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Sustainable Cities and Investments: Addressing the Bottlenecks to Urban Infrastructure Development



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**Sustainable Cities and Investments:
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Urban Infrastructure Development**

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1. INTRODUCTION

Currently, more than 50% of the world's population lives in cities. The importance of cities and urban development cannot be overstated as cities not only generate more than 70% of global wealth, but also produce 70% of global greenhouse gas emissions. Global sustainability will therefore not be possible without first ensuring the sustainability of cities. There are many examples in history of towns and cities that have collapsed because they exhaust the resources necessary to sustain them. These include food supplies, naturally, but also water, energy and infrastructure. Downturns are not just regular occurrences, but part of the process of change in global trading patterns. Usually, such processes do not occur rapidly, allowing the redistribution and resettlement of urban populations to other locations over time. Sometimes, however, the consequences are dramatic. In such cases, the trigger is often produced by climate, which can have a severe impact on the ability of a city to support itself. Depleted or exhausted water tables, contamination of local cultivatable land, and pollution levels that affect the health of the inhabitants of cities already pose major problems worldwide and come at a cost that is not only financial in nature, but also impacts social wellbeing, health care, education and more.

Sustainable cities are dependent on infrastructure, which requires a large amount of investment. The United Nations Human Settlement Programme estimates that the current investment gap for physical infrastructure amounts to USD 1 trillion per year. It is not only about generating heavy investment for flyovers, parking sensors and green buildings, but also about providing the basic infrastructure and social services for all classes of urban citizens. The need for infrastructure development in the developed world is equally as important as in developing countries. With the current estimated population increase and a deficit in existing infrastructure and services, the problems stand just beyond our front door. If not addressed now, this could lead to disastrous living conditions and enormous environmental problems.

The New Urban Agenda (NUA), which was adopted in Quito, Ecuador in October 2016, following close behind the adoption of the 2030 Agenda for Sustainable Development in September 2015 and the Paris Agreement on Climate Change in December 2015, strongly recognizes the means and requirements for its implementation. These include technology, capacity-building and knowledge transfer, as well as ample access to financing. The NUA also emphasizes multi-stakeholder partnerships and collaboration between the developed and developing world, which will act as a key element in support of its implementation nationally, regionally and locally.

Sustainable Development Goal 11 champions the cause of urban development and aims to “make cities inclusive, safe, resilient and sustainable”, insofar as the 2030 Agenda is concerned. But as a city in and of itself comprises various components and factors, it is hard to limit urban development to a single goal. The Paris Agreement also refers to cities as “non-party stakeholders”. However, the strong presence of over 400 mayors at the 21st Conference of the Parties has firmly established the role that cities will play in the Paris Agreement's implementation, which will include upscaling cities' efforts in combatting climate change and moving towards climate-resilient infrastructure development. The Agreement also encourages and promotes the creation of platforms for exchanging challenges, solutions and best practices. In this regard, city networks and mayors will play an important role, in particular in advancing those resolutions addressing topics such as, inter alia, finance, technology and capacity-building (Tollin & Hamhaber, 2017).

This issue paper is therefore designed to stimulate discussion during the “BRIDGE for Cities – Belt and Road Initiative: Developing Green Economies for Cities” event, organized jointly by the United Nations Industrial Development Organization and the Finance Centre for South-South Cooperation, by providing information on innovative financing mechanisms, which cities may wish to leverage when implementing their sustainable urban-industrial development plans and projects. Financing the long-term needs of cities in a rapidly urbanizing world is a global challenge that will require constant collaboration. This paper additionally summarizes potential financing mechanisms and opportunities available to cities seeking to address the urban financing gap. The paper also aims to support the “BRIDGE for Cities” event's matchmaking activities, during which cities, as well as potential investors, can discuss solutions and forge agreements for future cooperation.

2. CITIES AND THE NEED FOR URBAN INFRASTRUCTURE DEVELOPMENT

In today's rapidly urbanizing world, detrimental and troublesome side effects are inevitable. Growing urban populations, as well as the migration of people from rural to urban areas, are putting immense pressure on urban infrastructure. The need for upgrading urban infrastructure in urban areas is therefore urgent, and cities and municipal authorities are facing challenges in meeting the rising demand. Most times, infrastructure upgrading is related to quick-changing product and production cycles. Many forms of infrastructure are subjected to ongoing and regular change, not only minor adjustments but also transformations.

Infrastructure in general can be classified according to two categories: (1) hard infrastructure and (2) soft infrastructure. Hard infrastructure includes physical structures or the equipment in place to support urban systems and services. For example, roads, railways, power transmission lines and bridges are some of the many examples of hard infrastructure. Soft infrastructure refers to institutions that contribute to maintaining economic, social and cultural standards. Examples could include the education system, healthcare and law enforcement. Both hard and soft infrastructure contribute to and facilitate the development of a nation or city's economy and are one of the most important prerequisites to determining their competitiveness or development status (Chambers, 2010). Another important classification consists of technical, institutional and personal infrastructure. This classification better supports the operationalization and implementation of incubators and think tanks exploring the future of urban development.

In terms of sectors, infrastructure can be classified broadly as follows (Kim, 2016):

- **Transportation:** Surface (roads, parking, bridges), public transportation system (metro, buses), air (airports, navigation system), and sea (ports, canals), traffic interconnections;
- **Environment:** Solid and liquid waste management, water supply, sanitation, land use management;
- **Social:** Educational institutions, such as schools and universities, health facilities, justice facilities, law-enforcement agencies, cultural institutions, defense and security, money-transfer institutions, social value systems;
- **Energy:** Power generation plans, including hydro, geothermal, gas, solar, wind, biomass and nuclear, as well as distribution grids and networks;
- **Telecommunications:** Fiber optics, towers, satellites, cables;
- **Oil and Gas:** Refineries and extraction facilities, storage;
- **Other:** Industries (mills, production plants, etc.), agriculture, mining.

From the abovementioned sectors, the transportation, social infrastructure and environment sectors are chiefly covered under the public domain. The remaining sectors fall largely under the domain of the private sector. Often infrastructural sectors, from a financial standpoint, include primarily transportation and social infrastructure, which, together with the energy sector, contribute the most to the infrastructure asset category.

2.1 A Measure of the Dynamics of Sustainable Urban Development

As described by Perkins et. al., sustainability can be assessed by calculating the intertemporal asset/wealth accumulation of a particular economic system (e.g. a city). The adjusted net savings (ANS), also referred to as genuine savings, can be calculated using the common concept of gross savings (S). This needs to be adjusted by the depreciation of made capital (D_m) to capture net savings (NS), measuring the non-man-made component of environmental sustainability:

$$NS = S - D_m.$$

Further adjusting this by the depreciation of natural capital (D_n) over time, we arrive at the adjusted net savings (ANS):

$$ANS = S - D_m - D_n.$$

Sustainable urban development is possible, if adjusted net savings are positive. In fact, ANS needs to cater to population growth. Developing this metric further, we can introduce the depreciation of human capital (D_h), which allows us to capture the net change of intangibles (e.g. population growth, education, health conditions, economic activity, etc.) in terms of population:

$$ANS' = S - D_m - D_n - D_h.$$

This allows us to arrive at the following urban classifications:

				Dh	
				+	-
Dn	+	Dm	+	<i>Triple sustainability deficit</i>	<i>Infrastructure driven sustainability</i>
			-	<i>Technology and infrastructure driven sustainability</i>	<i>Environment driven sustainability</i>
	-	Dm	+	<i>Human capital driven sustainability</i>	<i>Technology and human capital driven sustainability</i>
			-	<i>Social sustainability gap</i>	<i>Triple star sustainability</i>

2.2 Challenges Facing Infrastructure Development Globally

As a result of rapid urbanization, the pressure on infrastructure, particularly in cities, is significant. However, the need for infrastructure development differs across different countries and cities, depending on their economic development stage. There is an urgent need in the developed nations to upgrade both existing and obsolete infrastructure. While in developing nations, where 90% of the world's urban growth is expected to occur in the near future, nations and cities need to act urgently by implementing urban-development plans and policies to ensure the sustainability of their cities and urban systems. Cities in developing nations require not only sufficient infrastructure to cater to the needs of the existing population, but also to plan for the future growth of the city and the city's resiliency to accommodate significant influxes of population in the coming years. Many cities in developing countries are short of electricity, water, and efficient and timely public transportation systems (Z/Yen Group Limited and WWF, 2015).



Figure 1: Regional urban challenges
(Source: WEF, 2015)

2.3 Categorizing Cities: Understanding the Differences in Challenges

Cities vary in size, have different identities and face different issues. One cannot generalize them and assess infrastructure demands and needs, as these all depend on each individual city's stage of economic development. To this end, in order to better understand urban-development issues, an attempt has been made in this section of the paper to categorize cities according to their development maturity and to identify their major challenges. It is hoped that this will offer urban stakeholders a brief overview of the different infrastructure development challenges facing cities throughout the globe.

2.3.1 *Survival: Poor Liveability, Workability and Sustainability*

Cities that fall under the “survival” stage have a minimal level of infrastructure and services. Most cities from least-developed countries, when assessed, will fall under this stage. Due to differences in the demand for and supply of infrastructure and services, these cities are under a great deal of pressure. Resources are routinely depleted and short-term measures, like power cuts and a reduction in the duration of the water supply, are introduced by the municipal government. Other issues, such as low employment opportunities, high slum populations and substandard medical and emergency services, are also apparent (I.C.L.E.I. et al., 2007). In addition, many of these cities are characterized by urban primacy, in which a major city is surrounded by a set of subordinate small-scale cities located in the periphery. At this stage of development, both the primate city and subordinate cities are insufficiently interconnected, and growth in the primate city has no effect on the others, particularly in the rural sectors of the economy.

2.3.2 *Basic: Limited Linkages*

Cities at the “basic” stage have better infrastructure and service levels in comparison to those at the “survival” stage. Technological development is lower in comparison to more advanced cities. These cities have a basic public transportation system, which can meet the needs of the citizens. It includes trains, buses and trams within and outside of the city. Primary and secondary education is available for citizens living within the city boundaries. Basic emergency services are available and citizens experience a certain level of comfort in daily life (Swilling et al., 2010). There is still scope for improvement in regards to reducing travelling time, traffic congestion and fragile connectivity. Most importantly, however, development frameworks and policies are often implemented at the national level as opposed to the sub-national.

2.3.3 *Advanced: Smart Components*

Cities in the “advanced” category have a high level of infrastructure facilities, which are designed to transform the city into an economic hub and to increase productivity. Advanced cities have an efficient mass transit system, including roadways, railways and waterways. They are much better prepared for unforeseen disaster and natural hazards. For example, buildings are earthquake resistant, and the streets are outfitted with a proper drainage system. Advanced education centres, including universities and research and innovation centres, are also located in cities of this type. City development strategies are focused on sustainability and workability. Advanced cities are still developing, however, as there is still some scope for improvement and many best-available technologies are available to upgrade cities' efficiency. Many mature cities are at a crossroads in their lifecycle and must begin to adapt to their continuously changing development conditions and infrastructure investment gaps.

2.3.4 *Smart: High Liveability, Workability and Sustainability*

The final stage of city development includes only those cities that have achieved a certain level of “smartness” within each sector. These could be smart people, smart environment, smart transportation or smart buildings. Cities categorised as smart have advanced urban infrastructure and services. With smart-city solutions, like e-governance, proper administrative systems and supporting government policies, already in place. Quick access to all emergency services, including medical facilities, is prioritized. All modes of transportation are

centralized (inclusively organized) and connected with one another. With one ticket, a traveller can switch effortlessly between different modes of transport, such as buses, trains, the metro and trams. Special care centres for the elderly, adult-education centres, environmentally friendly buildings and a safe environment for citizens are a few of the most common features of a smart and sustainable city (Amitrano et al., 2014). Once this level of city development has been achieved, technology plays an important role. With the help of information and communications technology (ICT), city services are easily accessible remotely, for example, mobile phone applications for public transport, city services and remote bill payments. With progressive and successive technological advancements, even the smartest cities have to keep abreast of the latest trends and smart-city solutions.

As seen in the section above, cities around the world have to upgrade constantly to remain competitive and resilient and to weather rapid increases in urban population and the demand for urban infrastructure. But the challenge of infrastructure development, bring us to the challenge of accessing proper financing. Urban-development projects require a great amount of financing, to which local city governments often do not have sufficient access. According to McKinsey Global Institute, global infrastructure investments of over USD 57 trillion will be required between 2013 and 2030 for the development of the telecommunications, transportation systems, water and power-supply sectors. Countries in Africa and Latin America are suffering the most due to a lack of urban investment. Persistent underinvestment or lack of sufficient funds will further hinder the course of development in developing economies.

3. INFRASTRUCTURE DEMAND AND REQUIRED INVESTMENTS

Urban infrastructure and services are key areas of investment and financing because they can unlock huge potential for future growth. With the world urbanizing and developing at a rapid pace, investments supporting sustainable urban-development projects are of the utmost importance. Urban investments should be leveraged to achieve the sustainable economic development of cities, as well as their nations. When it comes to attracting investment for infrastructure development, cities often need help conducting feasibility studies and ensuring that their urban-infrastructure projects are “bankable” or financially viable and able to secure financing from third-party sources.

As seen in the figure below, annual infrastructure investments in the amount of USD 750 billion will be required only in Asia. The United Nations Human Settlement Programme also estimates that the current global infrastructure investment gap amounts to USD 1 trillion per year (Kamiya, 2016). Without proper financing, economic growth stagnates, living standards are impaired and cities are unable to combat the adverse effects of climate change.

Region	Annual infrastructure investment needed (USD)	% of regional GDP
Africa	93 billion	15%
Asia	750 billion (between 2010-2020)	-
Australia	23 billion ¹	-
Europe	Over 560 billion ² (up to 2030)	2.6%
Latin America	320 billion	6.2%
North America	510 billion	-

Figure 2: Requirements for regional infrastructure financing
(Source: Z/Yen Group Limited and WWF, 2015)

Estimates of required infrastructure investments are alarming. Even without a proper consideration of the ill-effects of climate change and global warming, the cost of upgrading and renovating existing cities will require huge investments. Developing countries and their cities are facing a heavy burden when it comes playing economic “catch-up”, while catering to the demands of the existing population. Where climate change is concerned, both the developed and developing economies are struggling with greenhouse gas emissions, as well as an increased strain on urban infrastructure. World economists have applied various methodologies and timeframes, as well as considered the costs of carbon-neutral infrastructure development, in order to assess the potential costs associated with overcoming these issues. Their estimates vary wildly. However, all sources have estimated that an enormous investment will be required to ensure cities’ livability and to combat climate change. The table below lists estimates of infrastructure investment from some key sources:

Table 1: Infrastructure investment needs
(Source: Allianz SE, 2014)

How much?	For what?	When?	Source
Over USD 40 trillion	Global infrastructure investment most of which will be spent on urban infrastructure development and maintenance	2012 - 2037	KPMG (2012)
Around USD 41 trillion	Amount that cities worldwide will need to invest in expanding their water, power and transportation systems	2005 - 2030	Booz&Company (2007), quoted in Siemens (2010a)
Around USD 50 trillion	Global infrastructure requirements	2007 - 2030	OECD 2006/07 estimates, quoted in OECD (2013c)
USD 57 trillion	Global infrastructure investment needed (even without green targets and development goals)	2013 - 2030	McKinsey (2013)

The World Investment Report provides a comprehensive account of investment gaps in various sectors in developing countries.

Table 2: Current investment, investment needs and gaps, and private-sector participation in key SDG sectors in developing countries
(Source: UNCTAD, 2014)

Sector	Description	Estimated current investment (latest available year) \$ billion	2015-2030		Average private sector participation in current investment ^b	
			Total investment required	Investment Gap	Developing countries	Developed countries
			Annualized \$ billion (constant price)	Annualized \$ billion (constant price)		
A	B	C = B - A				
Power ^c	Investment in generation, transmission and distribution of electricity	~260	630–950	370–690	40–50	80–100
Transport ^c	Investment in roads, airports, ports and rail	~300	350–770	50–470	30–40	60–80
Telecommunications ^c	Investment in infrastructure (fixed lines, mobile and internet)	~160	230–400	70–240	40–80	60–100
Water and sanitation ^c	Provision of water and sanitation to industry and households	~150	~410	~260	0–20	20–80
Food security and agriculture	Investment in agriculture, research, rural development, safety nets, etc.	~220	~480	~260	~75	~90
Climate change mitigation	Investment in relevant infrastructure, renewable energy generation, research and deployment of climate-friendly technologies, etc.	170	550–850	380–680	~40	~90
Climate change adaptation	Investment to cope with impact of climate change in agriculture, infrastructure, water management, coastal zones, etc.	~20	80–120	60–100	0–20	0–20
Eco-systems/ biodiversity	Investment in conservation and safeguarding ecosystems, marine resource management, sustainable forestry, etc.		70–210 ^d			
Health	Infrastructural investment, e.g. new hospitals	~70	~210	~140	~20	~40
Education	Infrastructural investment, e.g. new schools	~80	~330	~250	~15	0–20

By adjusting the total investment required by the proportion of urban population (the urbanisation rate), particularly in developing nations, future trends in urbanisation can be projected. It is consequently possible to estimate urban-investment needs by sector.

3.1 Sector-Wise Demands of Sustainable Infrastructure Investments

Sustainable infrastructure refers to projects that are economically, socially and environmentally sustainable. Social sustainability includes infrastructure-development projects that are inclusive, ensure poverty reduction, and supports equal rights and access to all basic services. For economic sustainability, infrastructure projects should contribute to job creation and to boosting GDP. Environmentally sustainable infrastructure projects can assist in the mitigation of changes in urban micro-climates and pollution, as well as support the transition to a low-carbon or green economy. According to a study undertaken by the McKinsey Center for Business and Environment, as illustrated in the figure below, energy and transport sectors will demand the majority of infrastructure investments.

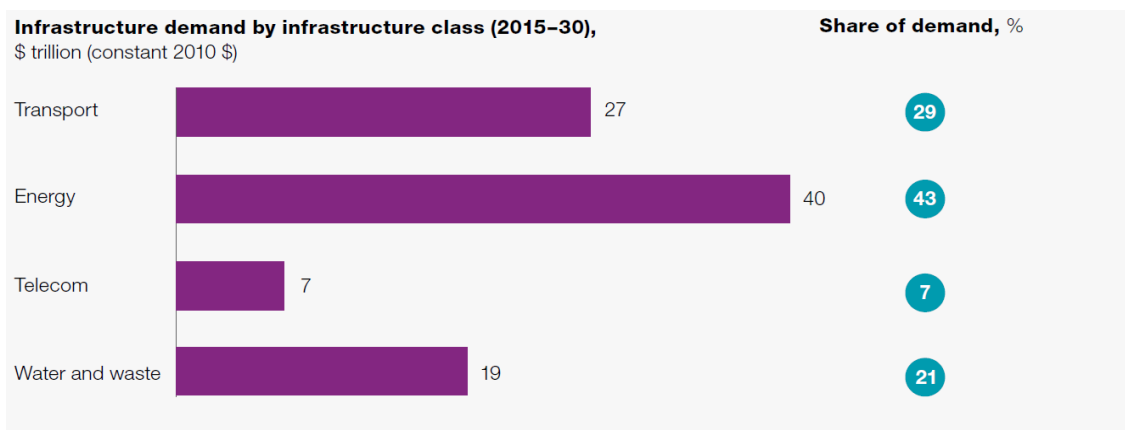


Figure 3: Infrastructure investment demand by infrastructure class (2015-2030)
 (Source: McKinsey Center for Business and Environment, 2016)

3.1.1 Water and Waste

Access to clean water is already a challenge in cities worldwide. Without proper recycling and waste-management systems, rapidly urbanizing cities from developing countries also face health issues due to polluted water sources. In addition, in many cities, water is often wasted as it is considered a basic service and is highly subsidized by the local government. In Brazil, for example, 40% of water is wasted due to leakages. In Singapore, on the hand, water waste only accounts for 6%. Many national and local governments are therefore working on projects that focus on water recycling, wastewater treatment plants, and fixing and upgrading existing water-service related infrastructure systems (KPMG International, 2012).

Similar to water management, the management of waste has always been a top priority for municipal authorities, in both developing and developed countries. Poor waste management not only has a direct impact on health but also affects economic growth, land fertility and the environment. Advanced waste-management systems, waste segregation techniques and recycling facilities have proven highly effective in cities from the developed world. There is a constant strain on their capacity, however, which needs to be addressed regularly. Cities from developing countries, facing huge challenges due to improper waste collection and management systems, will require access to both technology and finance to overcome this issue. Another crucial problem is that many developed nations export their waste to less developed countries. According to McKinsey, both the water and waste sectors will require an investment of USD 19 trillion globally in the coming years.

3.1.2 Energy

Cities currently consume more the two thirds of the global energy supply, most of which are still heavily dependent on coal, oil and gas to fulfill these requirements. Transition to renewable energy sources and the upgrading of existing power-transmission systems is of the utmost importance. Smart metres and smart grids, for example, need to be introduced and adopted in cities to log energy-consumption patterns and to balance out power requirements during peak hours (KPMG International, 2012). Policy changes and close cooperation with power distributors, without the inflation of electricity prices, will be required in developing countries and their cities to address this issue effectively. Subsidies and tax rebates are other potential solutions to ensure the viability of renewable energy-related technologies and to attract the interest of the private sector. 43% of total global infrastructure investment demand in the next fifteen years, which totals USD 40 trillion, belongs to the energy sector alone.

3.1.3 Transportation

Transportation or mobility is one of the most important and most discussed challenges for urban areas. Public transportation systems need to be fast, efficient, and eco friendly or green, as well as integrated with ICT. However, the most important thing is to organize spatial land-use systems that reduce the need

for transportation by implementing flexible and integrated functional systems. With increased use of public transport, the use of private vehicles will decline, which will in turn reduce greenhouse gas emissions and traffic congestion (KPMG International, 2012). With the adoption of ICT, public transportation systems, such as buses, trams and the metro, can be tracked to offer citizens a larger set of available transport options. Cities in developed countries need to constantly upgrade their public transportation systems already outfitted with advanced technologies, while cities in the developing world need to address transportation-related issues by striking a balance between maintaining traditional modes of transport and slowly advancing toward modern systems. Innovative ways to manage urban land-use systems will also play a key role in both developing and developed nations and can help cities optimize access for all. McKinsey estimates that USD 27 trillion will be required globally for the transportation sector. As is already evident in cities from developed countries, multi-stakeholder partnerships and the private sector will have an important role to play in assisting cities in meeting this daunting demand.

3.1.4 Telecommunication

Advanced communications systems are key elements of an innovative ecosystem. Investments in the telecommunication sector are required to complement other infrastructure sectors and services, such as transportation, power transmission and construction. Upgrading existing networks, while extending them to underserved or rural areas, will have a strong positive impact on the supply and productivity of other sub-sectors, such as the gas, electric, water and transportation sectors. As telecommunication investments are “lumpy” by nature, municipal governments often face a challenge in meeting investment demands. McKinsey predicts a required investment of USD 7 trillion between 2015 to 2030 (OECD, 2009).

4. THE ROLE OF KEY STAKEHOLDERS IN URBAN FINANCING

4.1 Municipal Government

Municipal governments are mandated by local habitants to be, first and foremost, a provider of public services. By law, they are the public sphere closest to the people and are therefore in the best position to maintain and improve neighbourhood living conditions. Services, in the context of technical, institutional and personal infrastructure, include utilities, such as public transportation, water and gas, and social welfare, such as healthcare and education (Duque, 2016). In the world of rapid urbanization, municipal governments are also mandated to contribute to the realization of sustainable development. They are to help improve air quality, convert traditional transportation to new modes of climate friendly transportation and drive forward the continuous development of the local economy.

Underlying all these functions is a division of revenue and expenditure. Municipal governments are the principal owners of these divisions, arranging reasonable capital expenditure plans and responsible for raising funds through internal and external channels. In either case, a sound financial management scheme is required for a city to develop sufficient endogenous sources, sometimes referred to as the “benefit” model (UN-HABITAT, 2009). Endogenous sources are primarily wealth that comes from land ownership, public assets and public companies. These forms of wealth, of which cities can make use if properly assessed and registered, are considered “latent”. Municipal governments provide services at a cost, which normally takes the form of user fees, property tax and income tax.

A significant part of municipal financial management is the design and implementation of the local tax. The World Bank Institute characterizes a good local tax as “1) The tax base should be relatively immobile so that local governments can vary the tax rates without losing a significant portion of the tax base; 2) The tax yield should be adequate to meet local needs, increase over time as expenditures increase, and be relatively stable and predictable; 3) The tax should not be one that is easy to export to non-residents; 4) The tax base should

be visible to ensure accountability; 5) Taxpayers should perceive the tax to be reasonably fair; 6) The tax should be relatively easy to administer” (Bird, 2000).

Another example of endogenous wealth that has been intensively discussed over recent years is the leverage on assets, namely municipal land properties. In countries like China where lands are state-owned, proceeds from selling lands have become the biggest source of revenue. In other countries, land financing primarily takes the form of property tax. In these cases, besides a sound taxation policy, governments should maintain an efficient land registration system, which allows them to periodically update information on asset and property ownership. Effective property tax collection enables municipal governments to practice land-value sharing, in which they direct those resources toward housing improvements for residents and compensating proprietors with income.

4.2 National Government

Senior-level governments make intergovernmental transfers to municipal governments. These are paid regularly according to the habitation size or expenditure needs of a municipality. There are also conditional transfers designated for particular urban projects. The rationale behind this is that the central government collects a majority of fiscal revenue, while a substantial part of government spending should be spent at the local level, creating a vertical imbalance among different governmental layers. With continuous urbanization, as it stands today, this vertical imbalance grows. Within one country, there can also be horizontal imbalances between different areas, caused by historical or geographical issues. By granting intergovernmental transfers, central governments can at least ensure a minimum level of service level that is universal across the country (UN-HABITAT, 2009). However, it is important that the transfers are isolated from political cycles or electoral issues (UN-Habitat, 2016).

4.3 External Financing Channels

It is also important that municipal governments utilize long-term funding, especially long-term borrowings, to finance their infrastructure investments. A large infrastructure project requires significant initial investment typically outlaid in the first one to three years, while its payback period can extend as long as several decades through collections from the benefit model. This pattern fits well with the arrangement of a long-term project finance, where the lender advances principle at the very beginning and requires installment repayments across the following decades. This also eases the burden on a city’s budgetary planning as the cost of a project amortizes equally across a substantial amount of time. This is, however, difficult in cities in developing countries as it requires bond financing and creditworthiness.

4.4 Private-Sector Participation

While it is both sensible and beneficial for municipal governments to directly borrow from the capital market, it is not always practical. Some cities are restricted by the national government to borrow externally, others, who are in a rapid development stage, may easily reach their debt ceiling, and still others in less-developed economies are simply not accessible to the capital market. The participation of the private sector in these cases becomes critical. The total privatization of a public sector is always an option, but it is not always desirable and in many cases not achievable as the long payback periods, high capital commitments and complex managerial requirements drive private companies away. The most realistic procedure is to establish a public-private partnership (PPP). The particular arrangements of PPPs vary in different cases, but essentially, a PPP engages the private sector in infrastructure and other public services without rendering the ownership of these assets. Through this partnership, the government typically provides partial capital investment, an injection of assets and in some cases policy support, where the private sector provides its expertise in commerce, management, operation and innovation.

5. POTENTIAL FINANCING MECHANISMS

5.1 Commercial Bank Financing

Commercial banks are significant participants in urban-development projects. They either directly invest in municipal projects, typically providing funding, project-based performance bonds and a letter of credit, or indirectly invest in those private and public companies who are involved in urban development. Commercial bank lending helped finance the urban development of Western Europe in the twentieth century. In countries such as China, Brazil, Chile and Mexico, where the world’s most active urban investment is found today, the commercial banking sector has become the principal provider of infrastructure funding, as well. Projects in these countries are normally backed by public resources and state support, thereby allowing them to gain a near or equal to state-level investment grade.

However, the participation level of commercial banks varies across regions. In some least-developed regions, a nationwide low bank penetration prevents commercial banks from taking a central role in infrastructure finance. In other nations with a mature banking network, technical difficulties between the nature of commercial bank finance and that of infrastructure requirements are also evident. The biggest challenge is that, as the World Bank Group has pointed out, “[t]he complexity and duration of project financed projects often means that local banks in many developing countries lack the technical capacity or willingness to enter into these projects, and where they do they tend to be junior members of syndication” (World Bank, 2016).

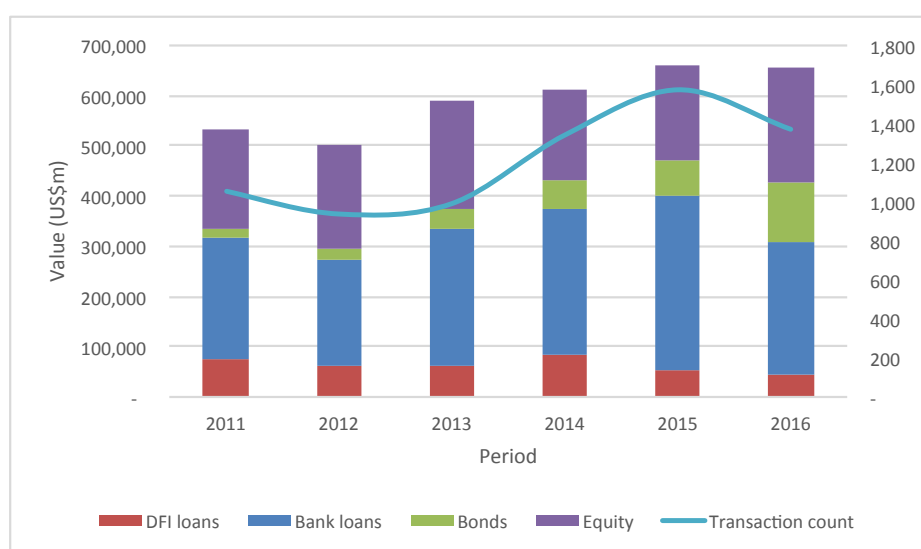
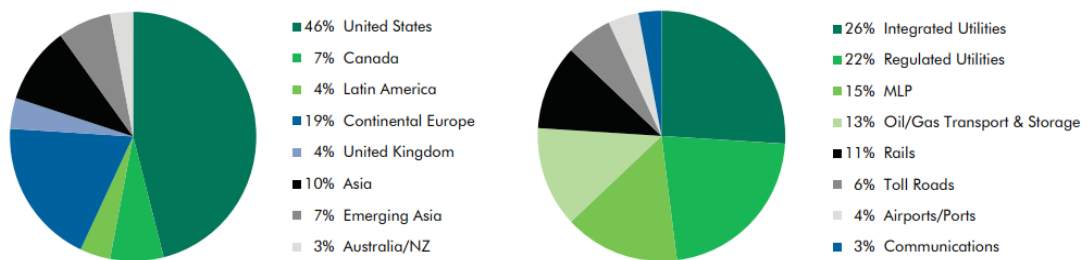


Figure 4: Global infrastructure investment by funding source
(Source: IJGlobal, 2017)

5.2 Capital Market Financing (Debt/Equity)

The utilization of the Debt Capital Market (DCM) has gained increased importance in urban-development financing, and this is usually achieved by the issuance of municipal bonds. Just as bank lending financed the urbanization of Western Europe, municipal bonds funded a similar process in North America. The United States in particular is still the world’s biggest municipal bond issuer and has maintained a total of USD 3.7 trillion outstanding in municipal bonds as of 2011 (US SEC, 2012). Municipal bonds, in comparison to bank borrowing, tend to have a larger issuance value and a more secure, fixed interest rate. They are consequently ideally matched to capital-intensive projects. However, bonds are an inherently less flexible and more complex product that requires the high-quality financial management of the issuer.

The Equity Capital Market casts an even higher bar than the DCM. Normally, municipal assets in advanced economies with large company profiles, strong growth potential and sound financial transparency can be publically listed. Yet, successful infrastructure companies exhibit a steady capacity for cash-flow generation. They oftentimes dominate a certain market and are relatively protected from the ups and downs of the macro-economy. Though these assets have a longer payback period and often lower returns compared to more traditional investments, their risk-adjusted return can be satisfactory. These features make infrastructure stocks a popular investment in the portfolio. Today’s equity market consists of 413 companies worldwide who boast a combined USD 3.4 trillion market capitalization (CBRE Clarion Securities, 2016). Because of the high entrance barrier, a majority of the listed companies remain in developed economies.



Source: Bloomberg, CBRE Clarion Securities

Figure 5: Breakdown of the listed infrastructure investment universe
(Source: CBRE Clarion Securities, 2016)

5.3 Equity Funds

There are an increasing number of private-equity funds that participate in urban and infrastructure development. From a capital-market perspective, funds across the world are searching for investment into infrastructure-related bonds or equity as an important part of their portfolio. There are also numerous designated infrastructure funds, which work with project-management companies to provide funding. This is normally done by the provision of mezzanine financing, in which infrastructure funds take “more risk than traditional lenders but less than sponsors” (World Bank, 2016).

Infrastructure equity funds first became popular in Australia in the 1990s and have now become a primary funding source in the field of finance and investment. In 2016, a record USD 59 billion was raised by a total of 181 unlisted infrastructure funds (Preqin, 2017). In the current market environment, where traditional investments offer declining interest-rate income, investors do look for infrastructure investments with strong risk-adjusted returns and downside protection. A survey conducted by Preqin suggests that 73% of fund managers plan to deploy more capital to infrastructure assets in 2017 than they did in 2016 (Preqin, 2017).

5.4 Export Credit Agencies

An Export Credit Agency (ECA) is “an agency in a creditor country that provides insurance, guarantees, or loans for the export of goods and services” (IMF, 2003). These agencies are particularly active in cross-border transactions or projects that are either initiated by governments or the private sector. They are involved with companies or organizations who take on municipal projects outside of their own country. In short, ECAs provide support in three main areas:

- “Direct lending. They provide export loans to parties who sell their services and goods to another country. This is the simplest structure.
- Financial Intermediary Loans. The ECAs lend to a financial intermediary, such as a commercial bank, that in turn lends to the importing entity.

- Interest rate equalization. A commercial lender provides a loan to the importing entity at below-market interest rates, and in turn receives compensation from the ECA for the difference between the below-market rate and the commercial rate” (World Bank, 2016).

5.5 Development Finance Institutions and Multilateral Development Banks

Development finance institutions (DFIs) are set up by developed economies to provide funding and foster growth in developing economies. These organizations can be bilateral, “such as the Netherlands Development Finance Company (FMO), or part of larger bilateral development banks, such as the German Investment and Development Company (DEG), which is part of the German development bank KfW. They are both among the largest DFIs worldwide” (OECD, 2017). There are also Multilateral Development Banks that are jointly established and managed by several countries. The majority of them have a regional focus and stronger capacity as they provide longer-term equity investments and borrowings. Examples include the International Finance Corporation, the African Development Bank, the Asian Infrastructure Investment Bank, the Asian Development Bank, and the European Bank for Reconstruction and Development (OECD, 2017).

5.6 Sovereign Wealth Funds

Sovereign Wealth Funds (SWFs) are established by countries with a surplus in their budgetary planning. They allow these countries to invest the budgetary surplus domestically and overseas in exchange for a return. These funds broadly share the same investment pattern as private-equity funds insofar as they invest in a portfolio of “assets including stocks, bonds, property, precious metals, and other financial instruments” (World Bank, 2016). But because of the stability of the funding, they tend to look for longer-term projects with a more secure return. This makes infrastructure and urban development projects a more attractive asset class. The world’s total assets under management of SWFs was an accumulated USD 6.59 trillion as of March 2017 (Preqin, 2017).

5.7 A Comparison of Different Mechanisms

	SENIORITY	COST	PRODUCT FEATURE	FIELD OF APPLICATION
Commercial Bank	Senior Debt	Cost of bank loans and bonds are generally comparable. They are considered to be some of the lowest-cost funding available in the open market	Commercial banks offer the widest product range in the market. They provide short-, mid-, and long-term funding, and accommodate working capital and project finance needs. Unlike bonds, loans can be repaid early, allowing more flexibility for the borrowers. Banks normally ask for floating interest rates, which exposes borrowers to interest fluctuation risks.	Wide range of fields from working capital to project finance. Can apply to differently sized borrowers as well.
Capital Market Debt			Bond market opens the borrower up to more public scrutiny. It mostly covers short- to mid-term funding needs. Longer term finance (ten to twenty year project loans) is rarely seen. Bonds are usually tied with a fixed interest rate that can mitigate interest fluctuation.	Usually apply to larger-sized deals backed by a good company profile. Bonds for over ten years are rare.
Export Credit Agencies		ECAs and DFIs provide financing at a near-to-market cost. But this is also subject to a case-by-case arrangement. In some of the more policy-led deals, costs of financing can be significantly lower than the market.		Cross-border transactions, usually from developed to developing economies
DFIs			Depends on case-specific terms but usually similar to bank loans.	Similar to bank loans but limited to policy-driven deals.
Private-Equity Funds		Mezzanine Finance	Equity funds are subordinated to debt so they are more expensive. In most cases, Private equity is less expensive than public initial public offerings because investors usually enjoy voting rights or managerial duties in the company.	Equity funds are ideal for capital expenditure because they enhance a company's capital base and do not require repayment. Equity funds normally look for a clearly defined exit strategy (public listing or selling) when they enter an investment.
SWFs				
Capital Market Equity	Subordinated equity		Public listing is a high bar for any company. Usually, prime quality assets in economically developed cities get to be listed. Investors enjoy their annual dividend income and potential gain from transactions in the stock market.	Good-quality assets that are looking for long-term capital expenditure.

6. FINANCIAL INNOVATION

Impact investment instruments for urban revitalization have significant potential to address the urban financing gap by offering opportunities for collaboration with municipal leaders and the private sector, as well as DFIs (Council of Development Finance Agencies, 2017).

6.1 Social Impact Bonds

One form of impact investment is Social Impact Bonds (SIBs), which are also sometimes referred to as pay-for-success contracts (PFS). This is an innovative funding scheme designed for urban projects with a measurable social impact. The contract typically involves government bodies, non-governmental organizations (NGOs) and private-sector investors. The payoff of this bond depends on the actual outcome of the underlying project. If the project succeeds, investors get the principle back and oftentimes an interest surplus. If the project fails, investors are at the risk of losing their principal.

The most famous example of an SIB is the Roca Social Impact Bond issued in Massachusetts in the United States in 2014. This bond is built upon an intervention project towards “929 at-risk young men aged 17 to 23 who are in the probation system or exiting the juvenile justice system. Roca’s programming aims to reduce recidivism and increase employment through intensive street outreach and targeted life skills, education, and employment programming” (Goldman Sachs, 2015). The project will be considered successful if the incarceration rate in the region declines. Only under this case will the investors receive back their principal and interest. The incentive for the Government of Massachusetts is that they can save money from decreased incarceration rates. Goldman Sachs, with its USD 9 million senior loan, is the biggest financial backer of this project. The incentive for investors is the social impact of the project, as well as their faith in the project’s outcome.

SIBs are being implemented worldwide. Globally, active SIBs total roughly USD 200 million. The United Kingdom is the epicentre of PFS and SIB activity, with almost GBP 55 million committed to fifteen projects focusing on recidivism, youth employment and foster-care avoidance. The European Commission has expanded its Social Business Initiative to foster social entrepreneurship and investments in social innovation throughout Europe, where PFS projects designed to address adult and youth unemployment have been launched in the Netherlands, Germany and Belgium. Similar activities can be found in Australia and South Korea, as well as India, where the Children’s Investment Fund Foundation will pay out an initial USD 238,000 in funding for a development impact bond, financed by the UBS Optimus Foundation (Rangan and Chase, 2015).

6.2 Pooled Finance Development Scheme

The Pooled Finance Development Scheme (PFDS) consolidates the financing needs of various municipalities, referred to as Urban Local Bodies (ULBs), into a state-level mechanism. Under this scheme, the central government acts as the principal borrower, who then redistributes the proceeds to lower-level governments on an as-needed basis. The biggest benefit of PFDS is that the central government essentially provides credit enhancement to ULBs who may be too small to establish creditworthiness on their own. As the burden of debt rests on the national government, the cost of borrowing will be lower because national governments are considered less risky. In addition, by consolidating different transactions into one, governments save on transactional and personnel costs. PFDSs, however, require the cooperation of municipal development corporations at the national level to ensure some form of sovereign guarantee. For this reason, both SIBs and PFDSs do not work well in developing countries, except in Latin America and middle-income Asian countries.

6.3 Cooperative Funding

Cooperative funding or a public-private infrastructure cooperative is an innovative model to address early phase funding risks for PPP projects. This model helps eliminate the requirement for subsidies for PPP projects as it converts them to market-driven PPP equity and debt capacity with return for reinvestment. As there always exists political risk for PPP projects, this model effectively mitigates this risk.

One good example is I Co-op in California, which is an independent infrastructure bank established to finance PPP projects. Based on PPP ownership, initial capital draws upon private capital, including contributions from investors, a state's non-capital contribution in the form of guarantees, and bank deposits. I Co-op helps the state or government increase their debt capacity without direct capital contributions, while offering investors a model with which to access the city's infrastructure assets portfolio. I Co-op or cooperative funding is therefore a good solution for governments seeking to attract investment from the private sector for urban infrastructure development (Julie Kim, M. et. al, 2012).

6.4 Technological Innovation: Changing the Course of Urban Development

On the one hand, technological innovation has propelled urban development throughout human history. In the nineteenth century, people tore down walls and fences to make space for factories. In the twentieth century, roads were being strengthened and widened for the introduction of auto vehicles. On the other hand, technological developments can help tackle various urban-development issues and help build smarter cities, as is the case in Reykjavík, Iceland where automatic light-dimming systems improve energy efficiency and preserve the cities' world-famous night skies. Or how an internet-based housing system helps São Paulo in Brazil track and boost property tax income.

In today's world, instant internet connections and the advent of artificial intelligence have brought about what many experts are hailing as "the fourth industrialization". Technology has revolutionized urban planning, and it has therefore become critical for stakeholders to keep track of these constant changes. In their publication *Inspiring Future Cities and Urban Services*, the World Economic Forum has summarized some new city operation models inspired by technological innovation (WEF, 2016):

- **Digital "Integrated City" Services or Smart Cities:** This is the idea of consolidating various government-provided services using information systems and the "Internet of Things". Many infrastructural fields correlate with each other. For example, water supply and water treatment, industrial production and waste management. Through integration, the government can not only promote economies of scale, but also provide a one-stop solution for its citizens and enterprises.
- **Public Asset Revitalization:** Technology can help convert and repurpose public facilities that are no longer in use. For example, when a machinery factory is moved out of the city centre, the old site can be renovated and transformed into a recreational park or an exhibition venue. In this way, a city can utilize those "dead assets" to improve its resource efficiency. Cities can also apply value-added services to an existing and functioning asset in order to get a better social and economic return. A good example of this is the "Things of Array" project in Chicago in the United States. The city installed 500 sensor nodes on street lamps. These sensors can collect information on air quality, climate, traffic and other urban features for the purposes of research and urban governance. This project saves additional costs for the government and research institutions who would otherwise have to collect data elsewhere (University of Chicago Computation Institute, 2016).
- **Outsourcing of Innovative Public Services:** City governments have long been outsourcing some of their services to the private sector for the sake of efficiency and better service. This could be the outsourcing of a whole sector, such as mandating a private company to oversee wastewater treatment, or the outsourcing of internal functions, such as appointing a human-resources firm

for personnel administration. With technological advancement, the outsourcing of public services takes things a step further by allowing technological innovation to become a part of urban development. For example, London in the United Kingdom has concluded a ten-year outsourcing contract with the IT Consultancy Firm Capgemini. The latter will be responsible for some of the core operating functions of city buses, including crew scheduling, operational staffing, on-bus revenue accounting, performance monitoring and mileage planning. This project automates the bus-management process, allowing the system to be more responsive, error-free and cost effective (Capgemini, 2009).

Box 1: Urban Innovation in Vienna

DigitalCity.Wien Initiative



DigitalCity.Wien was found to foster ICT - Open Innovation in a cooperative setting. To generate added value, it connects private-sector companies with the city administration. Instead of planning and implementing activities based only on internal coordination, the municipality moves ideas forward in cooperation with private businesses. A monthly *jour fixe*, where projects, initiatives and/or companies can present themselves and their products, ensures a high level of communication and new collaborations. This initiative is not only a pool of experts, but is also a movement of people interested in supporting innovation in ICT.

From the beginning, DigitalCity.Wien has been open to all, offering various participatory activities. At the start of DigitalCity.Wien, almost 2,000 representatives came together in a flashmob to highlight the importance of ICT and digital matters. Since then, about 150 Viennese IT companies have been working together on this process. One key outcome of the cooperation is the so called “education initiative”. Working together with the Vienna School Council and numerous companies, an online platform for schools has been set up to facilitate workshop bookings for pupils, which are offered by IT companies for free.

Smarter Together Project



Financially anchored in a European Commission H2020 lighthouse project, “Smarter Together” is a co-creational process, bringing together 30 partners and end-users to implement technical innovations in urban retrofitting and mobility. Three residential neighborhoods in Vienna, with 1,300 inhabitants, have received a “smart refurbishment”. A strategy on mobility is elaborated and implemented with a special focus on shared mobility options. This project takes a co-creational learning approach, with experimental settings fostering the creation of new ideas. A “flexible” office, known as SIMMobil, has been developed to support lively dialog between the city administration and the citizens. It is a workshop and office space based in a caravan that can be placed anywhere in the project area. It goes where the people are, and it starts dialogues anywhere, any time. “Smarter Together” develops operational practices that are incorporated in the overall governance structure of the city. This project is a role model for crowdsourced innovation. Urban Innovation Vienna is a project partner, focused on replicating the outcomes in other urban areas of Vienna.

Cities are our Passion



Urban Innovation Vienna GmbH is the City of Vienna’s leading thought incubator for analysing and consulting in the area of contemporary urban issues. Our purpose is to act as an influential adviser and process provider for advanced urban development and smart city excellence. We strive to support Vienna’s administration and its companies, as well as other cities facing up-and-coming urban challenges in a competitive global environment, to the best of our abilities. We therefore develop new methods and generate new approaches and new understanding in a co-creational way together with the city administration and city-owned companies, as well as with partners from scientific and business sectors.

Urban Innovation Vienna consists of an interdisciplinary team of more than twenty experts, who work in close cooperation with the City of Vienna and are engaged in continuous exchange with international experts. Our performance is based on years of research, strategic advice and policy-oriented practical services, and our working areas are grouped according to three thematic clusters: smart cities, energy innovation and the future of cities.

6.5 The Sharing Economy

A sharing economy is an economic model in which individuals are able to borrow or rent assets owned by someone else (Investopedia, 2017). These assets can be either physical or intellectual, and the sharing normally happens when these assets are not fully utilized by their owners. The essence of the sharing economy is the sharing of information, specifically when and how the assets in need are available to rent. Technological development, particularly the widespread use of the internet, makes it cheaper and easier for people to share information peer-to-peer. The sharing economy is therefore a predictable by-product of the information age.

The term “sharing economy” first appeared in early 2000s when several businesses started to use emerging social-networking platforms to sell products. The first known usage of the word occurred when Yochai Benkler, a professor at Harvard Law School, issued a paper in 2004 promoting goods sharing as part of the economy. In 2010, Rachel Botsman introduced a similar concept – collaborative consumption – in her book *What’s Mine Is Yours*. This book effectively popularized the idea of the sharing economy. Then, later in 2011, Time Magazine named collaborative consumption as one of “10 ideas that will change the world” (Duverge, 2016).

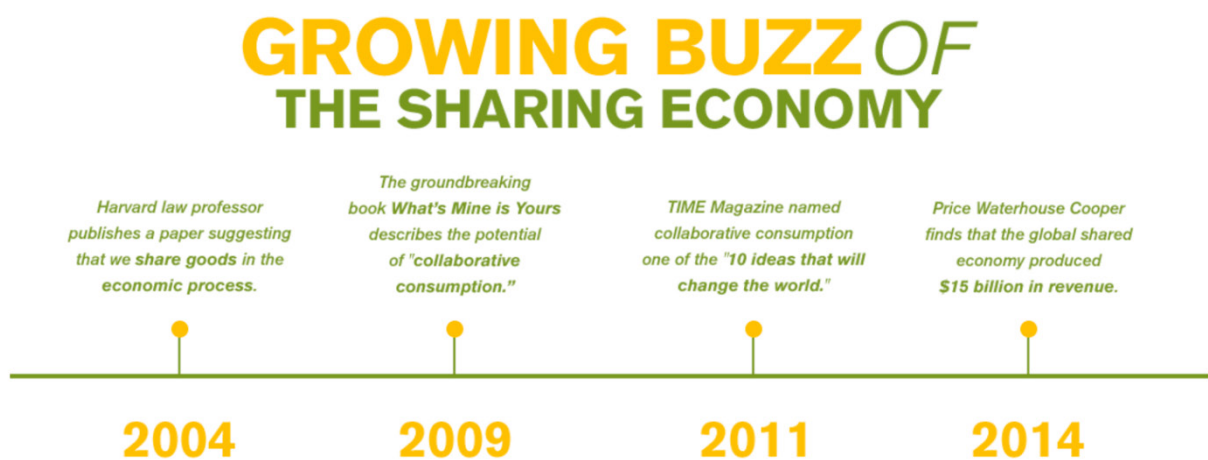


Figure 6: Sharing Economy

(Source: Duverge, 2016)

Nowadays, the sharing economy has taken hold in various niche markets. A Forbes article summarized several examples in different fields (Marr, 2016):

- **Freelancing** — Sites like TaskRabbit, Care.com and Upwork have taken the freelance market to a new level. Upwork specializes in helping more traditional freelancers (writers, graphic designers, coders, etc.) connect with business owners looking to hire; while TaskRabbit does the same for services like handymen, dog walkers, personal assistants, and so on. Care.com specializes in caregivers for both children and the elderly. The platforms each of these sites have built make it possible to connect those offering services with those seeking the services.
- **Coworking** — WeWork is only one of many companies providing coworking spaces in big cities around the world. Freelancers, entrepreneurs, and telecommuters can rent a desk or an office without the overhead and cost of renting an entire building or suite. Prices are low enough that you can use it as you like, and space offers some of the benefits of an office including meeting space, phone lines, the internet, and often free coffee and even free beer and wine sometimes.
- **Car sharing** — Services like Lyft and Uber allowed individual drivers to operate like a taxi service by providing them a safe way to find clients and get paid. Zipcar allowed people to borrow cars for very short periods of time, like the length of a big shopping trip. And now, services like Getaround

enable individuals to share their cars with neighbours and get paid for it by connecting the users on the Getaround platform, automating payments, and even insuring the cars for up to \$1 million. Liquid provides the same service for renting bicycles!

- Peer-to-Peer lending — Lending Club and sites like it allow people to lend one another money, with much lower interest rates and fees than traditional credit cards or bank loans. Investors earn solid returns and borrowers get more competitive rates, all facilitated by the platform.
- Fashion — Sites like Poshmark and thredUP allow individuals to sell their gently used clothing while services like Le Tote offer subscribers the ability to borrow clothes and return them like a Netflix subscription for your closet. Rent the Runway allows women to rent designer gowns for a special event at a fraction of the price of buying one.
- Sharing resources — Neighbourgoods and similar sites allow people to borrow resources — like tools and kitchen appliances — directly from their neighbours. Rather than buying a specialized tool for a single project, people can connect with and borrow from their neighbours, facilitated by the platform.”

6.5.1 How the Sharing Economy Can Reshape Urban Development

The emergence of a sharing economy has had a perceivable impact on urban development. Cities are fundamentally built upon the idea of sharing. Public services, facilities and goods, which were originally coordinated by governments or companies, are now being shared among citizens. Just as the sharing economy is restricted by different city conditions, it nevertheless changes how urban development unfolds and alters the patterns of citizen behavior.

The sharing economy fuels the short-term free-flowing movement of population. Before, the flowing of inhabitants from one place to another was costly and hasslesome. City planners enact zoning laws that assign different neighbourhoods with different functions. Services like Airbnb break zoning easily by allowing tourists to flow to all corners of various city districts. In fact, 74% of the Airbnb properties are located outside of the main hotel districts (Airbnb, 2017). These localized travelers help to boost the neighbourhood economy as they are more likely than long-term residents to spend in local restaurants and entertainment facilities as a way to fully experience the destination.

The sharing economy places accessibility over ownership. With the advent of car-sharing, ride-sharing and bike-sharing systems, people no longer have to own the vehicles themselves to be able to utilize them. This eventually forces city planners to focus more on developing efficient information-sharing systems that enable people to access spare vehicles whenever and wherever they need rather than creating purchasing plans that more people can afford. Transportation sharing offers clear improvements over conventional models. It “reduce[s] road congestion and air pollution, reduce[s] personal vehicle ownership and associated costs, and reduce[s] parking space demand” (Martin and Shaheen, 2010). The sharing economy also changes people’s preferred housing conditions. Some will now prefer to live in a smaller unit in the more expensive neighbourhood because they can easily reduce the appliances they own at home, as long as they are accessible in the sharing-economy system.

The sharing economy changes the way people do trading. Peer-to-peer trading sounds like a comeback of the bartering system, but modern-day technology makes it far more efficient and widely accessible. End users can now skip the middleman and purchase directly from producers. This helps to cut down on trading costs significantly and allows local and small businesses to survive, innovate and provide more jobs for the neighbourhood. And user-to-user sharing helps people exchange spare goods more conveniently, as a way of saving resources.

Through the sharing economy, private assets are voluntarily re-purposed to provide commercial services and to bridge the bottlenecks of publicly provided infrastructure. As the sharing economy is a comparatively new concept, however, and one that is heavily reliant on private assets, its capacity to alleviate infrastructure bottlenecks may only be temporary until sustainable solutions can be implemented by municipal governments.

6.5.2 How the Sharing Economy Can Reshape the Future of Financing

The financing system is ultimately a peer-to-peer mechanism. A lending transaction relocates financial resources from those in surplus to those in deficit and adds a surcharge on top of the relocation. Traditionally, these transactions are dominated by large financial institutions as intermediaries, but this status is now challenged by the development of financial technology or “FinTech”. Big banks are said to be either substituted by FinTech companies or be largely reshaped by them. In 2014 alone investments into FinTech more than tripled, reaching over USD 12 billion (PWC, 2016). These investments are making an impact on the existing financing landscape.

FinTech has helped to bring back a more straightforward peer-to-peer financing system. A simple information-sharing platform enables individual lenders to directly connect with borrowers so they can invest their money at a higher lending rate, compared to giving money to banks at a deposit rate. Peer-to-peer financing exhibits the most typical feature of the sharing economy, representing decentralized business conduct and emphasizing accessibility rather than ownership. Peer-to-peer finance is growing at a significant speed worldwide. “In 2015, UK peer-to-peer lenders collectively lent over GBP 3bn to consumers and businesses” (Nesta, 2016). The US-based lending club is currently the world’s biggest peer-to-peer finance company with a USD 1.4 billion loan outstanding as of the first quarter of 2017 (Lending Club, 2017). In 2016, China had around 2000 peer-to-peer finance platforms with a total transaction value growth of 110% for the year (WDZJ, 2017).

Another breakthrough in FinTech is “blockchain” technology. Blockchain is a distributed database that is used to maintain a continuously growing list of records, referred to as blocks. In finance terms, blockchain is a ledger of peer-to-peer trading or lending activities. Unlike existing currencies, the supply of blockchain is not determined by a central bank, and the network is completely decentralized, echoing the essence of the sharing economy. Conducting transactions on blockchain is faster, easier and cheaper. Blockchain has also revolutionized how companies, especially start-ups, raise funding. The traditional tripartite process of angel investor/venture capital/initial public offering can now be substituted by what is called Initial Coin Offerings (ICOs). ICOs allow companies to engage equity investors at an early stage. They are typically done via the blockchain system by injecting bitcoins. In 2016, blockchain companies raised USD 400 million from traditional venture investors and nearly USD 200 million through ICOs (Dickson, 2017). Importantly, blockchain establishes trust between unacquainted counter parties because the transactions are highly transparent, easy to track and secured by encryption methods.

7. THE WAY FORWARD

Sustainable cities or sustainable urban development, without the necessary infrastructure, is unimaginable. But accessing and arranging the finances to upgrade or develop infrastructure is a bigger challenge than the rising demand for infrastructure itself. There are a multitude of solutions and financial mechanisms available to cities and municipal bodies. This paper is therefore intended to raise awareness of issues related to urban investment and aims to stimulate discussion of how urban stakeholders can engage in partnerships. The key takeaways and open issues to be addressed are:

7.1 Prioritizing Transportation and Energy

As highlighted in the paper, the energy and transportation sectors together will constitute USD 67 trillion of required infrastructure investments globally between 2015 and 2030. There is a need for the national and local governments to learn from past experiences, to identify the most suitable solutions and technologies, and to arrange their finances accordingly. The private sector and DFIs should explore the global landscape and forge PPPs and multi-stakeholder partnerships with municipal governments (Urban Land Institute and Ernst and Young, 2013).

Guiding Questions:

- How can cities in developing countries effectively decouple the use of energy and transport from overall growth without sacrificing their primary economic targets, such as controlling the cost of living?
- How can local community stakeholders be efficiently engaged, preferably through participative democratic processes, so as to enable them to develop new agendas for sustainable transportation in the case of highly dense or populous cities?
- How can urban development concepts, such as transit-oriented-development around the major nodes of mass transit or rail hubs, be implemented while duly considering the interests of urban citizens living in that area?
- In an urban setting, households represent a substantial proportion of overall energy consumption. How can social marketing be put to use to achieve behavioural change fostering enhanced sustainability by improving household energy efficiency?
- What possibilities exist for reforming the traditional approach to high-capacity fixed-trajectory urban public transport systems by integrating aspects of the sharing economy and real-time optimization systems?

7.2 Setting Priorities and Ensuring Competitiveness

The infrastructure-investment gap should not impinge on the prioritization of projects based on their foreseeable economic, social and environmental benefits. Ultimately, national and regional development projects, which affect the greater good, should always take precedence over local one-off projects (ULI and Ernst and Young, 2013).

Both competitiveness and sustainability are important factors for urban development and can help to attract urban investment. Sustainability is a prerequisite for long-lasting urban competitiveness. To improve their competitiveness, cities should therefore not focus on any single factor or aspect of urban development, but should rather take an integrated approach, which will lead to a more sustainable development path overall (Ni, 2017).

Guiding Questions:

- Particularly in the context of developing countries, how can projects be sequenced so as to maintain a fine balance between the economic and social benefits/trade-offs and the environmental benefits/trade-offs? What parameters should be considered while assessing these priorities?
- How important is the need for public feedback or a public stakeholders' participation mechanism while formulating and implementing national and regional schemes? How can these mechanisms be successfully introduced?
- Considering the current growth rates and scales of cities, as well as the development complexities evident in the challenges facing cities of today, developing an integrated approach seems an almost impossible task. How can complex urban systems be adapted to ensure integrated and sustainable urban development?
- How can the short-term positive impacts of the sharing economy be extended in the longer-term to enhance urban competitiveness?

7.3 Putting Multi-Stakeholder Partnerships in Context

At a fundamental level, accelerating sustainable urban and industrial development and meeting its financing requirements comes down to partnerships forged between a variety of municipal-level and international actors, including international organizations and DFIs. Multi-stakeholder partnerships can effectively boost the development of many city-based industrial sectors, including power generation, water treatment and transportation. In this way, urban stakeholders engaged in multi-stakeholder partnerships can encourage one another, with the support of the international community, to adopt sound urban and industrial development strategies.

Guiding Questions:

- As cities generally have lower credit ratings compared to their respective national governments, they are struggling to attract investments, particularly from financial institutions and the private sector. What key actions are needed to be taken by municipal leaders for improving their creditworthiness and enhancing competitiveness?
- Globalization makes international financing mechanisms available to countries and urban agencies. How can the interests of underprivileged, marginalized and/or otherwise underrepresented groups be observed, while taking advantage of the international financing of urban development initiatives?
- Sustainable urban industrial development requires a multi-stakeholder partnership approach. What shared leadership models are available and how can these be utilized to ensure the appropriate representation of the interests of various community groups and agencies, as well as different levels of government?
- Various levels of government and agencies are well established institutions in society. They often rely on NGOs to drive public consultation processes, in order to improve the quality of their decision-making. What is the potential role of NGOs and other already existing community initiatives in driving sustainable urban industrial development?

7.4 Addressing Environmental Challenges and Climate Change

Investments in infrastructure should not only focus on infrastructure development and upgrading based on perceived future demands, but should also specifically emphasize sustainability and carbon-neutral projects. The Organisation for Economic Cooperation and Development estimates that climate action can affect economic growth both in the short- and long-term. These changes in policies could lead to an increase in 2.8% of GDP across G20 countries by 2050. To make the investment climate compatible, an additional investment of USD 600 billion will be required between 2016 and 2030, which is comparatively little considering the economic, social and environmental benefits (Amin, 2017).

Guiding Questions:

- How can the decarbonization of urban systems, particularly in the energy, construction, transport and production sectors, be ensured both in developed and developing countries?
- The Global North is struggling to curb emissions and to reduce high per-capita greenhouse gas emissions, while the Global South is yet to face this challenge, implementing new systems and processes. How can their two seemingly divergent objectives be balanced?
- With the recent decision of the United States to back out of the Paris Agreement, how can international trust in the climate-change-mitigation agenda be restored?

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