

ORIGINAL ARTICLE

Infrastructure provision in developing Asia's giants: A comparative perspective on China, India, and Indonesia

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ABSTRACT

This paper provides a comparative perspective on infrastructure provision in developing Asia's three largest countries: China, India, and Indonesia. It discusses their achievements and shortfalls in providing network infrastructure (energy, transport, water, and telecommunications) over the past two decades. It documents how three quite distinct development paths—and very different levels of national saving and investment—were manifested in different trajectories of infrastructure provision. The paper then describes the institutional, economic, and policy factors that enabled or hindered progress in providing infrastructure. Here, contrasting levels of centralization of planning played a key role, as did countries' differing abilities to mobilize infrastructure-related revenue streams such as user charges and land value capture. The paper then assesses future challenges for the three countries in providing infrastructure in a more integrated and sustainable way, and links these challenges with the global development agenda to which the three countries have committed. The concluding recommendations hope to provide a platform for further policy and research dialogue.

Keywords: *infrastructure; development; planning; policy; Asia; China; India; Indonesia*

1. Introduction

Infrastructure enables social and economic development, and it has been vital in facilitating developing Asia's growth over the past decades. However, despite—and in part because of—this rapid growth, infrastructure provision faces the prospect of severe shortfalls in the coming years. More than 700 million people in Asia still lack access to electricity, about 260 million cannot access clean drinking water, and a staggering 1.5 billion still have to live without access to proper sanitation (Asian Development Bank, 2016a). Rapid urbanization poses challenges of congestion—more than half a billion people live in urban slums across the region under blighted conditions with poor access to basic services and livelihood opportunities (United Nations Human Settlements Programme, 2016). Policymakers across the region are acutely aware of the challenge, yet struggle to deliver adequate levels of public and private infrastructure investment to keep up with the region's growing needs.

In this context, learning from each other's experience is vital. In this paper we take a closer look at the experience of the three largest

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countries in developing Asia: China, India, and Indonesia. These countries' experiences with infrastructure provision—the challenges they have faced in the past and will face in the future, what has worked well and what has not—can provide valuable lessons for policy and research throughout Asia. Why these three countries? Their sheer size and regional importance means they most likely have faced issues that other countries are also struggling with. Also, the three countries have had very different experiences in their development, and in the institutional arrangements through which their infrastructure was provided. These differences hold many useful lessons. Much has been written about the three countries separately; our purpose here is to draw on these studies, synthesize them using a comparative perspective across the three countries, highlight the similarities and differences in experience, and draw what lessons we can. Given the focus on historical experience and institutional arrangements, the approach is necessarily qualitative rather than quantitative, though relevant statistics are provided when necessary to buttress our arguments.

The paper is organized as follows: Section 2 provides context by summarizing the strides in economic development made by the three countries, comparing how well they have done in providing different types of infrastructure, and assessing the extent of private sector participation in infrastructure. Section 3 examines the institutional arrangements that enabled or hindered the provision of infrastructure, focusing specifically on energy, transport, water, and telecommunications. The role of coordinating and planning bodies is underscored, with a reflective view on how the three countries initiated and adjusted decentralization efforts and used gradual approaches to experiment with new policies before scaling these up. Given the role of local governments and the importance of state-owned enterprises in the concerned infrastructure sectors, the analysis also looks at their role in enabling infrastructure provision, and how this has shaped the participation of private sector actors in infrastructure markets. In addition, the particularities of political systems, planning regimes, and related legal and regulatory aspects are discussed. Based on this, Section 4 highlights key challenges the three countries face in providing infrastructure in a more integrated and sustainable way. Finally, conclusions are drawn from the analysis in the form of policy guidance.

2. A comparative review of economic development and infrastructure provision in China, India, and Indonesia

The strides in economic development made by China, India, and Indonesia were matched by the evolution of their infrastructure, which enabled this development to take place. As the comparative analysis will show, a tale of three quite distinct development paths emerges.

2.1. Development indicators

Structural transformation was an essential element in the development process in all three countries (World Bank, 2016b). Over the past two decades, China, India, and Indonesia saw double-digit declines in the share of agriculture in GDP to just 18% in India, 13% in Indonesia, and 9% in China. The shift of resources out of lower-productivity agriculture into higher-productivity industry (particularly manufacturing) and services was a fundamental driver of the growth process in all three countries.

This transformation raised incomes in all three countries, but growth in China far outpaced that of India and Indonesia. Between 1994 and 2014, per capita GDP almost doubled in Indonesia and tripled in India, but it rose more than five-fold in China. This disparity in growth has meant that while India and China had similar per capita incomes in the mid-1990s, incomes in China are now more than twice those in India, and China leapfrogged ahead of Indonesia in making the transition to upper-middle income status. Despite this, Indonesia has almost kept pace with China in poverty reduction, with poverty incidence in both countries dropping sharply (as measured by the fraction of the population making less than \$1.90 per day) from near 60% in the mid-1990s to near 10% at present. India poverty reduction has been much slower, and more than 30% of the population still lives on less than \$1.90 a day.

Stark differences in national saving and investment have also shaped economic development in China, India, and Indonesia. China's saving rates have always been high, in the range of 40%–50% of GDP, and have exceeded those in India and Indonesia by a wide margin. These high saving rates have enabled very high investment rates in China without recourse to external financing—indeed, China has been a net creditor to the rest of the world. Contrast this with Indonesia, which had very high investment rates in the 1980s (even higher than China's) and 1990s, but which was not supported by high domestic saving. The resulting current account deficits played a major role in Indonesia being the hardest-hit country during the Asian financial crisis of 1997–1998. Investment fell sharply as a result, and its recovery was protracted.

These contrasting patterns of development have shaped the demand for—and the supply of—infrastructure in the three countries. Rapid growth, in combination with industrialization, urbanization, and globalization, has required the provision of adequate transport, power, and telecommunications infrastructure. The tremendous growth of towns and cities into large urban agglomerations has also required that urban infrastructure be made available. Correspondingly, the availability of funds has shaped the three countries' ability to invest in such infrastructure.

2.2. Infrastructure investment

China's growth over the past two decades has been strongly interlinked with infrastructure investment. The use of infrastructure investment as a policy lever to manage the economy in China goes back to at least the late 1990s, when it was an important part of the government's fiscal stimulus program. The central government increased transfers to local governments, and that period also saw the first issuance of state bonds to fund infrastructure, with much of it going to irrigation, transport, water and sanitation, and urban infrastructure (Liu, 2004). The best available proxy of overall infrastructure investment over a two-decade period is based on public capital spending from the International Monetary Fund (2015) plus private infrastructure investment from the World Bank (2016). Based on this measure, infrastructure investment has consistently exceeded 15% of GDP over the past two decades in China, more than double the rate in the other two countries. India's infrastructure investment rate has been decent at around 7% of GDP since the mid-1990s, with the share of private infrastructure increasing as discussed below. Indonesia's infrastructure investment has always lagged behind the other two countries, and declined along with overall investment following the Asian financial crisis to around 3% of GDP. It is worth looking at how

these differences in infrastructure investment at the macro level are reflected in indicators for the key network infrastructure sectors: transport, power, telecommunications, and water and sanitation.

Transport

Substantial investment has allowed China's road network to catch up significantly with the other two countries. The extent of the road transport network in India, as measured by road kilometers per capita, was thrice that in China and almost doubled that of Indonesia as of the mid-1990s. The gap was even wider if measured by road kilometers per square kilometers of land area. However, over the past two decades China has made remarkable strides, surpassing Indonesia and basically equaling India in road km per capita, especially in paved roads. Quality has improved as well; the perceived quality of China's road network now exceeds that of India and Indonesia, based on the survey-based indicators from the World Economic Forum's Global Competitiveness Report, which are also reflected further in the analysis below (Schwab, 2015).

Similar progress can be seen in China's rail network. Between 1994 and 2014, China increased the length of its rail network (total route kilometers) by 24%, whereas India's rail network increased only by 5% and Indonesia's shrank by 7%. This implies a steady increase in China's rail kilometers per capita, but a decline in both India (where population grew by 37% over the same period) and Indonesia. Moreover, much of China's rail investments have not been in extending the network, but in increasing both capacity and quality (*e.g.*, high-speed rail). As a result, the perceived quality of China's rail network now exceeds that in India and Indonesia.

China's port infrastructure is also more developed and utilized, driven by the country's strong outward orientation. Container port traffic in China far exceeds that in Indonesia and India (both in absolute terms and when scaled by population), a reflection of the country's strong reliance on exports and its integration into regional and global value chains. Indonesia also relies heavily on port infrastructure due to its archipelagic nature, but while Indonesia's port traffic per capita was just over half of China's in 2000, that ratio had fallen close to one-third by 2014, reflecting the sharp rise in China's global trade following its accession to the WTO in 2001. India's relatively more domestic and consumption-oriented economy (and especially the higher share of services in its exports) implies much less use of port infrastructure compared to developing Asia's two other giants. The perceived quality of port infrastructure in the three economies does not differ as much as for other types of infrastructure, with China's ports deemed to be slightly better than ports in the other two countries. Still, China's port infrastructure was critical in allowing its exports to grow by 16% a year on average between 2000 and 2014, compared to 10% for India and just 2% for Indonesia.

Air transport shows similar patterns. Air freight transport has increased more than ten-fold in China over the past two decades, dwarfing the doubling in India and the stagnation in Indonesia where freight volumes remain close to where they were two decades ago. Air passenger transport has grown dramatically in all three countries; however, in per capita terms Indonesia still outpaces China on this front, hinting at its archipelagic nature in combination with a more widely deregulated airline sector, in which low-cost carriers from the region have since flourished, with visitor numbers rising particularly in the past decade. The quality of India's air transport infrastructure was judged to have been the best among the three countries in 2006, but perceptions of quality for India declined over the past decade and, here again, China has taken the lead.

Energy

Strong investments have pushed China's energy infrastructure far ahead of India's and Indonesia's in terms of quantity, access, and quality. In the early 1990s, electricity generation capacity per capita was relatively close for all three countries. Over the next two decades, China's electricity generation capacity per capita increased six-fold, compared to the doubling in India and Indonesia.

Energy accessibility in China has always been high, with 94% of its population already having access to electricity in 1990; by 2012 basically the whole population was on the grid. Indonesia has made substantial gains in this area, with access rising from 67% in 1990 to 96% in 2012. There has also been substantial progress in India, with access rising from 51% to 79%; but this still leaves one-fifth of the population without access to electricity.

Distribution losses have always varied widely across the three countries. China has the most efficient grid, with transmission and distribution losses of 6%–7% of output. Indonesia's transmission losses are slightly higher at 10%–16% over the past two decades, while India's grid results in losses of 18%–27% from 1993 to 2013, far higher than the other two countries. Taken together, the higher quantity, access, and efficiency of China's energy infrastructure is reflected in perceptions of its much higher quality than in the other two countries.

Telecoms

Mobile telecoms are one area where Indonesia takes the lead among the three countries. Information and communication technology (ICT) growth and technological advancements in the past two decades brought significant changes to telecommunications in all three countries, with all experiencing an explosion of mobile phone and internet users. Indonesia's mobile phone industry has been the most developed, with 325 million mobile cellular subscriptions in a country with a population of 250 million (or about 130 subscriptions per 100 people). This reflects Indonesia's vibrant and competitive telecoms sector, where eight mobile operators make the market openly competitive. However, India and China are not far behind, with 75 and 90 subscriptions per 100 people, respectively.

Indonesia lags when it comes to internet penetration, however. The country is third in terms of internet users per capita, with only 17 per 100 people using the internet. India is at similar levels, with 18 internet users per 100 people. In China, by contrast, there are close to 50 internet users for every 100 people.

Water and sanitation

Progress in water source access has been similar across the three countries, but China is ahead when it comes to sanitation. All three countries had comparable access rates in 1994 of 73%–75%, and by 2014 water source access had reached 84% in Indonesia and 94%–95% in India and China. Differences are more evident when improved sanitation facilities are compared. While the ranking of the three countries did not change between 1994 and 2014 and all three countries improved sanitation access rates by about 20%, China has always been several steps ahead, with access rates

remaining more than 10 percentage points above those in Indonesia, and more than 35 percentage points above those in India. Related to the infrastructure aspect of water provision, the topic of water security has gained significant importance, as all three countries have seen increasing challenges to their water resource uses for population and industries (Asian Development Bank, 2016b).

2.3. Differing patterns of private participation in infrastructure

One distinctive characteristic of infrastructure provision in China relative to the other two countries is the much more limited involvement of private and foreign actors in the sector (Gerhaeusser *et al.*, 2010). Over the past 20 years infrastructure investment with private participation in China has averaged about \$7 billion a year, a drop in the bucket relative to overall infrastructure investment in the country. Infrastructure investment with private participation in China has accounted for less than 1% of overall infrastructure investment in recent years. China has experimented with various models for private participation in infrastructure, including inviting foreign investors into power generation in the mid-1990s, but none has been fully developed and implemented (Bellier and Yue, 2003). Instead, state-owned enterprises account for the bulk of infrastructure investment. One possible factor that limited involvement of the private sector in Chinese infrastructure is the National Development and Reform Commission's (NDRC) strong centralized control of planning, while responsibility for building was devolved to local governments. Another factor has been the political risk and lack of certainty on tariff regulation, which may have also discouraged private infrastructure investment (Finlayson, 2007). In recent years there have been initiatives to attract strategic investors by making tariff regimes more market-based and transparent. This has helped to attract some investors into airports, expressways, and ports.

In India, previous heavy reliance on public provision of infrastructure delivered suboptimal results, so the Indian government made a clear shift toward increased private sector participation. Across the three countries, private participation in infrastructure is most evident in India, where about two-fifths of infrastructure investment was done by the private sector, accounting for about \$17 billion of infrastructure investment annually over the past two decades (World Bank, 2016a).

The Indonesian government has been similarly committed to increasing private participation in infrastructure. It legalized the concept of public-private partnerships (PPPs) in 2005, and thereafter introduced various initiatives to attract private investment in telecoms, railways, ports, electricity, and water and sanitation. Conducive to this has been the recent amendment to the Land Acquisition Law. Despite these efforts, however, relatively few PPPs have been able to finalize contract terms. As of 2011, Indonesia lies between China and India, with private participation in infrastructure accounting for one-tenth of overall infrastructure investment (ADB, 2017a).

Looking across infrastructure sectors, the energy sector has accounted for a large share of the number of projects with private sector participation in all three countries throughout these periods. As a share of total investment amount, however, private participation in telecoms becomes more important, particularly in Indonesia, while the investment amount in transport projects significantly increased in China and India. The factors that have shaped private participation in these economies are discussed further below.

Overall, the review of the three countries' economic and infrastructure development over the past two decades underscores how globalization and export orientation played a much stronger role in China, and how its much higher rates of saving and investment were a crucial component in enabling higher levels of infrastructure investment, with its impact evident across almost all infrastructure sectors. There are exceptions however (*e.g.*, telecoms in Indonesia), and private participation has been minimal in China. The following section will examine the institutional arrangements historical circumstances that shaped these development patterns.

3. The implications of planning regimes for infrastructure development

Even on a general level, the institutional planning systems in China, India, and Indonesia show clear distinctions. In China, the National Development and Reform Commission (NDRC) plays a key role in providing the strategic direction for development planning and corresponding investment (NSPRPB-MLIT, 2016a). Other national and sub-national plans must be aligned with NDRC's socio-economic five-year plans. It is the ability to prioritize resources for particular geographic areas and economic sectors that has made the NDRC's five-year plans a strong planning instrument. This is particularly so, as socio-economic planning by the NDRC has meant strong interlinkages between the economic growth strategies and urbanization strategies—with local, metropolitan, and inter-regional infrastructure projects as the key focus of investment and development (Liu, 2004).

The Indian planning system also utilized five-year plans developed by the Prime Minister's Planning Commission, until 2015 when these were replaced with socio-economic guidance by the National Institution for Transforming India Commission (NITI) (NSPRPB-MLIT, 2016b). Instead of the previous consolidation of various ministry, agency, and state government plans through five-year plans, NITI provides a federalist socio-economic development framework and guides toward high-relevance development areas of national interest. While national ministries/agencies continue to draft sector-specific plans and policies, India has no central planning coordination by a single line ministry. Being set up as a federal country, India sees a stronger planning responsibility on the sub-national state levels. In planning and regulatory terms, state governments are in the lead, and policies and plans vary from state to state, which explains the less stringent national-state guidance and coordination for planning and investment.

In the case of Indonesia, it is the national government that provides long-term development plans, which inform medium-term plans on the national level, as well as sector-specific development plans by each ministry or agency (NSPRPB-MLIT, 2016c). In a rather hierarchical planning system, regional plans and local implementation plans also have to derive from their corresponding national plans. The National Development Planning Agency (BAPPENAS) has the lead in the socio-economic planning.

3.1. Lessons learned from China

When comparing the three countries' spatial planning and governance systems, it is important to take into account the role and dominance of the public sector in infrastructure development, which is significantly more pronounced in China. This underscores differences in the linking-up of government planning with public or private investment, as exemplified by the strong role of NDRC

in China for both planning and investment—a role unmet by other national planning entities in India or Indonesia (Iwasaki, 2010). It plays out both in coordinating different sectoral ministries and agencies, as well as guiding sub-national entities in their planning. However, it goes beyond a simple top-down planning approach, as it builds up on inputs by sub-national governments and sectoral departments. In addition, NDRC enjoys a strong role also in the implementation stage for infrastructure programs, thus ensuring efficiency in managing typically cross-sectoral, integrated projects.

With a clear urban bias favoring infrastructure linkages in and between coastal areas and special economic zones, urbanization was made a socio-economic development concern of high priority, correspondingly linked to extensive infrastructure investment, guided by national-level policies and plans (Liu, 2004). Local governments were encouraged to take a lead role, boosting infrastructure provision, and developing crucial planning and implementation capabilities. It has been a crucial factor that China tended to implement its reforms first in selected localities before implementing them countrywide, thus providing opportunities for experimentation in developing market-based systems (Lall *et al.*, 2010).

This experimentation was linked to the ownership transfer of state-owned enterprises (SOEs) to the local level. The 1980s onward saw local governments developing an entrepreneurial sense in scaling up their enterprises and in boosting infrastructure development. This operational decentralization was accompanied by fiscal decentralization, which further elevated the role of provincial and local governments. While local governments themselves were not allowed to borrow money directly, they used their SOEs to do so, while other resources provided necessary means to shoulder increasing infrastructure investments. These resources included SOE revenues, user charges and fees, and land leasing deals (Wang *et al.*, 2011). With regard to land leasing, provincial and local governments have greatly benefited from land belonging exclusively to the state, generating a revenue source (land value capture) for infrastructure development and collateral in debt-raising for infrastructure project companies. At the same time, the government facilitated the limited bond and equity market access for some SOEs to broaden investment options and meet growing financing needs (Liu, 2004).

Particularly remarkable has been the wide application of user charges with cost-recovery levels in most infrastructure sectors. Through this, local governments in China were able to both recover the construction cost of infrastructure and ensure their maintenance, with tax revenues providing resources for current expenditures, and partly even adding to capital expenditures. One possible reason that people accepted the levying of such cost-recovery charges could have been the concomitant increase in wages (Liu, 2004).

A downside of the decentralization in the Chinese planning system has been the provision of infrastructure based on high estimates of capacity needs, as local governments saw their infrastructure SOEs as one way to ensure the achievement of targeted economic growth rates and related government performance indicators. Such high estimates have partly been exceeded in growth hubs, while more far-flung areas have experienced largely under-utilized infrastructure (Langfitt, 2015). Recurring cycles underscore how sub-national governments in China faced difficulties in finding sustainable development policies. Furthermore, concerns around stark regional

imbalances and heavy environmental degradation due to mostly coal-based growth have required serious policy shifts to address growing challenges, as discussed below (World Bank *et al.*, 2014).

3.2. Lessons learned from India

Following a round of gradual reforms toward economic liberalization before and especially during the 1990s, the Indian government increasingly took the role of facilitator and regulator in economic development, even though state (provincial) governments kept their managing role for existing SOEs (Ahluwalia, 2002). A focus on attracting foreign direct investment and devising Special Economic Zones helped to form an effective environment to make India part of an increasingly globalizing value chain. With national savings relatively low, the government turned to a liberalization of the financial market to open up different investment finance options to boost infrastructure provision. Although not sufficient, a regulatory framework was put in place for credit and risk management, as well as protection of investors. India installed numerous regulatory bodies that enabled private participation in the development of infrastructure in a variety of sectors. Together with the development of capital and long-term investment markets, India enabled a finance diversification. Its foreign exchange and corporate debt markets were also more developed than in China (Iwasaki, 2010). Nevertheless, private financing was insufficient, and infrastructure financing continued to depend heavily on budgetary contributions in the form of grants, while local governments did not have many tools at hand to raise other revenues for infrastructure financing (Ahluwalia, 2002). For example, one big difference has been the inability of governments in India to monetize land value by selling or leasing of public land, as has been the case in China, since land has been predominantly private in India.

In light of India's complex, multi-level federalism and multi-party system, the lack of strong national-level power and coordination in planning and execution has led to gridlock. The diversity and size of the Indian states brought various pathways for different planning and investment priorities with mixed results depending on the state government's capacities and strategic foresight. The varying legal and regulatory systems between states have made infrastructure provision a complex endeavor. General requirements for broad consultations combined with a myriad of bureaucratic procedures, multi-agency clearance and approval responsibilities, and related risk adversity in many administrations have impacted on the development and execution of infrastructure projects (Lall *et al.*, 2010).

Also, the politicization of the bureaucracy and planning furthered inefficient outcomes where subsidies were used for particular groups or mismanaged SOEs, which impacted on fiscal revenues, limited investments into infrastructure, and prevented the expanded commercial provision of infrastructure services (Lall *et al.*, 2010). The significant amount of inefficient, low-quality public utilities has impinged on the overall performance of the infrastructure sector. Subsidies have been flowing into these enterprises to cover up their losses and inefficiencies in resource use. These constraints increased the burden on existing infrastructure capacities, explaining the increasingly less dynamic improvements in India's infrastructure over the past decades.

3.3. Lessons learned from Indonesia

Infrastructure provision in the past decades in Indonesia can only be understood if political and economic events are taken into account, which have profoundly impacted on the development of the country (ADB *et al.*, 2010). On the political side, the change from Suharto's regime to a democracy in the late 1990s and the ensuing 'big bang' decentralization have to be mentioned. On the economic side, the boom and crisis phases of the Asian financial crisis were central.

Indonesia had rather unsophisticated banking practices, and SOEs dominated in many infrastructure sectors, holding quasi-monopolies and being predominantly rent-seeking. The recovery after the Asian Financial crisis turned out to be very difficult, and the limited long-term financing has hindered a scaling up of infrastructure investments, including expanded private-sector engagement. The government enacted a number of reforms to achieve a better investment climate and to increase the competitiveness of its economy, but distortions remained and Indonesia struggled to find macroeconomic stability (ADB *et al.*, 2010). The 'big bang' decentralization in 1999 left institutional structures and government services in a weak state. Jurisdictions overlapped and coordination between sub-national governments was mostly ineffective. This period also saw the fragmentation of corruption to sub-national levels, which seemed to be more difficult to manage. Sub-national governments enacted their own jurisdiction-specific regulations and laws, which opened up further rent-seeking opportunities. The ensuing back and forth in further devolution versus re-centralization reforms did not resolve the problems (Moeliono, 2011).

From a private sector perspective, there have been many hurdles to overcome in the implementation of infrastructure projects, as potential investors had to deal with much uncertainty in project schedules and potentially low return rates on their investments due to limited government capacities, a myriad of overlapping regulations, and a lack of legal enforcement. Continued project risks regarding political and legal matters were not conducive, as were complicated, long restructuring processes in the private sector in Indonesia. Social tariff setting was below cost-recovery levels, and subsidies fostered wrong practices. Hardly any efficiency gains could be achieved in energy and natural resource use, putting further stress on the existing infrastructure supply, already operating at or beyond limits, thus resulting in shortfalls, disruptions, and damages (ADB *et al.*, 2010). These deficiencies also exacerbated strong regional disparities, as infrastructure shortages or lack of access have impacted growth and social development, particularly in the poorest parts of Indonesia (World Bank and Australian Aid, 2016).

Trying to tackle the constant backlog in infrastructure project preparation and implementation, the government has set up the Committee for Acceleration of Priority Infrastructure Delivery (KPPIP), which within one year of operations since 2015 had managed to successfully address various bottlenecks in infrastructure provision for projects of national importance. In how far this committee can continue its role in cross-ministerial and multi-stakeholder coordination for infrastructure projects, it remains to be seen.

3.4. Reflections on lessons learned¹

Despite their unique stories of what factors influenced infrastructure provision in the past decades, some broader conclusions can be drawn (Gerhaeusser *et al.*, 2010). The role of a coordinating planning body has to be underscored. Infrastructure provision depends on proper coordination among many actors, including national and sub-national governments as well as private sector. Therefore, guidance and holistic planning requires an enabling framework in which investment can be planned for the long-term, properly prioritized, and coordinated between different sectors and jurisdictional areas. Decentralization can make sub-national governments committed actors in infrastructure provision, but regional competition, lack of inter-jurisdictional cooperation, and potential over-supply of infrastructure capacity can also emerge from this process.

In relation to political decentralization, fiscal transfers play a crucial role in providing sub-national governments with the necessary means for infrastructure investment. In addition, governments have benefitted from having different financing options at hand to ensure cost-recovery of infrastructure projects. The diversification of infrastructure investment instruments, for instance through issuing bonds, also supported expanded infrastructure provision to meet rising demands. However, regulatory and legal frameworks were partially still missing to prevent speculative/over-optimistic activities by sub-national governments or private sector investors and to secure project-related risks of refinancing or default.

Reforming their systems over time, the three countries had different experiences with regard to the phasing and application of reforms. A gradual approach across sectors and across geographic regions—as found in China—seemed effective, as it also allowed for experimentation before scaling-up reforms. Focusing investments on specific infrastructure sectors and geographic regions, all three countries encountered the challenges of disadvantaging other sectors, distorting markets—particularly for private investors—and falling short of inclusive, regionally balanced development.

Similar distortions emerged with regard to the role of SOEs. They were crucial for the economic growth in China, India, and Indonesia, but they also hindered expanded private sector participation in certain infrastructure sectors. Cost-recovery was distorted through social tariff setting, and market entrance was distorted through special subsidies and monopolistic behavior by SOEs. The liberalization of infrastructure sectors proved most successful where corresponding independent regulatory bodies were installed to protect customers from special interest of SOEs or private investors.

Due to differences in political systems and ownership, land was dealt with differently by China in contrast to India and Indonesia. In China's case, sub-national governments could use land as a financial asset in infrastructure development, while India and Indonesia saw more challenges in access to land and laws and regulations around land acquisition. The differences due to varying forms of participatory political and planning processes should also be highlighted.

There are areas where the three countries fell short, such as proper maintenance planning and budgeting, politically motivated tariffs and subsidies, related environmentally unsustainable natural

1. These conclusions on the lessons learned have been informed by: ADB, 2016. Roundtable Discussion “Infrastructure Provision in Developing Asia: Experiences and Lessons from the Three Largest Countries”. ADB: 31 May 2016. Manila.

resource use, as well as the dependence on more polluting technologies and resources, and the missed chance to avail of readily available efficiency gains as one measure to respond to growing demands for infrastructure services (McKinsey & Company, 2016). These issues are discussed in the following section.

4. Future challenges facing the three countries

There are three broad challenges facing China, India, and Indonesia as they try to meet existing and future infrastructure needs. First, there is the issue of the environmental sustainability of the massive extension of infrastructure and basic services across regions and populations. Second, there is the needed re-formulation and effective enforcement of laws and regulations. Third, there is the challenge of leveling the playing field for both public and private sector. These challenges will play out differently for each of the three countries (Kumar, 2008).

4.1. Country-specific challenges in China

China's current economic structure is energy and carbon-intensive (Sun, 2010). Energy-intensive heavy industry accounts for a third of output, and two-thirds of the country's energy comes from coal. The coal-dominated power system prevents the wider rolling-out of renewable energies, for which also smaller grid systems and related regulatory and pricing mechanisms need to be put in place. Although some good practices particularly in urban areas have recently emerged, demand-side management, carbon pricing, or pollution taxation are still mostly absent or ineffective (EDF *et al.*, 2014). As a result, environmental degradation has taken its toll on the country, with the cost of pollution damage estimated at 6%–9% of China's GDP (Zhang and Crooks, 2012).

If Chinese infrastructure is to be planned, built, and operated in a more environmentally sustainable manner, coordination between different departmental sectors must continue, and even strengthen, to ensure that environmental costs are properly internalized. With the central government still having a strong and guiding role in policy making and planning, its policy formulation can lead the way toward more sustainable and resilient development. At the same time, cooperation with the private sector and civil society holds much potential in improving the planning, financing, and implementation of infrastructure delivery.

In line with further liberalization of infrastructure sectors, effective regulatory bodies need to be put in place or strengthened to safeguard consumer interests from those of private enterprises and the government (Tsai, 2015). Existing and new regulations and legal frameworks only have an impact when they are effectively enforced. Greater private sector engagement is currently also hampered by an uneven playing field, where state-owned and collective enterprises are dominating, approval processes are complex and often nontransparent, access to finance is limited, and tax burdens are high. With regard to the public-private partnerships (PPP) model, changes in 2015 from the previous concession template for PPPs to a unified template applicable to all sectors ("Administrative Measures on Concession of Infrastructure and Public Utilities Projects") provide an opportunity for increased efficiency in infrastructure provision. Nevertheless, a "cultural" change is required by the government to change the perception and approach from an operational model to a procuring model, where more trust is put into the innovation ability and technical capacity of

private actors (Castalia Strategic Advisors, 2016). Otherwise, the ambitious target of having the private sector supply 85% of future “green” or sustainable infrastructure investments will be beyond reach (Green Finance Task Force, 2015).

4.2. Country-specific challenges in India

With a large infrastructure gap remaining in India, much needs to be done with regard to the integration of different regions and improving access to and quality of basic services. Population growth and rapid urbanization will continue to put further pressure on urban areas, sidelining environmental sustainability even more (Ellis and Roberts, 2016). With outdated maintenance systems and inadequate maintenance funding, the existing infrastructure networks would deteriorate further, impacting more on service reliability and, thus, on daily lives of citizens and businesses. Aging assets are underperforming and possible efficiency gains remain unused. Recognizing the current under-utilization of demand-side management measures and learning from China’s hard lessons with coal dependence can inform India about the relevance to carefully manage natural resources and environmental assets before reaching critical tipping points.

While the government is targeting half of needed infrastructure investment eventually being shouldered by the private sector, the capital intensity and complexity of such projects, together with insufficient political consistency and tedious approval processes makes this appear far from realistic.² If models such as PPPs are to be further promoted, corresponding capacity and skills in governments are needed to properly assess bids. India is currently witnessing over-aggressive bidding with inadequate due diligence and insufficient resources, capacities, and scales of private actors, who lack specialization and focus only on particular sectors. In order to attract more private sector participation, one-stop windows and e-Governance services for clearances and approvals are advisable. On the other hand, SOEs could be designed differently to provide infrastructure services at higher economic rates of return, even though the financial return rates remain modest. Currently, they are a tool of political patronage, with utilities being overstaffed and underperforming (Iwasaki, 2010).

Looking, for instance, at the market for renewable energy, the divisions and dependencies of service providers make generation and transmission services depend on distribution services’ payments in light of poor bill collection, thus creating risks that constrain private sector investment in the energy sector more widely. At the same time, it prevents India from shifting to more environment-friendly energy and, thereby, from contributing to its climate change agenda. Resembling the general infrastructure situation, cost recovery mechanisms are not sufficiently attractive to encourage private sector engagement, particularly as instruments such as tariffs are highly politicized (Iwasaki, 2010).

Another challenge emerges from the fragmented banking system. The privatization of state-owned banks will be difficult but necessary to address the dire state of commercial banks, which are already active infrastructure financiers but are reaching their lending limits, and which are concentrating too many risks and assembling a dangerous mismatch of assets and liabilities.

2. ADB. 2016. Roundtable Discussion “Infrastructure Provision in Developing Asia: Experiences and Lessons from the Three Largest Countries”. ADB: 31 May 2016. Manila.

Current requirements in the legal and regulatory framework prevent insurance and pension funds from engaging more broadly in infrastructure financing, while corporate bonds are limited due to, for instance, the absence of a robust bankruptcy law. A more holistic revamping of the current regulatory framework is required to enable the entry, operation, and exit in infrastructure development (Walsh *et al.*, 2011).

These aspects are linked to safeguards and the myriad of policies regulating land acquisition, environmental clearances, and related concerns. Although their general intent is laudable, they currently cannot create a setting in which social interests and environmental concerns are protected, while infrastructure expansion can meet rising demands. Structural reforms have already been initiated, but need to be expanded and consolidated. Improved decision-making and governance structures could address the current dysfunctional interaction or lack of coordination between the multiple agencies engaged in infrastructure provision. Various state regulations still need to be aligned more clearly with national government guidelines. Additionally, independent regulatory bodies are required to safeguard and monitor the liberalization of various infrastructure sectors.

4.3. Country-specific challenges in Indonesia

Indonesia continues to face regional and rural-urban growth imbalances and related infrastructure underinvestment, which impose significant logistics costs and social inequality. If the operations and maintenance regime is not professionalized and sufficiently funded, Indonesia risks seeing its already underperforming infrastructure stock falling behind further. A re-balancing of capital investments and recurrent expenditures is needed (ADB *et al.*, 2010).

Still, addressing the gaps and weaknesses caused by the ‘big bang’ decentralization in 1999, Indonesia’s sub-national government system continues to have overlapping jurisdictions and legislation, governments competing against each other in areas where coordination and joint infrastructure development would be recommendable. This corresponds to the limited capacities in sub-national governments to plan and execute large-scale infrastructure projects (Moeliono, 2011).

With the government anticipating about two-thirds of the needed infrastructure investments to come from non-public sources, infrastructure provision would benefit from deeper financial markets and a wider variety of financing options. Likewise, modes such as PPPs require better institutional and technical capacities in the concerned government agencies (particularly with regard to project structuring) and a solid set of regulations for proper risk management. Government decision-makers also need to be empowered to take on certain project risks by the public sector, as the private sector alone cannot bear all risks related to large-scale infrastructure projects. Furthermore, surveying of and access to land, frequent legislation changes at both the national and sub-national levels, bureaucratic planning processes, and implementation delays entail uncertainties and discourage private sector engagement.³

Although project development has recently seen improvements, a lack of bankable projects—for instance, in toll roads—remains, which prevents a broader engagement by the private sector (Tabor, 2015). Competition and efficiency have to be promoted in all infrastructure sectors. Tariff setting

3. Roundtable Discussion “Infrastructure Provision in Developing Asia: Experiences and Lessons from the Three Largest Countries”. ADB: 31 May 2016. Manila.

has to move above cost-recovery levels, and risk-sharing mechanisms need to be adjusted, for instance in the energy sector. Indonesia has not yet succeeded in breaking up monopolistic settings in some infrastructure sectors with regard to SOEs and their entitlements, which has hindered efficiency gains and expanded provision, slowed down the implementation of ambitious programs and reforms, and prevented larger private sector participation. In relation to this, rampant corruption on national and sub-national levels remains a burden, and related oversight bodies need to be firmly and independently established (ADB Independent Evaluation Department, 2010).

The formulation and enforcement of laws and regulations has to target the ongoing loss of valuable natural resources and its consequent socio-economic impacts (*e.g.*, deforestation contributing to rising carbon emissions) (ADB *et al.*, 2010). The limited network for generation, transmission, and distribution has prevented a larger-scale extension. At the same time, the inefficient operation of existing infrastructure has impacted on service reliability and shortened the lifespan of facilities—while inefficient, outdated technologies and industrial practices continue to cause environmental impacts, such as air pollution in Indonesia and even neighboring countries (Asia Pacific Foundation of Canada, 2014).

4.4. The international development context

While the individual analysis of the three countries' challenges reveals a long list of required reforms, their infrastructure development also has to be seen with regard to larger development objectives, as exemplified by the Sustainable Development Goals (SDGs). Along this line, growth or progress in infrastructure provision is not an end to itself, but has to be the means to achieve positive impacts in the economic and social development of China, India, and Indonesia. Some of the 17 goals of the Sustainable Development Agenda 2030 underscore the key interlinkages between infrastructure and development, such as SDG 6 – “clean water and sanitation”, SDG 7 – “affordable and clean energy”, SDG 9 – “industry, innovation, and infrastructure”, SDG 11 – “sustainable cities and communities”, and SDG 13 – “climate action”. These can be used as a reference to understand that future infrastructure development in the three countries will have to be more holistic and of higher quality to achieve sustainable development targets.

In addition to the 2030 Sustainable Development Agenda, China, India, and Indonesia have subscribed to other international development agendas and agreements, such as the Paris Agreement in December 2015, which relates to the reduction of emissions to curb climate change impacts. Such agreements provide another challenge to developing countries, as they will have to find the right development strategies to promote a less resource-dependent economic growth (International Resource Panel, 2011). At the same time, such commitments can nudge governments to formulate national policies that provide conducive legislation and additional funds for sustainable and resilient infrastructure development.

5. Conclusions: Policy guidance for infrastructure provision in growing Asia

The previous sections have provided a comparative overview of infrastructure provision in China, India, and Indonesia with respect to development performance, lessons learned, and future

challenges. The following six recommendations are meant to serve as a platform for further dialogue to advance knowledge and policies for improved infrastructure provision in growing Asia.

1) Recognizing interlinkages between infrastructure provision and social and environment objectives: While rising infrastructure demands in China, India, and Indonesia have to be met, social and environmental concerns are equally relevant (Sandhu *et al.*, 2016). Thus, infrastructure development has to include solutions that realize co-benefits and mitigate negative externalities, possibly moving toward concepts such as adaptable multi-purpose/functional infrastructure (European Commission, 2012). This is particularly relevant with regard to natural resource depletion and widely common disparate access to basic services, which are not affordable to every section of society. A basic needs approach should inform infrastructure planning and prioritization to ensure the well-being of all citizens.

2) Technology transfer for low-carbon, climate-resilient infrastructure solutions: In addition to rising infrastructure demands and their social dimension, China, India, and Indonesia need to find ways to drastically lower their resource dependency and increasing their resource use efficiency with regard to the nexus of water, energy, and land (Wakeford *et al.*, 2015). Both globally and within the Asia-Pacific region, innovative technologies in various sectors have been developed to help achieve these objectives. The three countries could benefit much from engaging more intensively with each other and within their region to learn from each other, encourage the transfer of good practices and technologies for low-carbon, climate-resilient infrastructure solutions, and collaborate on demonstration projects (Anbumozhi *et al.*, 2015). This exchange and transfer could form the knowledge element in enabling the implementation of measures toward broader development agendas, such as the Sustainable Development Agenda 2030, the Paris Agreement on fighting climate change, or the New Urban Agenda for sustainable cities. As the complementary element to low-carbon, climate-resilient technologies, governments also need to revisit possible demand-side management measures to encourage higher efficiency and environmentally-aware usage of resources and infrastructure services by residents as well as businesses, including, for instance, performance-based contracts to improve efficiencies and quality in the construction sector by triggering productivity growth (McKinsey & Company, 2016).

3) Maintaining infrastructure assets with a life-cycle approach: Extending infrastructure provision is the first step in improving the state of infrastructure in China, India, and Indonesia. An equally important aspect concerns the operation and maintenance of infrastructure assets. In order to put in place an effective asset management system, an informed overview of the existing assets is needed, combined with a monitoring system that responds with timely actions to possible infrastructure deteriorations. A funding mechanism is crucial to sustain the maintenance of infrastructure over its whole lifespan. When a life cycle approach is already applied at the planning stage, infrastructure can be better designed and budgeted for, and becomes a more viable asset class for investors, particularly sustainable infrastructure investment through social capital and corporate social responsibility (OECD, 2006).

4) Moving beyond a simple binary public-private actor perspective: Differentiating infrastructure provision only in public and private sector does not represent the diversity of planning, financing, implementation, and operations modes that can be found or could be applied in China, India, and Indonesia. No single model needs to be labeled as the best option to realize increased and

improved infrastructure provision. Instead, it is important to understand that such models require an enabling platform for different actors to join forces. Much trust building amongst actors of both the public and private sector sides is required to increase confidence in each other's strengths. Although SOEs have achieved much project delivery in the three countries, the participation of private actors has brought professional project preparation, infrastructure design innovation, and more efficient implementation (McKinsey & Company, 2016). Such value-add becomes increasingly important with regard to the need for more efficient use of both financial and natural resources. With the actor base broadening, it becomes more important to upscale capacities of national and sub-national agencies to effectively manage different project types. Particularly, the pre-feasibility stage does not yet receive sufficient attention and resources, for instance through project development facilities and funds, with regard to identifying and critically assessing various project ideas and pushing through viable options until project readiness to develop better pipelines of bankable infrastructure projects that also provide corresponding risk-adjusted return on investment (Ehlers, 2014).

5) Recalibrating financing options to meet market demands: Besides the private sector, governments in China, India, and Indonesia can already achieve improved financing of infrastructure projects by introducing multiple-year budgeting to account for long-term project planning and implementation phases. They can apply user charges, land value capture, and the monetization of existing assets, such as through PPPs models for the operations and maintenance phase. Their role is also crucial with regard to viability gap financing to help infrastructure projects to take off. On the other hand, there is no lack of other funds to enhance infrastructure investment; however, investors and projects are disconnected. Risks related to implementation delays, foreign exchange flows, capital expenditure, securitization of assets, and refinancing have to be carried by institutional actors or re-packaged to become financial products (OECD, 2015). With different types of bonds offering access to capital markets, it is often first up to governments to "make the market" by issuing debt or equity on their assets (ADB, 2015). Also, building specific infrastructure-related bonds markets, standardizing risk categories, and pooling risks or assets could be useful. For longer-term financing, guarantee funds as well as equity and mezzanine financing are needed (AFME and ICMA, 2015). Credit enhancement facilities are one instrument to enhance such financing. In addition, local currency lending and currency swaps will play an increasing role (Verdouw *et al.*, 2015). Multi-lateral development banks can play a role here by supporting client countries' understanding of the availability of these instruments and provide for their broader application in their services beyond the currently low rate of non-sovereign financing (ADB, 2017b). Also, multi-lateral development banks can scale up results-based and policy-based lending to encourage countries in strengthening high-impact infrastructure development and related policy-making. This is directly linked to the challenge that capital productivity will only be achieved through well-implemented projects. Regulations have to be checked to allow different types of investors to access infrastructure financing (Inderst, 2016). In addition, knowledge sharing and capacity building are of crucial importance to expand the knowledge base of public and private actors on the available financing options, including more innovative modalities through green bonds, social impact bonds, carbon tax, or cap-and-trade funding (Kim, 2016).

6) Policy reform for more effective legal and regulatory frameworks: The planning, financing, implementation, and operation of infrastructure are underpinned by institutions and structures. As the examples of China, India, and Indonesia show, there is much room for improvement to

formulate and enforce effective legal and regulatory frameworks. This concerns, for instance, the enabling of policies and rules for PPPs, the design of cost-recovery tariff systems, procedures for socially inclusive and timely processed land acquisition, and mechanisms for dispute resolutions or bankruptcy. Another key action area is the standardization of models and forms to streamline the process of appraising and approving PPPs, special-purpose vehicles (SPVs), and other project models. There is much opportunity for the three countries, as well as other actors in the Asia-Pacific region, to come together to exchange experiences and lessons learned, and to use these to develop context-specific legal and regulatory frameworks. Institutions such as the Asian Development Bank provide the platforms to enable such dialogue and to infuse good practices that have been practice-tested in a variety of projects and contexts.

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