GLOBAL BUILT ASSET PERFORMANCE INDEX 2016

Doing more with less: Buildings and infrastructure as drivers of economic performance
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The development of new buildings and infrastructure has fueled national economic growth for centuries. From a new port that can open up trade routes, to creating thriving communities through new housing, they form the very building blocks on which a country generates its GDP.

However, in a world where developed nations experience funding challenges and emerging countries seek to accelerate their economic standing with more speed, two new challenges materialize. Firstly, how do mature countries achieve better economic performance for aging assets that they cannot afford to replace? Secondly, how do emerging nations invest in their built environment in a way that will deliver quicker economic returns, and are also sustainable over the long term? Both challenges ask the question, how can countries do more with fewer ‘new’ assets?

This report, our second Global Built Asset Performance Index, seeks to shed light on these two issues through measuring the economic performance of the built environment in 36 countries. Using national data sources, we quantify the economic returns generated from a range of built assets, be it home, school, office, rail track, waterway or power station. We analyze how this has changed over the past two years and forecast which nations are likely to achieve even better returns over the next decade.

The good news is that, no matter what the challenge, new technologies and business models can help. The conditions have never been so favorable for achieving groundbreaking progress in asset intensive sectors. As labor productivity, investment and population growth slows over the next decade, asset productivity is going to be a critical driver of economic growth and embracing more effective asset management models can drive better short and long-term returns.

Similarly, new smart technologies such as Building Information Modeling and 3D printing are radically changing the way assets are designed, operated and modified during their lifecycle. These technologies need to be carefully applied to address the impact that emerging consumer trends, such as a shift towards a sharing economy (Uberization), will have on the type and quantity of asset required.

As such, investors, asset owners, asset operators, and policy makers need to explore new ways to boost asset productivity and help resolve the growth and sustainability challenges that the world faces. Arcadis works with our clients, in both the public and private sectors, to address these challenges, helping them design and deliver projects that will fully leverage new options that evolve through innovation. We also define and implement strategies to extract the maximum value from legacy assets.

This report provides a unique snapshot into the countries that are leading the way in taking up the world’s asset productivity challenge, and, by doing so, creating greater prosperity in a more sustainable way. We hope that you find it illuminating as you approach your own challenges.

Julien Cayet
Global Leader, Business Advisory
The research spans 36 nations that collectively represent 78% of global GDP.
EXECUTIVE SUMMARY

The Global Built Asset Performance Index reveals the total economic output generated from a country’s buildings and infrastructure. The research spans 36 nations that collectively represent 78% of global GDP. The second series of this report enables comparisons in performance from the 2014 data;

Highlights:

• Globally, built assets have become more productive, generating US$36 trillion in 2016, an increase of US$3 trillion in comparison with 2014.

• This represents 39.6% of global GDP attributed to buildings and infrastructure, an increase from 38.7% in 2014. The remaining GDP is generated from labor wages (56.9%) and 3.5% from resource rents.

• Over the past two years, China has pulled further ahead of the US as the country that generates the highest returns from its built assets at US$10.4 trillion, nearly doubling the US level of returns at US$5.4 trillion. China’s reliance on its built asset returns will continue as the rebalancing of China’s economy away from manufacturing and construction takes some time.

• Qatar has overtaken Singapore as the leading country in built asset returns per-capita with an average of US$66,300, showing Qatar’s success in economic diversification away from hydrocarbons.

• On a per-capita returns basis, three other small and affluent states follow Qatar – the United Arab Emirates at US$37,900, Singapore at US$35,900, and Hong Kong at US$21,400.

• The US is the best performing large economy, in per-capita terms, at an average of US$16,800 per person.

• Emerging economies including Mexico (63.6% of GDP from built assets), Philippines (59.4%) and Turkey (56.1%) are the most reliant on built assets for the GDP. Switzerland (20.3%), Russia (22.1%) and South Korea (24%) are the least reliant.

• The UK is becoming less reliant on its built assets as a proportion of GDP, falling from 27.2% to 26.3% due to low rates of both public and private investment in the creating of new assets in recent years.

• Australia achieved a consistent growth in the proportion of its wealth coming from built assets, moving up from 29.7% to 31.7% in 2016.

• Germany leads in Europe at US$1 trillion returns from its built assets, followed by Turkey at US$807 billion and France at US$794 billion. Most European countries do not generate particularly high returns on a per-capita basis compared to their stocks of assets, which are generally high. The region will have to improve asset productivity as aging infrastructure is depreciating faster than rebuilding.

• By 2026, emerging markets will increase their dominance for high performing and sustainable assets. India is forecast to overtake the US as the economy increases real returns to built assets by 126% - the highest growth of any country in the index.

• At the other end of the scale, Japan – with its falling population and slow economic growth – will only see a 3% increase in ten years.

• Indonesia will leapfrog Mexico and Japan in returns to physical assets between today and 2026. Brazil will edge ahead of Germany.

• Lower down the index, the Philippines and Ghana will enjoy the second and third-highest growth rates respectively, with increases of 88% and 86% in their returns to built assets over the next decade.

• New technologies and business models in the designing, construction, operating and redefinition of built assets can have a major impact on the short and long term returns from buildings and infrastructure.
3.0 GLOBAL BUILT ASSET PERFORMANCE INDEX

3.1 The importance of built assets to national wealth

Across the globe, governments are planning, developing and redefining their built environments in order to create thriving communities that improve quality of life for their citizens and generate better returns for the economy. A highly developed, sustainable, built environment is an important foundation to build economic wealth upon. Overall, US$36 trillion of GDP was generated from the built environment in 2016, an increase of US$3 trillion on 2014. This represents 39.6% of global GDP attributed to buildings and infrastructure, an increase from 38.7% in 2014. The remaining GDP is generated from labor/wages (56.9%) and 3.5% from resource rents.

3.2 Total built asset returns

Countries are under pressure to perform and built assets are central to powering their performance to generate sustainable growth for economies. Therefore finding new ways to improve asset productivity is key to achieving long-term results.

This measurement is a key factor in determining the economic growth that a country could achieve. It also reflects the return on investment obtained within an economy, and thus the potential profitability of businesses operating within it. The index’s analysis of built asset wealth and performance aids the wider understanding of built asset demand, growth and changes in economic performance.

Figure 1: Average distribution of GDP

- Wages/salaries: 56.9%
- Built assets: 39.6%
- Resource rents: 3.5%
The return from built assets in absolute terms is closely associated with the size of the economy as measured by GDP. The index measures returns in terms of PPP (purchasing power parity) to ensure figures are adjusted to how much they are worth in that country.

China’s manufacturing intensity has helped extend its lead ahead of the United States. At US$10.4 trillion versus US$5.4 trillion per year, China’s returns are almost double. India is in third place, Japan and Mexico completing the top five.

<table>
<thead>
<tr>
<th>RANK</th>
<th>COUNTRY</th>
<th>2014</th>
<th>2016</th>
<th>MOVEMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>CHINA</td>
<td>US$9.3 trillion</td>
<td>US$10.4 trillion</td>
<td>+12%</td>
</tr>
<tr>
<td>2</td>
<td>USA</td>
<td>US$5.2 trillion</td>
<td>US$5.4 trillion</td>
<td>+4%</td>
</tr>
<tr>
<td>3</td>
<td>INDIA</td>
<td>US$3.1 trillion</td>
<td>US$3.6 trillion</td>
<td>+19%</td>
</tr>
<tr>
<td>4</td>
<td>JAPAN</td>
<td>US$1.9 trillion</td>
<td>US$1.9 trillion</td>
<td>+3%</td>
</tr>
<tr>
<td>5</td>
<td>MEXICO</td>
<td>US$1.2 trillion</td>
<td>US$1.4 trillion</td>
<td>+11%</td>
</tr>
<tr>
<td>6</td>
<td>INDONESIA</td>
<td>US$1.0 trillion</td>
<td>US$1.2 trillion</td>
<td>+13%</td>
</tr>
<tr>
<td>7</td>
<td>GERMANY</td>
<td>US$978 billion</td>
<td>US$1 trillion</td>
<td>+3%</td>
</tr>
<tr>
<td>8</td>
<td>BRAZIL</td>
<td>US$923 billion</td>
<td>US$966 billion</td>
<td>+5%</td>
</tr>
<tr>
<td>9</td>
<td>TURKEY</td>
<td>US$784 billion</td>
<td>US$807 billion</td>
<td>+3%</td>
</tr>
<tr>
<td>10</td>
<td>FRANCE</td>
<td>US$760 billion</td>
<td>US$794 billion</td>
<td>+4%</td>
</tr>
<tr>
<td>11</td>
<td>UK</td>
<td>US$712 billion</td>
<td>US$719 billion</td>
<td>+1%</td>
</tr>
<tr>
<td>12</td>
<td>IRAN</td>
<td>US$582 billion</td>
<td>US$660 billion</td>
<td>+13%</td>
</tr>
<tr>
<td>13</td>
<td>ITALY</td>
<td>US$613 billion</td>
<td>US$620 billion</td>
<td>+1%</td>
</tr>
<tr>
<td>14</td>
<td>SPAIN</td>
<td>US$571 billion</td>
<td>US$593 billion</td>
<td>+4%</td>
</tr>
<tr>
<td>15</td>
<td>RUSSIA</td>
<td>US$516 billion</td>
<td>US$545 billion</td>
<td>+6%</td>
</tr>
<tr>
<td>16</td>
<td>THAILAND</td>
<td>US$496 billion</td>
<td>US$534 billion</td>
<td>+8%</td>
</tr>
<tr>
<td>17</td>
<td>CANADA</td>
<td>US$474 billion</td>
<td>US$495 billion</td>
<td>+4%</td>
</tr>
<tr>
<td>18</td>
<td>SOUTH KOREA</td>
<td>US$411 billion</td>
<td>US$437 billion</td>
<td>+6%</td>
</tr>
<tr>
<td>19</td>
<td>PHILIPPINES</td>
<td>US$355 billion</td>
<td>US$400 billion</td>
<td>+13%</td>
</tr>
<tr>
<td>20</td>
<td>POLAND</td>
<td>US$378 billion</td>
<td>US$399 billion</td>
<td>+6%</td>
</tr>
<tr>
<td>21</td>
<td>AUSTRALIA</td>
<td>US$336 billion</td>
<td>US$376 billion</td>
<td>+12%</td>
</tr>
<tr>
<td>22</td>
<td>SAUDI ARABIA</td>
<td>US$248 billion</td>
<td>US$364 billion</td>
<td>+47%</td>
</tr>
<tr>
<td>23</td>
<td>EGYPT</td>
<td>US$319 billion</td>
<td>US$357 billion</td>
<td>+12%</td>
</tr>
<tr>
<td>24</td>
<td>UAE</td>
<td>US$302 billion</td>
<td>US$351 billion</td>
<td>+16%</td>
</tr>
<tr>
<td>25</td>
<td>MALAYSIA</td>
<td>US$291 billion</td>
<td>US$329 billion</td>
<td>+13%</td>
</tr>
<tr>
<td>26</td>
<td>NETHERLANDS</td>
<td>US$213 billion</td>
<td>US$230 billion</td>
<td>+8%</td>
</tr>
<tr>
<td>27</td>
<td>SINGAPORE</td>
<td>US$198 billion</td>
<td>US$204 billion</td>
<td>+3%</td>
</tr>
<tr>
<td>28</td>
<td>SOUTH AFRICA</td>
<td>US$184 billion</td>
<td>US$185 billion</td>
<td>+1%</td>
</tr>
<tr>
<td>29</td>
<td>HONG KONG</td>
<td>US$150 billion</td>
<td>US$157 billion</td>
<td>+5%</td>
</tr>
<tr>
<td>30</td>
<td>QATAR</td>
<td>US$137 billion</td>
<td>US$152 billion</td>
<td>+11%</td>
</tr>
<tr>
<td>31</td>
<td>SWEDEN</td>
<td>US$114 billion</td>
<td>US$127 billion</td>
<td>+12%</td>
</tr>
<tr>
<td>32</td>
<td>CHILE</td>
<td>US$100 billion</td>
<td>US$117 billion</td>
<td>+17%</td>
</tr>
<tr>
<td>33</td>
<td>SWITZERLAND</td>
<td>US$101 billion</td>
<td>US$103 billion</td>
<td>+2%</td>
</tr>
<tr>
<td>34</td>
<td>BELGIUM</td>
<td>US$70 billion</td>
<td>US$75 billion</td>
<td>+7%</td>
</tr>
<tr>
<td>35</td>
<td>DENMARK</td>
<td>US$67 billion</td>
<td>US$69 billion</td>
<td>+3%</td>
</tr>
<tr>
<td>36</td>
<td>GHANA</td>
<td>US$11 billion</td>
<td>US$13 billion</td>
<td>+23%</td>
</tr>
</tbody>
</table>

Mexico and Indonesia appear above Germany in the ranking despite both having smaller economies and lower manufacturing intensity. This is because a much greater share of national income is directed towards owners of built assets in these two countries. Germany’s higher overall output stems from returns on ‘human capital’ rather than physical equipment. The share of national income going to labor is generally greater across advanced economies, reflecting levels of employee skills and training as well as a stronger tendency towards collective bargaining.

*Top 5 five gains highlighted in orange
COUNTRY SPOTLIGHT CHINA

<table>
<thead>
<tr>
<th>OVERALL BUILT ASSET RETURNS</th>
<th>US$10.4 trillion (1st place)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BUILT ASSET RETURNS AS SHARE OF GDP</td>
<td>52.9%</td>
</tr>
<tr>
<td>BUILT ASSET RETURNS PER CAPITA</td>
<td>US$7,493 (26th place)</td>
</tr>
</tbody>
</table>

China’s economic growth is powered by its built assets, which sees the country rank number one in generating return on investment in built assets. The share of GDP returns accounted for by built assets increased from 39% in 1990 to 52.9% this year. This is expected to be the peak as China’s economy gradually rebalances towards services and consumption, as opposed to manufacturing and investment, but the process will be very slow, only reducing to just under half of GDP in a decade’s time.

While China is clearly experiencing a slowdown, GDP is still forecast to grow at around 7%, and there is an expectation for the country to continue investing in built assets at an unprecedented level. Faced with a slowing economy, China has looked to new avenues to sustain its appetite for growth, with One Belt One Road (OBOR) being one of the most high profile examples. The delivery of OBOR will create an economic land belt stretching from Europe to West Asia and the Middle East that includes countries on the original Silk Road, as well as a maritime route that will link China’s port facilities with those of Africa and Europe via the Suez Canal. Recognition of this project and other large mobility programs will redirect China’s domestic overcapacity and result in significant capital investment for the foreseeable future across the country.

Figure 3 China: Return on built assets per capita (left axis) / Returns on built assets as % of GDP (right axis)
COUNTRY SPOTLIGHT USA

<table>
<thead>
<tr>
<th>OVERALL BUILT ASSET RETURNS:</th>
<th>US$5.4 trillion (2nd place)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BUILT ASSETS RETURNS AS SHARE OF GDP:</td>
<td>30.2%</td>
</tr>
<tr>
<td>BUILT ASSET RETURNS PER CAPITA:</td>
<td>US$16,762 (5th place)</td>
</tr>
</tbody>
</table>

The US has seen a steady downward trend in its built asset share over the past 26 years. Two factors that have contributed declining reliance on built assets are the rise of the country’s service sector profile, and the subsequent contraction of the manufacturing sector as plants migrate away from the US to lower cost countries.

The US is also experiencing a decline in the effectiveness of existing assets reducing productivity (e.g. transit, rail, aviation, roads) due to a chronic under investment over decades, pulling negatively against the GDP’s return on assets.

With a significant gap between the country’s infrastructure investment needs and government’s planned funding, the issue is gaining significant public and political attention, as cities across the country experience increased urbanization, that strains their existing systems. There are strong efforts to increase the performance of existing assets with the use of better data, technology and decision making. For example, the recent FTA requirement for Transit Asset Management Plans for Transit Agencies is a welcome expansion of the Department of Transport policy. Only time will tell if agencies will go beyond compliance and genuinely build the capability required to increase the performance of the built assets. In addition, the new administration’s plans for additional infrastructure investment over the next decade will likely impact future ranking.

Figure 4 USA: Return on built assets per capita (left axis) / Returns on built assets as % of GDP (right axis)
Similar to other large developed economies, the performance of built assets in Germany has been flat. Long term under investment is the main challenge, as there has been low levels of replacements of the existing built asset base. This results in net de-investment through depreciations, especially in the public sector.

In the last few years, there have been several investment programs to reinvigorate aging public infrastructure driven by both federal and state authorities as well as private investors. These programs focus not only in rail and road, but also power and utilities, telecommunications and other sectors. The question remains if Germany can execute these programs effectively, which depends on how the country deals with its two main challenges: effective stakeholder management and the need to increase the resource pool of qualified engineers.

Several mega projects have seen major delays. Increasing budgets for projects such as the new Berlin airport, Stuttgart main station, and the “Energiewende,” energy revolution are proving unpopular with the public. There is a strong backlog of infrastructure projects waiting to be carried out, but although funding is available, many of these are not executed due to a lack of resources, particularly of qualified engineers in the construction industry.

If Germany is be able to find solutions to both skill shortages and budget overruns, the country will move from net de-investments to a growing asset base continuing to attract investments in the long run.
3.3 Built asset returns as a share of GDP

The highest built assets returns, as a percentage of GDP, are found in Turkey, Philippines, Mexico, Thailand and China.

Typically, middle income emerging economies tend to rely more heavily on their built assets to generate economic returns as they have heavier manufacturing industries. More developed countries, on the other hand, will have relatively lower GDP from the built environment as their economies have become more diversified into services and people orientated industries.

For example, Thailand’s, at 28%, is the third-highest; China’s is the highest. By comparison, the US has only a 12% share of manufacturing in total output, with the UK even lower at 10%. Both of these economies are significantly lower down in Figure 5.

Manufacturing is a capital-intensive sector and therefore significantly more national income is captured in the form of returns to assets rather than wages. For the majority of countries ranking highly for built asset performance relative to GDP this is impacted by lower wages for workers in those economies. Apart from South Korea, most of the countries at the lower end are more intensive in service industries. The UK, Denmark, Saudi Arabia and Russia, all have small manufacturing sectors compared to the other economies examined, and subsequently built asset returns also account for a lower share of national income.

Figure 5: Returns to built assets as a proportion of GDP
It took the UK six years to return to its pre-crisis peak in terms of returns from built assets. In 2013 it reached US$10,377, surpassing the US$10,362 generated in 2007. Recessions tend to cause a sharp downturn in returns from built assets. On the other hand, when the economy recovers – as it did from around 2012 – returns from built assets see a stronger upswing. By similar logic, profits tend to increase ahead of employment and the profits/wages share moves in favor of profits.

Over the long term, although the UK is moving towards a more service-oriented, knowledge industry that is reliant on intangible assets, the UK economy will benefit significantly from continued and sustained investment in smart infrastructure and built assets. The downturn in the last two years shows the potential consequence of delays to major infrastructure decisions such as nuclear new build and the proposed new runway for the South East. It also highlights the imperative to accelerate the delivery of major new programs such as High Speed 2 (HS2), Thames Tideway Tunnel and Crossrail 2.

The UK market expects to see some pick-up of activity due to investments underway around other national infrastructure, such as the regulated water, gas and electricity networks and major rail and road enhancements by Highways England and Network Rail, and increased investment by cities and local authorities into their built asset stock. Sovereign wealth funds and private equity investors are more cautious post-Brexit, which could cause some major programs to stall.

*Figure 6 UK:* Return on built assets per capita (left axis) / Returns on built assets as % of GDP (right axis)
3.4 Built asset returns per capita

Four economies with relatively small populations, three of which are city-states, top the rankings in Figure 7. Two have substantial oil wealth and three are trading ports (the United Arab Emirates fulfils both roles, and Qatar is moving in this direction). The US, which has modest returns compared to its economic might, appears near the top by virtue of incomes being among the world’s highest.

India ends up almost at the bottom of Figure 7, lower than any country but Ghana, which is partly due to the relative poverty of the country and lack of investment in maturing the country’s infrastructure. Instead, it is following a development path focused on services, an unusual route similar to the Philippines but few other countries. The export of its services requires some infrastructure, but far less than a factory would, with the capability to export cheaply and reliably to the rest of the world.

Figure 7: Built asset returns per capita
Historically, Singapore has enjoyed a steady increase in returns on built assets per capita, though this report confirms this growth has plateaued. High savings rates were ploughed into productive investments that created a strong manufacturing hub, which resulted in Singapore steadily moving up the value chain. Now competing in some of the most high-value knowledge industries, reliance on built assets is slightly reduced, though it retains some of its high-tech manufacturing.

Singapore’s economic growth, which exemplifies development through investment both in built and intangible assets, is certainly slowing. It may be difficult for the country to keep up its current rates in a world of lower trade growth and where the regional engine, China, has moved into a lower gear. However, the resilience of Singapore’s economic growth over decades has been remarkable and so only a slight reduction is expected.

This optimism in the strength of the economy is shown through new smart infrastructure and urban development projects such as the new Central Business District in Jurong, into which the country is investing heavily. Integral to the new Central Business District will be the Singapore terminus for the High Speed Rail to Kuala Lumpur in neighboring Malaysia. There continues to be significant investment in Singapore’s Changi Airport, with the new Terminal 4 under construction and plans for both the new Terminal 5 and third runway, which will double passenger capacity from the current 66 million to 135 million by 2025.

Figure 8 Singapore: Return on built assets per capita (left axis) / Returns on built assets as % of GDP (right axis)
COUNTRY SPOTLIGHT
UNITED ARAB EMIRATES (UAE)

OVERALL BUILT ASSET RETURNS: US$351 billion (24th place)

BUILT ASSETS RETURNS AS SHARE OF GDP: 49.8%

BUILT ASSET RETURNS PER CAPITA: US$37,861 (3rd place)

Built assets are expected to contribute US$350 billion to the UAE’s overall economic performance in 2016. In absolute terms, this is less than some countries considered in the study, however, it equates to almost 50% of the UAE’s total annual GDP, the sixth highest percentage out of the 36 nations considered in this year’s report.

This reflects the level of investment that the UAE continues to make in its real estate and infrastructure sectors as part of its 2021 Vision. It also suggests that the country is performing very well when it comes to securing a healthy return on this capital investment and can gain even more long-term returns with high quality, sustainable assets in mind.

When the total economic return from built assets is considered on a per-capita basis, the UAE continues to score impressively; ranking second highest. This is partially attributable to the fact that the UAE has a smaller population than many of the other countries examined (around 10 million people). However the fact that this return has continued to increase in recent years, even with population growth, is testament to the country’s enduring ability to create wealth from its investment in new assets.

The key for UAE’s built assets is to maintain the same level of economic return, prioritize the big programs, and to focus on less developed locations and asset classes. It is evident that, over the last decade, the UAE has made tremendous strides in diversifying its economy including building its aviation, ports, tourism and financial services sectors. With the 2021 Vision in place, the country is well-positioned to continue on this trajectory and move towards a mature and stable economy that is built upon a high stock of built assets yielding good long-term returns.

Figure 9 UAE: Return on built assets per capita (left axis) / Returns on built assets as % of GDP (right axis)
4.0 FUTURE BUILT ASSET PERFORMANCE 2026

4.1 Growth forecasts

To forecast the built asset performance in 2026, the same method is used as calculating present values. GDP forecasts are collated and past trends used to estimate the expected share of national income going to labor and to resources.

Two notable changes expected in 2026 are India overtaking the US and Indonesia overtaking Japan. This is in line with middle-income countries increasing their built asset stocks and the returns to those stocks. China’s asset wealth accumulation slows down a little, but not much. Its rebalancing towards services has been one of the world’s major economic stories in recent years, but planners find this dynamic much more difficult to sustain than the construction and infrastructure powered growth it has perfected. China’s government relies on growth of some 6%–7% to quiet social unrest and to achieve this it has frequently fallen back on industrial production.

India’s economy has been growing rapidly for years, but momentum received a boost in mid-2014 with the election of Narendra Modi. A more pro-business stance cheered many companies, while a slightly more authoritarian style is thought to be more likely to drive through infrastructure projects. A strong stance on anti-corruption is welcomed worldwide, and foreign capital has flowed into the economy. The resulting cash crunch must be adequately addressed to allow for the predicted growth and performance as indicated in the report, a lofty return of more than double by 2026 (the fastest rate of growth in all the countries considered). Infrastructure is likely to be key to this. Improving energy, transport, utilities and housing will remove bottlenecks in Indian growth that make businesses less productive, preventing the economy from reaching its potential. Our forecast assumes that significant progress is made. India will rely on foreign investors to help it achieve this, but meagre growth prospects in most of the rest of the world will work in India’s favor in attracting capital.

Figure 10: Returns to built assets, 2016 and 2026 (forecast)
### 4.2 Regions to watch

The greatest percentage increases is in India, China, and South East Asia (with the exception of Thailand, whose economic performance has suffered since a coup two years ago). Ghana, as the poorest nation in built asset terms at present, does well. So do some of the Middle East entrants, particularly Egypt and Iran. Much of the story here is simply convergence. The emerging markets have been growing at above-average growth rates for many years and they will continue to, some volatility notwithstanding.

The last two years have seen changes in built asset volumes for many of the large commodity producers, especially petro-states. Many of them saw a large fall in national income in a matter of months as their main export halved in value between August 2014 and January 2015. This does not directly affect returns to built assets: the oil price was well above most countries’ extraction costs and so they suffered a reduction in the component of national income defined as resource rents. Mostly, their GDP did not fall by the amount their exports did, implying something replaced the lost income. In response, many of them ran government deficits, a normal response to recession. The government spending would have been directed towards a range of activities, and so we split it between wages and returns to assets in the same proportions as the economy as a whole. This causes the returns to built assets to go up between 2014 and 2016 in commodity producers such as Saudi Arabia, Iran and Qatar – a surprising result at first, but one entirely in keeping with the response to an oil-shock recession.

### COUNTRY SPOTLIGHT

**AUSTRALIA**

<table>
<thead>
<tr>
<th>OVERALL BUILT ASSET RETURNS:</th>
<th>US$376 billion (21st place)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BUILT ASSETS RETURNS AS SHARE OF GDP:</td>
<td>31.7%</td>
</tr>
<tr>
<td>BUILT ASSET RETURNS PER CAPITA:</td>
<td>US$15,460 (6th place)</td>
</tr>
</tbody>
</table>

Australia has been tied to China’s economic momentum for some time now. It became a commodity supplier to Chinese factories and the construction industry, leading to the “mining boom” in places far from traditional economic centers. This caused the role of built assets in Australian GDP to fall to 24% during the commodity price spike in 2008, recovering after prices fell back towards long-term averages and below. The next few years are likely to see stabilizing at levels similar to those that prevailed before the mining boom, as Australia returns to its older strengths. These it will still export to Chinese consumers – but they will be education, real estate and tourism rather than nickel, copper and iron ore.

The overall consistent growth Australia has demonstrated across the last 25 years, approaching a modern record for avoiding periods of recession, is mirrored by its built asset wealth, which has also increased consistently, in terms of both size and productivity. However, the headlines mask significant ongoing changes in Australian built asset investment, with future years likely to show a substantial shift in the types of assets being invested in.

Key drivers are a decline in manufacturing, and falling commodity prices, which will cause a substantial downturn in investment in new oil, gas, and mining extraction, processing facilities, as large existing construction schemes are concluded, and new ones
postponed or cancelled. The recent shift towards focusing on increasing the productivity of those assets is one trend, but the bigger impact on the composition of Australia’s overall built asset wealth is likely to be the swing towards growth in the stock of transport infrastructure assets as key regions play catch up.

In New South Wales and Victoria in particular, major new transport schemes are underway to deal with historic underinvestment and growing populations. Investments in Road, Rail and Metro assets are likely to provide the major positive in continuing Australia’s growth in its overall built asset stock, rather than new resource-related schemes. This shift reflects the related economic realities of Australia relying more on the growth of urban-based services industries to drive economic growth through this year and the near-future, rather than growth in revenues from mining or oil and gas.

In resource focused areas of Australia the focus will be on driving operational efficiency from existing assets, and effectively dealing with the legacy environmental issues created by those industries. Meanwhile in the cities the focus will be on creating sustainable and livable urban centers, through the provision of high-quality transportation and housing assets, in order to create environments that can attract the jobs and people required to support economic growth.

**Figure 11 Australia:** Return on built assets per capita (left axis) / Returns on built assets
5.0 HOW TO BOOST BUILT ASSET PERFORMANCE

5.1 The relationship between built asset wealth and performance

The line in Figure 12 represents the world average performance for built asset returns per capita in correlation to built asset wealth per person. Countries above the line manage a relatively higher return on built assets compared to their peers. Qatar achieves a higher return than expected, along with the UAE and Singapore. Towards the lower end of the scale, Turkey also performs well.

The challenge is, how can countries boost their built asset performance and move above the line?

Figure 12: Return on built assets per capita versus stock of built assets per capita
5.2 Mature markets – technology as an enabler of improved performance

Many European countries are seeing depreciation of their asset stocks faster than they build new assets. Having built up asset stocks earlier than most of the economies considered, their legacy includes decaying industrial capacity, rendered redundant through globalization, rather than the smart infrastructure that would improve productivity in the modern global economy.

Management of assets could be better to increase returns. Rather than building more, using the assets in a more sophisticated way can generate higher returns. For example, predictive technologies allow facilitating much cheaper repair and maintenance of assets, compared to intervening after an event such as a breakage. Or adopting “Uberization” provides a way to monetize an existing built asset, creating extra returns with little extra investment. With these kinds of capabilities our requirements for built assets fall, provided countries invest extra in their upkeep and efficient usage.

Eventually, built asset operators may be able to use this kind of matching with more and more assets. For example roads – through networked vehicles, which can optimize overall traffic flow – or energy, which utility companies should be able to supply with less spare capacity when prices can smooth demand more effectively. Grid-networked electric cars can function as batteries, supplying the grid during the day when demand is high and charging themselves at night. With time, this may radically reduce the stock of built assets needed while maintaining stable, or even rising, returns.

5.3 Developing markets – building assets with high productivity in mind

Commodity producing countries have a different set of issues. When land takes a large portion of national income, the return to built assets can be boosted in other capacities. In almost all cases, it is better to export manufactured goods and services than commodities. Prices of commodities are volatile – aptly demonstrated by the last two years’ experience – and so reliance on them is risky.

Certain economies in the Middle East have managed to reduce their reliance on commodities in recent years. One aspect of the UAE’s diversification program was to build infrastructure geared towards international aviation and tourism and is one of the best examples and leaders of how built asset performance generates high returns for its economy. Its stock of assets are designed for high productivity such as the Dubai and Al Maktoum International Airport, Burj Khalifa and Downtown Dubai, and its ports and rail links, and have been strong business cases underpinning growth and diversification to the economy. Qatar has taken steps in the same direction, building infrastructure to host the World Cup in football as well as museums and galleries, which have increased and diversified the returns to built assets.

South East Asian countries have rich commodity endowments – Malaysia, Vietnam and Indonesia have large deposits of a range of commodities – but over long periods, they have moved towards manufacturing. It is essential for their further development that they continue along this path. In built asset terms, this requires reliable power, transport and communications. These would tend to help extractive industries too so it is essential that governments prioritize non-commodity sectors in development plans. In this way, sources of income can be shifted from natural resources to returns on built assets. Malaysia is a prime example of an economy generating impressive returns from non-commodity sectors with projects such as the Kuala Lumpur International Airport, Merdeka PNB 118 and Malaysian-Singapore high-speed rail.

5.4 Summary

The performance of built assets continues to be an important measure for nations seeking to boost their economic returns. The creation of new assets and the realization of the associated economic and social benefits does take time, which is why trends over a ten-year period show more movement than just year-to-year analysis.

However, no matter what stage a country is in the maturity of its buildings and infrastructure creation and operation, lessons can be shared from best practice in other countries around the globe. While different needs, regulatory frameworks and funding models exist, there are common elements that can be adopted and adapted across borders.

Technology is one such disruptor which has the potential to dramatically boost the effectiveness of built assets for governments, investors, asset owners and operators. Coupled with taking an innovative approach to delivery models, those who innovate and seek to work collaboratively have the potential to see dramatic improvements.
6.0 APPENDICES

6.1 Measuring built asset performance
Measuring built asset performance requires measuring two quantities: the total stock of assets, and the total return from assets. The ratio between them can be seen as the return on built assets in that economy. If the return, expressed as a share of GDP, is relatively high compared to the average, while the stock of assets is about average for an economy of that size, then built asset performance is above average.

The stocks of built assets are measured in Arcadis’ publication Global Built Assets Wealth Index, released in 2015. Arcadis updated those figures as the first stage of this work. National built asset stocks include any physical capital that generates income: buildings, infrastructure, machinery, equipment, etc. They are calculated using capital formation estimates and depreciation schedules for the main asset classes. For more information, please see the Global Built Assets Wealth Index.

6.2 Contribution of built assets to GDP
Built assets are any physical objects that generate income. Economies count three main factors of production: labor, land and capital, the latter of which includes built assets. Three types of income correspond to these: wages, resource rents and returns to capital. The index measures these as described below.

1. Wages
The share of GDP going to labor is the total wage bill.
This is a key issue for distribution of income in the economy. Several organizations produce measures of it for many countries, and it can be calculated using labor market statistics if no estimates exist. It is the sum of all employees’ earnings plus the self-employed.

2. Resource rents
The share of GDP going to land is termed resource rents.
Economically, “rents” from resources are earnings over and above their cost of production. Estimates of rent per unit of many resources are available, which separate what is the cost of production in each country from the “profit” available to that country by selling on the world market. Based on this, price is set by the global supply/demand situation, independent of market conditions in that particular supplier. The index forecast each economy’s total resource production to calculate how much of that country’s income goes to (the owners of) land which the resources come from.

3. Built assets
The remainder of GDP, after subtracting wages and resource rents, is the return to built asset capital, here termed assets. Capital comes in two forms: physical and intangible assets. The first is infrastructure, equipment, machinery, buildings, etc. – in other words, built assets. The second includes intangible assets such as software and intellectual property, which are excluded here.

6.3 Research methodology and data sources
Produced by Arcadis and conducted by the Centre for Economics and Business Research (Cebr), the index builds on the 2014 Global Built Asset Performance Index and carries forward insights on stocks of built asset wealth from the 2015 Global Built Asset Wealth Index.

The return on built assets was calculated using the share of profits in gross domestic product, adjusting for the return on intangible capital. Rents from the extraction of natural assets, such as oil and gas, were also excluded from the return. As a result, these estimates are reliant on the accuracy of GDP estimates, gross fixed capital formation, labor compensation and natural resource extraction on a country by country basis. The return is somewhat different to that of financial return on investment. Furthermore, the return as the index measures it is realized at the economy level, rather than by any single asset level.

The owners of the assets do not necessarily accrue all the income generated from a built asset. For example, government investments in rail transport or airport capacity may increase tax receipts by supporting business activity, but the profit itself is realized by those businesses, which benefit from the use of the infrastructure.

Similarly, investments by one business into a new production facility may have spill over benefits for other businesses who construct the facility, and for firms who may benefit from any new business activities associated with that asset. However, in all cases, the increase in economy-wide profits provides an indication of the economic contribution made by the income derived from built asset wealth. As such, it is this increase in profitability, which is used to assess the performance of built assets. Since profits
motivate investment decisions, the index analyzes
the returns to built asset wealth, in terms of profit,
across the economy. These investments may also
facilitate increases in labor productivity, but increases
in productivity without higher profitability would not
lead to further investment.

Measuring the profit income accrued from built asset
wealth offers insights into the incentives, which exist
to undertaking such investments, and can illustrate
how such incentives appear to be developing over
time.

6.4 Accounting for recent volatility in
commodity prices

An important economic development between the
last edition of the Global Built Asset Performance
Index and this year’s edition has been extreme
volatility in commodity markets. The way this
development has influenced the results of the index
is through its impact on resource rents, one of the
three main factors of production in our accounting
framework (the other two being labor and capital,
with the latter including built assets).

Resource rents are the earnings above what is needed
to bring the factor of production into use. Therefore,
using oil as an example, it is the difference between
the international price of oil and the cost of production
in the country in question.

If the price of oil falls, the return to capital should not
necessarily rise to compensate. For example, in Saudi
Arabia, the government responded to the recent price
crash by running a large deficit to replace the lost
earnings. A number of other commodity producers
did the same. These must be reassigned to factors of
production, or else the residual approach, which used
to calculate returns to built assets would simply see
an artificial transferal of income from resource rents
to built assets. Instead, it was reassigned the extra
spending to a mixture of built assets and labor.

This matches reality: when governments spend, the
income necessarily flows to workers and to capital.
Arcadis finds that the average hit to GDP, had all else
been equal, produced by the commodity price crash
would have been 5% across the 20 most commodity-intensive
economies considered. However, on average the
economies grew by 3%, meaning extra income
came from somewhere. Much of this was borrowed,
and it (necessarily, because we know resource rents)
went to the other factors of production.
7.0 FURTHER READING

Global Built Asset Wealth Index 2015
Global Built Asset Performance Index 2014
Sustainable Cities Index 2016
Asset Management
Catalyst for Change
Mall of the Future
8.0

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