reporting for Impact Assessment
	Sustainability and Resilience Management		
	Stakeholder Engagement		
	Anti-corruption and Transparency		
Society	Human Rights	24	
	Labour Rights and Working Conditions		
	Community Protection		
	Customer Focus and Community Involvement		
	Socioeconomic Development		
Environment	Climate	18	
	Biodiversity and Ecosystems		
	Resource Management		
	Pollution		
	Land Use and Landscape		

Table 1. GIB Standard for Sustainable and Resilient Infrastructure – Categories of Assessment Criteria

In practice, the SuRe® Standard offers two services. First, during the initial planning phase, it can be used as an early stage assessment whilst in later stages serves as a rating and performance monitoring system. Whilst the SuRe® Standard is relatively new, there is insufficient ratings data available to fully demonstrate the potential utility and benefits to infrastructure assets. However, there are multiple examples of the application of the early stage assessment catalysing design or management improvements expected to lead to tangible financial benefits, including the following: better understanding of project risks (through the use of future climate scenarios for planning), increased revenue volume by increasing market size through inclusive design and price targeting strategies for tariffs); increased revenue stability by diversification of user groups and measures to improve resilience to shocks and stresses); optimisation of operating and capital costs leading to improved Net Present Value, namely by reducing material costs and co-production of energy, water or achievement of biproduct synergies. The following diagram provides an example of an infrastructure assessment summary. It indicates the areas in which a hypothetical

project is performing well, as in, Management and Oversight, Environmental Protection, and Socioeconomic Development, as well as the areas in which the project may seek to address identified issues such as, Climate, Community Impacts, Customer Focus & Inclusiveness and Transparency.

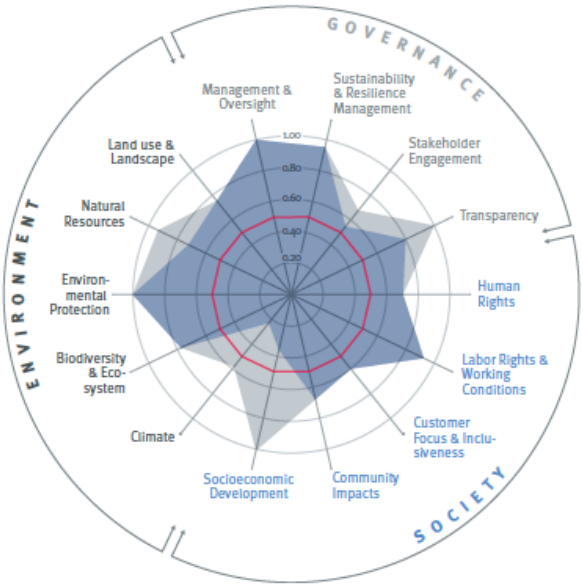


Figure 3. An early stage SuRe® Assessment

4.3.The Financial Characteristics of Sustainable Infrastructure

Infrastructure in general enjoys only limited correlation with bonds, equity, real estate, general market performance and even with business cycles.

It is hardly correlated with bonds and equity since infrastructure cash flows are generated by tariffs from end-users or public funding such as service agreements or taxes that are not affected by the aforementioned markets. For example, revenues from the "Santander Bicycles" rental scheme in London are generated by the users who either "pay as they pedal" or have subscribed to a yearly

By associating **sustainable infrastructure equity and debt in the same pocket** of investment, over the long term, a new Hybrid Sustainable Infrastructure Asset Class can be created. It represents a strategic allocation due to the financial advantages elaborated upon in the preceding sections as well as the preferred financial characteristics discussed below.
membership. Additional revenues come from the advertisement fee that Santander pays Transport for London for placing the Bank's brand on cycles and station. Highways under concession are predominantly financed by road-tolls. In different case, a rental fee paid for 25 years by the Health Ministry of Turkey is used to finance the Adana Integrated Healthcare Campus, a Public Private Partnership.

Infrastructure is not correlated with stock market performance. The reason is that infrastructure debt has fixed interest rates; no matter how volatile the stock market may be, infrastructure will pay a fixed return. Infrastructure thus offers a first-choice diversification opportunity to both bond investors and stockholders.

Likewise, infrastructure is not correlated with business cycles. Infrastructure is a central piece of the economy. Some even argue that it is backbone of a country's economy, which means that infrastructure will be the last business sector to shut down. Infrastructure is indeed irreplaceable in many ways. Even if the economic flows shrink, there will still be lorries on the roads. Schools will hopefully continue to teach pupils regardless of stock market woes. Information will continue to transit through the communication networks even if the country is heavily indebted. Infrastructure shall therefore be a safe investment opportunity, with limited risk compared with other investment types.

Infrastructure is relatively inflation-hedged, because it may quite often proceed to price adjustment to cover inflation losses. However, in many cases, legislation, political controversy, or contracts may not allow for a sufficient tariff increase in response to inflation. This is less

likely to happen with sustainable infrastructure due to its inclusive "licence to operate" and better management practise, which would identify such a risk and resolve it early on: It can often proceed to price adjustment to cover inflation losses since it enjoys higher acceptance by stakeholders. In particular, end users who actively participate in the infrastructure management acknowledge the necessity of such measures if the wish the service to persist.

Infrastructure investors receive an illiquidity premium (i.e. the premium that is paid to infrastructure debt or equity holders as a compensation for not being able to sell the underlying asset at any given time, based on their need). The very notion of illiquidity means that the asset is not readily tradable on the market, resulting in greater exposure to market fluctuations, and thus higher risks. The premium may take the form of higher returns paid to debt holders. In case of equity holders, the illiquidity premium may result in higher profits when compared with other equities.

Given that an option exists for sustainable infrastructure investors to securitise their assets (see securitisation option further down), the illiquidity premium might fall for those who need more flexibility in their portfolio. Those specific investors would enjoy an enhanced capacity to exchange infrastructure assets, meaning that the risk associated with infrastructure would decline. Tradeable sustainable infrastructure HSIs may thus emerge with comparably lower risk and return, which would potentially help attract additional infrastructure investors (who don't aim at the longer tenure and higher returns of relatively illiquid, non-tradeable HSIs).

Sustainable Infrastructure has low operational costs when compared to conventional infrastructure, because physical structures are built with higher–quality materials and thus incur fewer maintenance costs. By relying on sustainable infrastructure, for example, a bridge would require fewer major repairs and maintenance. Sustainable infrastructure is therefore expected to quickly offset its higher upfront costs through the savings from regular maintenance and repairs. Additional savings can also be generated from lower energy consumption. For example, sustainable buildings meet high environmental standards, meaning that their improved levels of insulation and passive design dramatically reduce the heating and cooling costs.

At the end of its lifecycle, sustainable infrastructure typically has a higher residual value than a conventional infrastructure. This means that society as a whole particularly values this infrastructure for the diverse services that endure well at the end of the operation phase such as initially planned. It may be that a school's structure is still solid enough to be refreshed and converted into social housing. It may also be that the foundations of former railways are so stable that a cycling path can be constructed on them, such as the path that connects Bristol to Bath in England.

Sustainable Infrastructure enables more resource-efficient management. In fact, since transparency and accountability lie at its very core, the internal management, as well as the wider public, will scrutinise all revenues and expenses so as to crack down on corruption and resource-inefficient work. As a result, savings are obtained, business is run quicker and more fairly, and the infrastructure's value increases. The reputational benefit from transparent and accountable management is proportional to the drawbacks of a project burdened by corruption. Not only did ABB have to pay USD 58 million in 2010 to settle bribery cases in Mexico and in Iraq, but also had it to invest in cleaning its image, for instance, by updating and strengthening its anti-corruption policy.

Superior worker productivity can be expected in sustainable infrastructure. Managing sustainable infrastructure implies that managers listen to workers' demands more closely. They can then integrate these comments so that working conditions better match the employees' skills and produce higher

levels of output, thereby generating positive outcomes for both employer and employee. Swanberg *et al.* (2008) document a positive correlation between flexible working hours and the productivity of workers.

In addition to financial advantages, sustainable infrastructure reduces a wide range of risks and helps to build resilient and diversified portfolios. Hence it is worth noting that that financial advantages and lower risks are two separate but related issues. Sustainable Infrastructure is less likely to suffer disruption of service due to shocks and stresses, such as extreme weather events or political upheavals, since such threats are anticipated and managed with the help of resilience criteria. One of the specific challenges to long term investments is the statistically significant rise of such uncertainties. For example, an asset built to safety specifications based on the past 100 years of environmental data may anticipate going out of service once per five years due to heat waves or other extreme events. But it is no longer clear, how much we can rely on such conventional statistics and associated risk management tools, which basically extrapolate the past into the future. If events accelerate in severity and frequency, revenues and costs will be adversely affected beyond these predictions. In this regard, the holistic planning characterized in sustainable infrastructure leads to better revenue stability in an increasingly uncertain environment.

Furthermore, sustainable infrastructure is designed to be more inclusive and provide services for a greater proportion of the population, which leads to both higher revenue and improved revenue stability. For example, a metro rail company may implement measures to be more inclusive to children and female travellers, such as women-only-carriages and security improvements. This grows the ridership of the metro, and therefore the potential revenue. Simultaneously it diversifies the customer base, leading to an increase in revenue stability, for example in cases of events or habits that affect a certain profile of users but not others, such as those that use the metro during peak-hour rushes or to attend sporting events.

4.4.De-Risking with Sustainability and Resilience

Exposure to political and social risks is lower with sustainable and resilient infrastructure than with conventional infrastructure. A significant part of sustainability focuses on the acceptance of a project by social and political groups. By involving local communities and stakeholders during the entire lifetime of the infrastructure, including decommissioning, the clear goal is to reduce opposition or address it swiftly and decisively in cases when it exists. Sustainable infrastructure seeks to obtain guarantees from the political sphere not to break or renegotiate planned infrastructure projects. It aims to mitigate the changes on the governmental agenda that inevitably occur due to political cycles. It even anticipates some changes in the law. In the coming decade, legislation is expected to raise the environmental standards that all businesses need to comply with, including the construction and operation of infrastructure; sustainable infrastructure will hardly be affected, though, since this risk was incorporated from the beginning of the planning phase.

Sustainable infrastructure endeavours to render environment variations a lesser threat to the project. In fact, unlike conventional infrastructure, the range of environmental changes and potential impacts is much more comprehensive. When constructing a new road, engineers not only examine the local topography, but they also model the future dynamics that alter the infrastructure, including the predicted hydrological cycles and wind patterns. This special attention to all environmental factors significantly limits the environmental risks the infrastructure is

exposed to.

Backtracking and benchmarking allow strategic asset allocators to generate predictable returns from a new source. The widespread use of holistic sustainability standards would allow investors to analyse more reliable and larger amounts of data, covering accurate risk profiles so that uncertainty can be better understood and managed.

Embedding resilience within the asset clearly reduces the potential damages that (re)insurers can be liable for. This risk reduction is not only necessarily accompanied by a reduced premium, it can also bring about the possibility to cover an asset (or associated revenues) that otherwise would not qualify as insurable. Insurers are able to diversify, in order to manage such risks, especially those related to extreme weather conditions, by tapping into debt markets. The emergence of Catastrophe Bonds exemplifies how capital markets can play a role in transferring specific climate-related risks from the insurance market to investors. Plus, the usage of so-called "parametric[3]" triggers to compensate for losses clearly reduces the time to make the payments, as compared to contracts that ask for actual loss assessment (MAN, 2018). This enables the system to bounce back faster should an extreme event occur. Likewise, a premium reduction can significantly enhance the project's Internal Rate of Return. Hence, it is in the project sponsor's interest to first carry out a cost/benefit analysis and later implement exactly those adaptation-enhancement interventions that most effectively heighten the overall project resilience.

3 Parametric triggers refer to specific parameters that can be measured in the case of an extreme event. For example, peak ground acceleration in the case of an earthquake. Should those pre-set thresholds be met, immediate release of compensation payments will be activated.

4.5.The Ternary Development of the Sustainable Infrastructure Asset Class

The development of Sustainable Infrastructure as an Asset Class requires the following three steps.

3. Securitisation Option	Liquidity of infrastructure investments
2. Hybrid Investment Vehicles	Investment grade infrastructure bundles
1. Sustainability Standard	Project level, views complete life cycle

The initial step involves the broadcast and establishment of the SuRe® Standard – or a similarly comprehensive tool required to assess infrastructure at the project level. It should offer a transparent understanding of a wide range of features affecting the project's long-term sustainability and resilience. The SuRe® Standard also grasps the project's entire life span, predicts the costs, anticipates the revenues and assesses the wider impact on the communities that the infrastructure serves and otherwise effects. Notably, the SuRe® Standard clarifies the different externalities and their nature – for example, whether they improve employment, or – in another case – if they dynamize an economy based on tourism by protecting threatened and rare species.

The infrastructure projects are graded against all the criteria gathered in the SuRe® Standard – or another similarly homogeneous and credible standard. This meticulous process produces profiles with similar risk/return characteristics, allowing investors to create homogeneous, but broadly diversified bundles of projects, facilitating investment in Sustainable Infrastructure. In short, asset managers and limited partners (asset allocators) are given the tools to tailor their Sustainable Infrastructure Investments to their risk appetite in a holistic, but still practical way. The emerging Asset Class permits increased clarity and trust, both of which can attract new strategic investors.

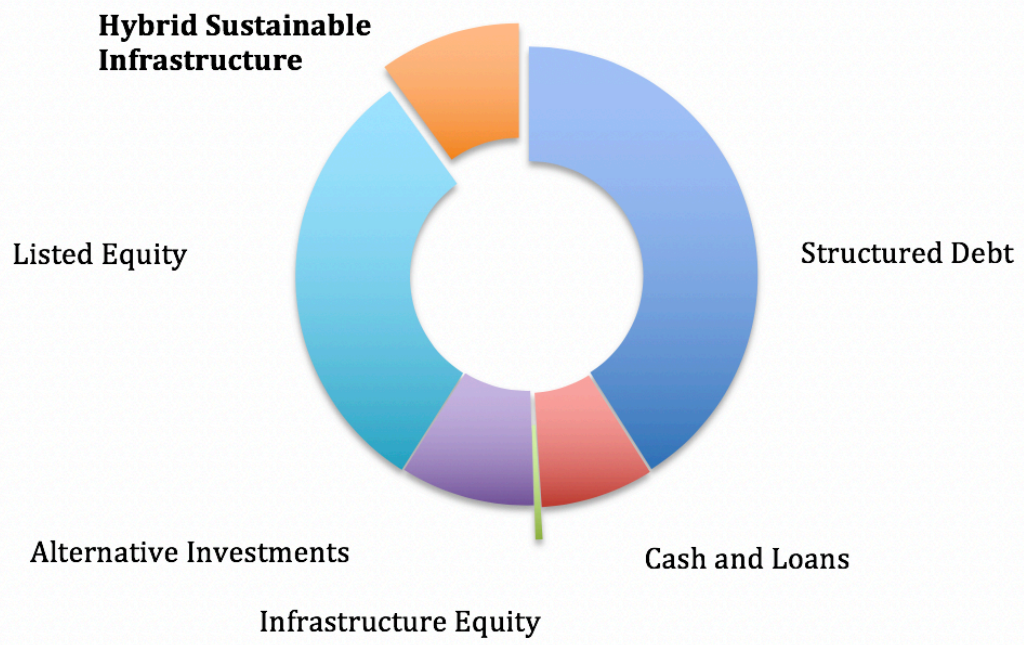
Using the standardisation of the infrastructure assessment and the project bundles subsequently created, the financial sector has the possibility to increase the liquidity of Sustainable Infrastructure by securitising the bundles. Such achievement will help contradict one of the infrastructure characteristics, i.e. its illiquidity, for those investors who need such a feature. As a consequence, the illiquidity premium of such financial products is diminished. This does not represent a drawback for the overall market development, since it is likely to be largely offset by the expansion of the sector through the emergence of new investors (e.g. risk-averse pension funds or re-insurers,

who depend upon liquidity) and the resultant business opportunities.

This process should ensure that sustainability doesn't come at an additional cost, but rather as the actual enabler of investments and the provider of stable risk adjusted returns. At the same time, Sustainable Infrastructure contributes to meeting the Sustainable Development Goals. Hence, the implementation and development of this new Asset Class will not only emerge as highly attractive for institutional investors, but it will also enhance the common good.

There is an efficient and profitable way for responsible investors to serve their clients and help develop and protect the world at the same time: By pursuing "Sustainable and Resilient Infrastructure as an Asset Class".

Figure 4. The expansion of Sustainable Infrastructure Outlook to 2030



5. CONCLUDING REMARKS AND POLICY RECOMMENDATIONS

In April 2013, a roundtable at the World Bank's Headquarters in Washington D.C., chaired by then World Bank President, Mr Jim Yong Kim, dedicated itself to boosting worldwide infrastructure investments with the purpose of promoting global prosperity. While this was not the first high level discussion around that topic, this meeting of ministers and of leaders from the financial sector decisively moved forward the awareness, that massively scaling up such investments would only be feasible with the help of private capital. At the same time, the roundtable confirmed that the order of magnitude needed from the private sector for bridging the defined funding gap would have to level off at around one billion dollars annually over several decades (in addition to another two billion dollars a year of public infrastructure investments, which had been available before). That's when the reflections around this paper started.

Soon it became apparent, that in order to stimulate such massive private funding in a relatively new field, the participation of institutional investors would be a decisive factor. And that "infrastructure as an asset class" would be the best way to facilitate such a movement, because institutional investors such as pension funds usually tend to allocate their assets based on a strategy that addressed the distinct features of several asset classes, which would correspond with their liabilities.

Since 2013, many conferences and projects circled around the "infrastructure asset class" term, without really helping to close the investment gap. In sum, the "infrastructure asset class" is still perceived as either too risky (in the sense that it is hard to assess the risk because of the long term and asset heavy nature of the investment, which not only requires high returns, but also grows capital charges enormously) or too illiquid (in the sense that securitisation of infrastructure carries high cost).

Larry Fink, the founder and president of BlackRock, the world's largest asset management firm, is cited in chapter 3 of this paper with his vision from the 2013 World Bank meeting: "We need to juggle out infrastructure from that crazy box called 'Alternative Investments' and establish it as a new asset class, somewhere between debt and equity." This paper showed that this could be achieved by applying a sustainability and resilience lens to infrastructure. Creating "sustainable and resilient infrastructure as an asset class" has the potential to de-risk and future-proof infrastructure investments to the extent that project risk becomes more predictable and securitisation more practical. The main driver of such a development being that the specific features of infrastructure make it plausible that the highest overall returns of infrastructure investments can be generated by applying high standards of sustainability and resilience, which jointly and inherently align the interests of equity and debt investors. It was also shown that the "sustainable and resilient infrastructure asset class" is plausibly the only asset class that boasts this specific feature.

Corporate and government policy makers on all levels should not only acknowledge the infrastructure gap; but we recommend that they

take serious action to harmonise[4] and standardise the **infrastructure sector in order to improve project comparability. This would attract additional funding urgently needed for infrastructure development**. For the success of this harmonization, it is crucial that standards for infrastructure project evaluation are adopted. While the idea of project finance as the backbone for a new infrastructure asset class is well on its way, the standardization of documentation and disclosure requirements, which is currently under discussion, needs to be complemented with additional sustainability criteria.

Several sustainability standards for infrastructure debt and equity (namely project finance) will probably emerge, but we recommend that only standards developed under the **ISEAL methodology** – a non-governmental organization, whose mission is to strengthen sustainability standards systems for the benefit of people and the environment – should be applied. The independent Sure® Standard, for example, provides a generic and transparent measurement of the relevant resilience and sustainability criteria. These are of particular importance for investors, because infrastructure projects are **by nature asset heavy and long term.**

The "future proofing", standardization and bundling of such projects with the help of an independent and credible sustainability and resilience standard provides the **groundwork for the creation of a sustainable and resilient infrastructure asset class**, which is particularly attractive to institutional investors with long-term liabilities, such as pension funds, insurances or family offices. The sustainable and resilient infrastructure asset class also speaks to the needs of impact investors.

It is highly desirable to further develop **insurance-linked financial products**, especially those with underlying assets located in emerging markets where project insurance protection is the least. An efficient market risk transfer can contribute to extend coverage to those projects so far uninsured. Plus, adequate risk pricing can reduce existing insurance premiums and hence bring about greater asset valuations. Secondary markets for insurance underwriters are key in facilitating the financial case for investing in resilient infrastructure.

Creating trust in equity as well as debt investment in sustainable and resilient infrastructure for this broad variety of potential funders will allow for a significant contribution of applied sustainability criteria in bridging the global infrastructure investment gap. Certified, high-quality infrastructure projects represent large-scale, main-stream investment opportunities with attractive returns, while helping to achieve the Sustainable Development Goals.

4 GIB has teamed up with ISCA and ISI to derive from their respective leading standards an Aligned Set of Indicators that synthesizes and captures the sustainability and resilience features of infrastructure projects. This one-of-its-kind collaboration is supported by the Private Infrastructure Advisory Facility (PPIAF).

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7. GLOSSARY

GDP: The Gross Domestic Product measures the wealth created within a country over one year. Using the expenditure definition, GDP (Y, i.e. production) is the sum of consumption (C), investment (I), government spending (G) and net exports (X – M):

$Y = C + I + G + X - M$

ANNEX 1

The 8 Characteristics of Infrastructure (Adapted from Weber and Alfen 2010)

(1) In first instance, infrastructure represents a **key public service**. Infrastructure assets support the development of societies since they deliver fundamental public services such as the provision of clean water or electricity, improve mobility of persons and goods, enhance people's health and education, and offer efficient communication.

(2) Infrastructure is also characterised by a **low elasticity of demand**. This means that the use of infrastructure is often independent from business cycles. Indeed, as it plays fundamental roles in the economy, it will be the last sector affected by economic fluctuations: for example, the rail and road networks are used even during downturns. Hence demand for infrastructure services is expected to remain relatively constant.

(3) A further dimension of infrastructure is its **quasi-monopoly situation** with high barriers to market entry: given that the upfront cost of new infrastructure can be tremendous – sometimes amounting to some US$ billions – and that there are important returns to scale – once the network exists, connecting one more household is relatively cheap –, incumbent firms will seek to cover the entire market. Competition is therefore limited or even inexistent.

(4) As a direct consequence, infrastructure may be subject to **regulation**. In fact, in case of little or no competition, regulatory authorities do correct the market. Taking the example of the European electricity market, since French electricity provider Électricité de France (EDF) enjoyed a nuclear rent that prevented firms to enter the market, it had to share part of this rent (Percebois, 2013). Alternatively, authorities can fix prices while compensating the infrastructure holder through a set of guarantees.

(5) **Long service life** is another particularity of infrastructure. The current road network in Europe is still partly based on patterns laid out by the Romans some 2,000 years ago, alluding to the long-term lenses through which to look at infrastructure. This millennium example is certainly not representative, but infrastructure assets often have service lives of as much as a century. Of importance for investors is then to amortise their investment within the associated life span.

(6) In addition to the features mentioned above, infrastructure provides a degree of **inflation protection**: revenues are likely to be tied to inflation adjustment mechanisms, be it through regulated income clauses, guaranteed yields or any other contractual guarantees. When revenues are generated by user charges, prices typically follow the Consumer Price Index (CPI) or GDP growth.

(7) **Regular, stable, yet late cash flows** also characterise infrastructure. After an initial construction phase, infrastructure assets are likely to produce regular and stable cash flows during their operational phase. Thus, they are generally perceived as relatively safe investment opportunity for risk-averse institutional investors.

(8) Infrastructure is often characterised by relative **illiquidity**. Indeed, infrastructure projects used to be too dissimilar to allow the creation of homogeneous products bearing analogous risk. As a consequence, there is either a non-existing or under-developed market on which to exchange ownership participations. The legal framework may also be a hurdle that makes infrastructure illiquid.

ANNEX 2

The Achievement of the Sustainable Development Goals (SDGs) Hinges upon the Development of Infrastructure

A choice of the most important goals with reference to sustainable infrastructure:

"Goal 6: Ensure availability and sustainable management of water and sanitation for all" highlights the need for better water networks. In particular, it requires further development of water cleaning stations, replacement of leaking old lead pipes and construction of new tubes, and the introduction of smart tools that would reduce water waste while increasing consumption efficiency.

"Goal 7: Ensure access to affordable, resilient, sustainable, and modern energy for all" stresses the urge for both larger and cleaner power generation. Aiming to use modern forms of energy and simultaneously decrease the energy sector's environmental footprint implies the expansion of electricity. In practice, small-scale power plants shall be constructed for instance, smart electricity networks too.

"Goal 8: Promote sustained, inclusive and sustainable growth, full and productive employment and decent work for all" can hardly be achieved without the development of a dense infrastructure network, ranging from freight railways to airports increasing workforce mobility, from fibre-optic cables to new geostationary satellites, both boosting the transmission of information. Infrastructure does indeed facilitate the mobility of humans, goods and services, improving economic productivity and human wellbeing alike.

"Goal 9: Build resilient infrastructure, promote inclusive and sustainable industrialisation and foster innovation" unambiguously stresses the necessity to further develop infrastructure. It would benefit from the technological discoveries to adapt to a changing environment; simultaneously, it would improve the state of the industrial production system so as to secure resilient and innovative outputs that contribute to increasing people's quality of life.

"Goal 11: Make cities and human settlements inclusive, safe, resilient and sustainable" is a goal infrastructure can contribute to. Indeed, enhanced public transports will ameliorate the connectivity of different areas, reducing spatial inequalities. Moreover, adequate and well-thought infrastructure that includes flooding areas for example helps mitigate the effects of severe storms. The Thames Barrier incarnates the resilience-advantage for a megalopolis such as London.

ANNEX 3

Benefits from Sustainable Infrastructure for Achieving the Sustainable Development Goals (SDGs) with Respect to the three Pillars of Sustainability

	Economy	Society	Environment
Goal 2 agriculture	Increased efficiency and resilience as small-scale farms knit a dense network	Local production results in higher employment and diminishing migration in urban areas, better cohesion	Increased efficiency implies lower ecological footprint
Goal 6 water	Better management of scarce resource benefits industry production and supply to household	Prevention of severe humanitarian catastrophes and droughts (cf. California)	Better management of groundwater, reduction in surface run-off
Goal 7 energy	Idem	Possible empowerment of people, improvement in literacy rates when household possesses electricity and light	Reduction in GHG emissions, smaller impact by power plants (as they are of smaller scale)
Goal 8 growth & employment	Solow model: infrastructure = capital, hence growth Sustainable infrastructure enables sustained and resilient growth with employment Green jobs shall also be linked to improved work conditions.	Integration of "new" population while maintaining/improving living standards	Aims at decoupling economic growth from environmental impact
Goal 9 infrastructure	Increases resilience and efficiency of economic activity	Improve mobility and connectivity	Chanel fluxes more effectively, with lower spill over
Goal 11 cities	Greater availability of labour force –better transports/denser cities Kremerian model: the larger the population, the more ideas to increase TFP	Multi-cosmopolitanism, cooperation	Smart cities reduce their ecological footprint