



# Construction Goes Global: Infrastructure and Project Delivery Across Borders

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Asia Pacific Edition





# Foreword

By Michael W. Cooper and Trevor Sturmy, HSBC

Taller buildings, faster public transit, more brilliant skylines. Whether in Hong Kong or London, Shanghai or Dubai, multinational construction and infrastructure projects are no longer bound by borders, bringing interconnectedness and complexity. We see this new breed of cross-border super projects forming around two major trends common across Europe and Asia, and a third that is region-specific. First common trend: the rise of the mega general contractors, where the largest domestic firms in emerging markets have become subcontractors to firms that can operate across borders – mostly found in more developed regions. Second, the digitization of supply chains are spreading and accelerating managerial logistics over a wider network of suppliers. In Asia, urbanization is becoming the most profound driver of the new age of global construction. In Europe, what was old is becoming newer, greener, and even “smarter.” More on each below before a word on infrastructure finance.

## Rise of Mega-General Contractors

Hyperactive new development in Asia is creating the need for infrastructure investment, engineering expertise, and sound risk management counsel. The biggest European and American firms able to operate across borders are partnering with the largest domestic firms present in other markets including Asia. Alliances can be observed where language and cultures meet: Spanish firms dominate Latin America; American and UK firms largely operate in English-speaking Australia, Canada, and the Middle East; French and German firms can be observed largely in Europe and Africa. Everyone is in the Far East.

Winners in Asia are firms that have the strongest relationships with regional authorities and the deepest understanding of cultural norms shaping the planning, designing, and constructing of these new mega projects. These are important attributes that Western firms need for successful project completion. Refraining from “owning” large, long-term workforces in countries where it is more efficient to rely on local partners seems to be the ideal model for most European and American firms. On the other side, this partnering effect is largely beneficial for most Asian firms. Now they have the experience to take on mega projects on their own, having gained the expertise in their past endeavours.

For example, some 15-20 years ago in China, European and Japanese know-how was necessary to rapidly expand its already impressive heavy freight and passenger rail lines and to deliver subway systems for its first- and second-tier cities. Sino Construction and China Construction Realty (CCR) and other state-owned enterprises learned alongside their Western and Japanese contractors who took the lead. Now, China is taking that expertise abroad to Africa and the Middle East, pairing their newly formed skills with lower costs as they import their own labor, sometimes with massive work camps. This leaves the established firms to discover a new business model as their formerly junior partners become their equals.

Lastly, if it's not talent or expertise that Western firms export to Asia and other developing areas, it is likely heavy machinery needed to assemble their ambitious projects.

## Digital Supply Chains

Next-generation supply chains have formed as a result of projects that require it. Components are manufactured around the globe. Parts are digitally measured offsite. Three-dimensional modeling is ensuring that when these pieces do arrive on site, they all fit together. In some cases the first visible inspections of fittings are during final assembly – thousands of feet above or below ground, hundreds of miles from origin. This acceleration of the design-build process is increasing efficiencies as well as raising the risk factors.

Project management teams visit and live—sometimes for years—overseas in order to be near foreign subcontractors and vendors. As projects become more complex, such as LNG plants manufactured in China and Korea and sent to Australia, this trend has become critical.

## Asia: Urbanization

Any discussion of the built environment in Asia should begin with acknowledging that the movement of people into cities is a powerful, dominant force. Understanding how they work, live, interact, travel, enjoy each others' company is key to meeting their needs.

As Asia continually marches towards urbanization, China's city populations are due to increase by more than 300 million by 2030.<sup>1</sup> The Philippines might be an even stronger case in point of urbanization driving construction. The island nation is forecast to add 25 million people to its urban center—primarily Manila—by 2030. It has critical infrastructure needs in ports, rails and energy as well as significant needs for its waterways, roadways and airways. The other emerging markets in Asia also have strong demands for new infrastructure, which must improve as their economies shift from agrarian-based cultures to ones developing around manufacturing and service sectors.

1. Ronald Man, "Bridging the Gap," HSBC Global Research, May 2013

### Europe: Newer, Greener, Smarter

Applying new technology, techniques, and tools to refresh the more aged skin and bones of infrastructure in Europe is the third macro-trend for this region, akin to what urbanization is to Asia. Smart grids send mountains of data back to their brains, but require significant infrastructure upgrades. Intelligent traffic management systems can save lives, but need to be installed on top of and often underground. Greener cars and trains powered by electricity or (relatively cheap) liquid natural gas require the installation of new terminals. It's safe to say that Europe is getting a face-lift.

### Infrastructure Finance

Just as global construction is becoming a multi-national affair, so too is infrastructure finance. Japanese banks are extraordinarily liquid. The French banks were absent for a while but have returned. Other banks, like HSBC, Standard Chartered and others play a very important role in select markets. We're seeing with Chinese and Korean construction projects that they also bring in their own finance, particularly in projects in Africa and Asia.

The projects themselves—particularly where financing is concerned—are challenged. Banks increasingly resist providing the long-term funding required for infrastructure. Bond finance is becoming the preferred vehicle of finance for infrastructure. Bond investors don't like construction risk. In a lot of cases, you'll see banks taking the construction risk by offering loans during the construction period. Then increasingly when the construction project is completed successfully, a takeout in the bond market will occur, which also suits purchasers of bonds because they've got a rated product they can invest in.

**Finally.** We can see the exciting result of a world where construction has gone global in the taller buildings, faster public transit, and more brilliant skylines. With interconnectedness and complexity across borders comes the need for more innovative financing and an appreciation of new and different risks these trends present. Only by understanding the trends can we stay ahead of them. We look forward to analyzing the trends, and enjoying the outcomes, together with those reading this report.

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“When we became Sister Cities back in the 1980s, Shanghai asked us for help with their sewer system,” said San Francisco Mayor Ed Lee. “We sent our Public Works Director. Fast forward 30 years later and China is helping us with our bridge.”

# Executive Summary

Growth in the global construction industry is on an unprecedented trajectory, fueled by the growth of cities and accelerated development in emerging markets. In an increasingly global society, construction projects are no longer bound by borders, bringing both an interconnectedness and a complexity. For the first time ever, rising economies are hosting the majority of the world's construction projects. In less than a decade, emerging markets have gone from posting a third of the world's construction work to just over half of the industry's total revenue.<sup>1</sup> And in the next ten years, nearly two thirds of all construction activity will take place in these rapidly developing nations.<sup>2</sup>

In an economic cycle of booms and busts, this dynamic shift is projected to be a long-standing trend,<sup>3</sup> rather than a simple economic upswing and corresponding downswing. If economists are correct, an expansion of the worldwide construction industry in dollars is set to outpace the growth of the world economy and should continue for decades.<sup>4</sup>

Driving record breaking construction numbers are three events. First, the historic reemergence of an ancient economy: China, which undertook a series of economic reforms to transition to a market-based economy. The "Central Nation's" quarter of a century economic rise is also lifting neighboring economies, including the Philippines, Vietnam and Indonesia. On other continents, China's quest for resources is driving construction activity upward in both Africa and Latin America. India, while trailing China in overall growth, is also making an impact.

Second, mass urbanization. A rise in population and a growing middle class is creating demand for transportation, housing and basic utilities, especially energy. The rise in urbanization is particularly keen in Asia, and it is bringing along with it a correlated increase in the middle class.

By 2030, more than 55 percent of the Asian population will live in cities, according to the Asian Development Bank.<sup>5</sup> Furthermore, the United Nations (U.N.) predicts the global urban population to top 6.25 billion by 2050—80 percent of whom are anticipated to live in cities within Africa and Asia.<sup>6</sup> More immediately, the U.N.

anticipates that 80 percent of the urban population added in the next 15 years will occur in countries like China, India, South Africa, Nigeria, Indonesia and Pakistan.<sup>7</sup> Urbanization will remain the largest driver of economic growth in China over the next decade, according to Morgan Stanley Smith Barney.<sup>8</sup>

And thirdly, construction starts around the world are up due to creative financing. Large private and state-owned firms are financing their own work in exchange for concessions. As the projects included later in this report show, road, rail and port facilities are being built in sophisticated exchanges for commodities, including food. And national banks remain a source of low-interest loans to favored firms.

Global growth is increasing the complexity of multinational construction programs. As a result, infrastructure endeavours are more commonly massive in scope, well over a billion U.S. dollars. Firms are venturing beyond their national borders making global infrastructure delivery a robust forum of foreign construction firms. Fabrication is taking place in multiple countries and a project's supply chain can involve multiple nations. When building, these firms often bring their own work forces, creating small cities of workers to support the large-scale projects in Africa, Latin America and the Middle East. The boundaries of these projects often cross international borders.

Conversely, the advantages in the global market belong to firms with the keenest understanding of the local market in which they operate. Risks on the legal, compliance and tax fronts are traps that ensnare the most sophisticated contractors. The ramifications can be devastating to newer players on the world stage. Longer supply chains put greater pressures on schedules and create more opportunities for damages, while also increasing loss and customs complications. When international firms are involved, litigation and risk can involve numerous jurisdictions.

"Messy complexities," is what Thomas P. Hughes, author of *Rescuing Prometheus: Four Modern Projects That Changed the Modern World*, calls these large projects. In the modern world, Hughes argues, increasingly complicated, costly and capricious projects are demanding sophisticated project management. Comprehensive approaches that ensure the timely and safe delivery of a project are no longer an advantage but rather a necessity.<sup>9</sup>



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1. Urban World: Cities and the Rise of the Consuming Class," McKinsey Global Institute, June 2012, [http://www.mckinsey.com/insights/urbanization/urban\\_world\\_cities\\_and\\_the\\_rise\\_of\\_the\\_consuming\\_class](http://www.mckinsey.com/insights/urbanization/urban_world_cities_and_the_rise_of_the_consuming_class), accessed January 15, 2014, p. 4.

2. "Urban World: Cities and the Rise of the Consuming Class," p. 4.

3. "Urban World: Cities and the Rise of the Consuming Class," p. 34.

4. "Urban World: Cities and the Rise of the Consuming Class," p. 34.

5. "Facts and Data about Cities and Urbanization in Asia," Asia Development Bank website, published March 29, 2012. [www.adb.org/features/12-things-know-2012-urbanization-asia](http://www.adb.org/features/12-things-know-2012-urbanization-asia), accessed January 29, 2014.

6. "Facts and Data about Cities and Urbanization in Asia," Asia Development Bank website, published March 29, 2012. [www.adb.org/features/12-things-know-2012-urbanization-asia](http://www.adb.org/features/12-things-know-2012-urbanization-asia), accessed January 29, 2014.

7. *World Economic and Social Survey 2013 Sustainable Development Challenges*, published by the UN Department for Economic and Social Affairs, July 2013, p. 54, 56.

8. Edward Kerschner, Naema Huq, "Asia Influence: The Emerging 21st Century Middle Class," Morgan Stanley Smith Barney publication, June 2011, p. 6.

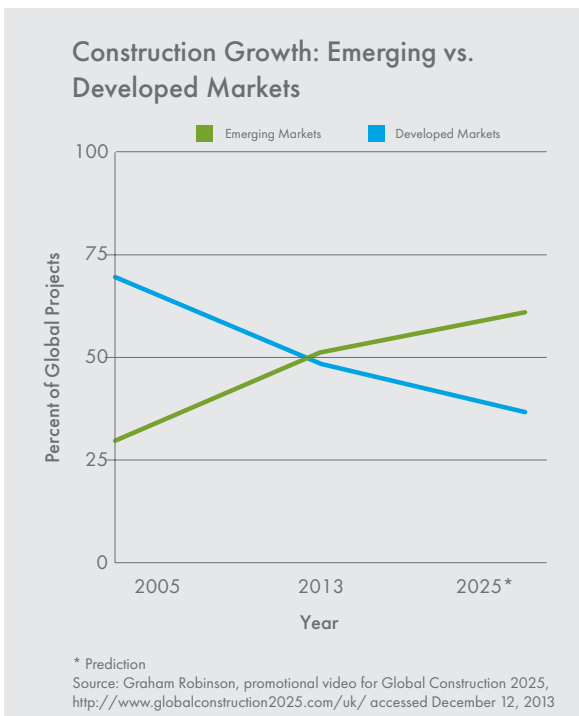
9. Thomas Hughes, *Rescuing Prometheus: Four Modern Projects That Changed the Modern World*, Vintage Books, New York, N.Y. © 2000.

## Mega Projects, Major Trend

Planning, building and maintaining the world's large scale infrastructure projects has triggered the global movement of owners, architects, engineers, contractors and manufacturers from nearly every continent.

Today, seven of the 20 largest global construction firms are Chinese-owned. Japan, Spain, France and the United States are represented by two firms each, according to Engineering News-Record's 2013 ranking of top global contractors. Australia, Austria, Brazil, Germany and Sweden each have a domestic firm in the top 20.<sup>1</sup> The ranking is based on total revenues, which includes both work done domestically and in other locales.

The growth of a global construction community and the pace of its expansion are set to continue into the foreseeable future. Current global infrastructure demand is \$4 trillion annually, according to the World Economic Forum.<sup>2</sup> At this rate, global construction will outpace global GDP by 2025, according to the publication *Global Construction 2025*.



"This is a really big trend. It's a very fundamental shift in the construction industry of the globe and it's ongoing," lectures Graham Robinson, author of *Global Construction 2025*. "If you look back to 2005, 35 percent of all construction globally was in emerging markets. Today, 52 percent, so we are at a tipping point. And we are going to zoom up to 63 percent," Robinson predicts when looking to 2025. "That's a huge shift in volume that's going to be built in emerging markets versus those developed markets."<sup>3</sup>

Demand for the delivery of global infrastructure is at a peak and the global construction community stands to make impressive gains. However, the needs of many nations remain unsatisfied. Industrious and purposeful projects with noble intentions are going unrealized because of the limited resources among countries wanting to modernize.

"We've talked a lot about the demand potential. What we haven't talked about is whether the world's got the resources to actually deliver on this level of construction," warns Jonathan Hook of PricewaterhouseCoopers LLP's global engineering & construction industry practice, "How is the world going to prioritize its resources if it is going to deliver this sort of growth?"<sup>4</sup>

Regardless of certain emerging markets' ability to supply the resources necessary to design, build and maintain vital civil projects, this pattern is set

to continue for decades. The global construction industry will persist in delivering these projects at increasingly ambitious schedules. The issue is which countries rise to the challenge to successfully deliver vital civic projects? Those markets are the ones that are underway with intensive urbanization policies. The two are interdependent: urbanization both drives and demands civic projects.

## Desirable Density

The world is urbanizing as quickly as it is populating. "By 2050, there'll be two billion additional city dwellers; sustainable urbanization will be a major construction challenge and the industry must strive to find innovative new products and solutions to contribute to building better cities," says Bruno Lafont, Chairman and Chief Executive of global building products Lafarge.<sup>5</sup>

The population explosion is forcing governments to urbanize in order to increase efficiencies of delivery while providing even more goods and services. In 1999, U.N. Secretary General Kofi Annan proclaimed the birth of a baby boy in India as the world's six billionth person. Twelve years later, the U.N. made another birth announcement, this one of a baby girl in October of 2011—the seven billionth person on the planet.<sup>6</sup> Further projections anticipate that the world's population will reach nine billion in 2043, and 10

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1. "Top 250 Global Contractors," Engineering News-Record, August 2013. <http://enr.construction.com/toplists/Top-Global-Contractors/001-100.asp>, accessed December 17, 2013.

2. "Strategic Infrastructure: Steps to Prepare and Accelerate Public-Private Partnerships," published by World Economic Forum and Boston Consulting Group, May 2013, p. 3.

3. Graham Robinson, promotional video for *Global Construction 2025*, <http://www.globalconstruction2025.com/uk/> accessed December 12, 2013.

4. Jonathan Hook, promotional video for *Global Construction 2025*, <http://www.globalconstruction2025.com/uk/m> accessed December 12, 2013.

5. Bruno Lafont, promotional video for *Global Construction 2025*, <http://www.globalconstruction2025.com/uk/m> accessed December 12, 2013.

6. "Indian baby picked as world's 'seven billionth' person" BBC News website, October 31, 2011. <http://www.bbc.co.uk/news/world-south-asia-15517259>, accessed December 16, 2013.

billion in 2083, respectively.<sup>7</sup> In less than a century the world's population will have doubled. To meet this crushing population the most practical way to accommodate the world's rapidly increasing population is to build bigger—smarter—cities. This requires infrastructure modernization.

Universal urbanization is being driven by necessity and desirability. Seeking wages, healthcare and education for their children, millions are populating the cities of the fastest growing economies. Governments of these rising economies are encouraging the trend. When it comes to preserving natural resources, economizing on energy and benefiting from an economy of scale for necessary services such as schools, urbanization holds the most promise.

## Super Supply Chains

The connection between infrastructure investment and population benefit is increasingly clear. A case in point is China's infrastructure frenzy that began with Deng Xiaoping in the 1980s. In this instance, researchers found that public infrastructure investment led to growth and provided benefits for the poor. Between 1980 and 2000, it is estimated by the World Bank that nearly half a billion Chinese were lifted above the poverty line.<sup>8</sup>

Researchers determined that "the conclusion that infrastructure both raises growth and lowers income inequality implies that infrastructure development is a key win-win ingredient for poverty and inequality reduction. In addition to raising society's overall economic growth, it also helps raise the share of income earned by the poor. Infrastructure development within China has proven to be one of the most effective ways to reduce poverty. Development along these lines suggests that it is also an effective way to create equality within the Central Nation's populace."<sup>9</sup>

Regardless of region, multinational projects have brought with them new risks.

China invested \$600 billion in its roads, focusing on better connecting its larger cities. That investment is attributed to a growth in income of six percent.<sup>10</sup>

As other countries attempt to follow China's model, many investors find delays in project readiness. According to a World Economic Forum study: "The reason for this paradox, especially in developing countries but also in some developed countries, is the 'project preparation gap', i.e. the shortage of well prepared, bankable [public private partnership (P3)] projects where investors are sufficiently reassured by the commercial and technical feasibility, the risk allocation, the public sector's contractual commitment and capacity as well as the institutional and legal framework."<sup>11</sup>

Not all of the potential for global construction remains in emerging markets, however. The United States and Europe—both once leaders in infrastructure investment—now find themselves with aging infrastructures desperately in need of retooling to compete with improving supply chains worldwide.

Lastly, investing in the world's premier urban areas is becoming increasingly desirable. London, New York and Hong Kong are considered some of the most coveted locations for the world's wealthiest to own property and for their children to attend school. London property has become an investment class in itself, making it the most expensive city to live in.<sup>12</sup> Similarly, New York and Paris also have growing investment appeals. While the focus on infrastructure investment in developing nations is grabbing much of the focus, more established cities and countries should not be ignored.

Regardless of region, multinational projects have brought with them new risks "and clients really need to be more sophisticated in the way that they now approach these risks," said Robin Johnson, AIG's Head of Broker and Client Management, Asia. "For instance, where there is fabrication in multiple countries, if a client were to fail to buy the right programs, they face the chance that the risks won't be covered, that there will be gaps in coverage. Before the globalization of these mega projects that simply wasn't the case. You could just buy a policy in the single country you were working in and be relatively certain that it would cover what you needed it to cover."

7. "Population," United Nations website, <http://www.un.org/en/globalissues/population/>, accessed December 16, 2013.

8. "China From Poor Areas to Poor People," Poverty Reduction and Economic Management Department, World Bank, March 5, 2009, p. 5.

9. Yumei Zhang, Xinxin Wang, Kevin Chen, Growth And Distributive Effects of Public Infrastructure Investments In China, Partnership For Economic Policy Study, July 2012, p. 32.

10. Strategic Infrastructure: Steps to Prepare and Accelerate Public-Private Partnerships, published by World Economic Forum and Boston Consulting Group, May 2013, p. 5.

11. Strategic Infrastructure: Steps to Prepare and Accelerate Public-Private Partnerships, published by World Economic Forum and Boston Consulting Group, May 2013, p. 14.

12. Rick Hampton, "Sky's the Limit," USA Today, December 14, 2013



## San Francisco-Oakland Bay Bridge, California

The \$7 billion East Span of the San Francisco-Oakland Bay Bridge, California's largest infrastructure project to date, opened on September 2, 2013. Damaged in an earthquake in 1989 and exceeding its lifespan, the nearly 80-year-old bridge needed replacing. The project stands as an icon to the rebuilding of America's infrastructure and its construction is emblematic of the trends outlined in this report.

"The superstructure is the world's largest self-anchored suspension bridge and the most seismically advanced civil structure ever built," explains Ken Terpstra, Project Manager for California Highway Department, the bridge's owner. Operating in a global market required innovative approaches. Terpstra adds, "we sent more than 60 experts from our staff to Shanghai in an unprecedented program, in order to oversee our contractor's work on the main structural steel fabrication. Since the work was on a heightened critical path, we had to ensure the metals, welds and fabrication were delivered to our exacting standards here in California. This level of overseas work has never been contracted out by our contractors before. Correcting problems on this side of the Pacific was not an option," emphasized the project's leader.

The bridge's components come from around the world. China produced the bridge's deck sections, the 525-foot tower and one of the world's largest-ever suspension cables. South Korea manufactured seismic bearings and temporary detour structures, Japan forged the world's first double cable saddle atop the Chinese tower and England produced the main cable's bands. The majority of manufacturing – about 80 percent of the total—was produced in the U.S.

ZPMC, a state-owned enterprise in China, fabricated the steel for the superstructure in a nearly \$400 million contract for its client,<sup>13</sup> a joint venture between The American Bridge/Fluor Joint Venture (ABFJV), which had exhausted possible fabrication sources in the U.S. Fluor singled out ZPMC to ship eight shipments every two months between Shanghai and the Port of Oakland in the United States. ZPMC manufactures about 80 percent of the world's giant port gantry cranes.<sup>14</sup> In 2006 it began expanding productions into record-breaking world-class highway bridges in a deliberate move to position themselves to support efforts in the rebuilding of American structures.

San Francisco Mayor Edmund Lee speaks to the global world of infrastructure delivery in his city, a sister city to Shanghai: "When we became sister cities back in the 1980s, Shanghai asked us for help with their sewer system. And we sent our Public Works Director, who was also named Lee, to go into Shanghai to help them develop a sewage system that worked for them," recalls the city's chief executive who also led San Francisco's Department of Public Works in 2005. "Fast forward 30 years later and China is helping us with our bridge."

## Makkah (Mecca) Mass Rail Transit, Saudi Arabia

When Saudi Arabia's King Abdullah bin Abdul-Aziz and China's President Hu Jintao met in February of 2009, the first phase of a construction project to build a rapid mass transit was launched.<sup>15</sup> The main purpose of the transportation project—known as the Makkah (Mecca) Metro—is to accommodate devout Muslims during the hajj, a five-day pilgrimage of faithful from around the world to Mecca's Great Mosque.<sup>16</sup>

Shortly after the contract signing ceremony, thousands of Chinese workers began occupying work camps in Saudi Arabia in order to start building the first phase of the \$20 billion project.<sup>17</sup> Cultural and political sensitivity was vitally important on this project. Aware of the consequences of missing a seemingly impossible deadline, the foreign contractors became interdependent. Heavy rains and high heat made for harsh conditions. Defaulting on the deadline triggered hefty penalties and endangered the promise of billions more in contracts in Saudi Arabia. The multi-national team, however, delivered the project in record time. Within 20 months, the China Railway Construction Corporation, eager to export its newly developed expertise in rapid mass transit, excavated, laid track and delivered world-class rolling stock.<sup>18</sup> Siemens of Germany built the power supply system, installed overhead contact lines and substations as well as delivered switches and diesel generators.<sup>19</sup> Parsons Brinckerhoff, a design firm

"When we became Sister Cities back in the 1980s, Shanghai asked us for help with their sewer system," said San Francisco Mayor Ed Lee. "We sent our Public Works Director. Fast forward 30 years later and China is helping us with our bridge."

13. Wang Ying, "Bridge Changes China's Image," China Daily, July 12, 2011, [http://usa.chinadaily.com.cn/epaper/2011-07/12/content\\_12884736.htm](http://usa.chinadaily.com.cn/epaper/2011-07/12/content_12884736.htm), accessed January 14, 2014.

14. Patricia Decker and Robert Porterfield, "Unparalleled Bridge, Unprecedented Cost," San Francisco Public Press, <http://sfpublicpress.org/news/2009-12/unparalleled-bridge-unprecedented-cost>, accessed March 9, 2014.

15. Chengcheng Jiang, "As China Woos Overseas Business, State-Owned Firms Take a Hit," Time, <http://content.time.com/time/world/article/0,8599,2033238,00.html>, accessed March 9, 2014.

16. Al Mashaer Al Mugaddassah Metro Project, Saudi Arabia, Railway-Technology.com website, <http://www.railway-technology.com/projects/al-mashaer-al-mugad/>, accessed March 9, 2014.

17. "Islamic World News," The Islamic Bulletin, [http://www.islamicbulletin.org/newsletters/issue\\_26/metro.aspx](http://www.islamicbulletin.org/newsletters/issue_26/metro.aspx), accessed March 10, 2014.

18. "Deadline in the Desert," Siemens company website, [http://www.siemens.com/innovation/apps/pof\\_microsite/\\_pof-spring-2012/\\_html\\_en/hajj-in-mecca.html](http://www.siemens.com/innovation/apps/pof_microsite/_pof-spring-2012/_html_en/hajj-in-mecca.html), accessed December 16, 2013.

19. "Deadline in the Desert."

based in New York City and owned by the United Kingdom's giant Balfour Beatty, consulted on engineering and construction throughout the project.<sup>20</sup>

The interconnectedness was the key to success in meeting a seemingly impossible deadline, all while adhering to local cultural sensibilities.

# Wheatstone Project, Australia

The world's demand for energy supplies to power growing cities and to support the population boom is driving the Wheatstone Project just west of Onslow in Western Australia. Australia is sitting on a 100-year supply of natural gas<sup>21</sup> and the country's proximity to Asia, and the region's rapidly increasing thirst for new energy sources, provide the drive for the Wheatstone Project.

The Wheatstone Project is poised to capitalize on the liquefied natural gas (LNG) boom. A global venture, the owners are international in scope. Key stakeholders include the Australian subsidiaries of Chevron (64.14%), Apache (13%), Kuwait Foreign Petroleum Exploration Company (KUFPEC, 7%), Shell (6.4%), and Kyushu Electric Power Company (1.46%), together with PE Wheatstone Pty Ltd (part owned by TEPCO, 8%).<sup>22</sup> The construction is being handled by a variety of global enterprises. Customers have already lined up agreements to purchase LNG once Wheatstone is viable.<sup>23</sup> Although the project is still in the early stages, (Chevron discovered the natural gas field in 2004;<sup>24</sup> groundbreaking began in 2011), Chevron has already made significant progress, both locally and globally, on the \$29 billion project.

In addition to the international consortium of owners, Wheatstone has included steel from Korea and China. Daewoo Shipbuilding & Marine Engineering Co. in South Korea is constructing the platform.<sup>25</sup> Australian company Worley Parsons provides construction management services. Locally, Chevron has also invested in upgrading Onslow facilities, including the Onslow Airport, a recreation and aquatic center and a picnic area and playground.<sup>26</sup>

Bechtel, having completed the Front End Engineering and Design (FEED), was awarded the engineering, procurement, construction and commissioning contract by Chevron. Australian company Thiess landed a subcontract from Bechtel for the onshore site clearing and preparation including bulk and final-finish earthworks for the plant, storm water drainage system and access roads around the project. Additionally, the Kiewit Ertech Joint Venture was awarded the Construction General Services 3 (CGS3) subcontract from Bechtel. Australian firms will also handle the 3,800-bed construction village with John Holland constructing the Construction Village buildings and utilities and their subcontractor Ertech undertaking roadwork and earthwork. Australian company Thiess and Belgian firm BESIX SA will develop the breakwater and materials offloading facility.<sup>27</sup>

Wheatstone sits in the midst of a \$200 billion building boom; a total of seven major LNG projects are under construction in Australia.<sup>28</sup> They will join the three major operations currently in existence. Forecasts show Australia with a 100-year supply of natural gas<sup>29</sup>, with most of that concentrated on the country's northwest coast. Exported in liquid form, Australia ranks as one of the top producers of liquefied natural gas (LNG) consumed in Asia.<sup>30</sup>

Note that many of the owners of the project are energy companies looking for a ready supply. Before the project had lowered its first drill, 80 percent of the resources were spoken for.<sup>31</sup> That shows a willingness on the part of energy companies to continue to invest in securing their supplies.

The project also showcases the sophistication of resource-rich regions. Requiring numerous commitments to hire and invest locally, the endeavour provided roughly 6,500 jobs at peak construction. An estimated \$17 billion of revenue is generated to Australian

Australia is sitting on a 100-year supply of natural gas. The country's proximity to Asia, and the region's rapidly increasing thirst for new energy sources produce the drive for the Wheatstone Project.

20. "Parsons Brinckerhoff wins deal for Makkah Metro," Construction Week Online website, [http://www.constructionweekonline.com/article-23305-parsons-brinckerhoff-wins-deal-for-makkah-metro/#.Uxy\\_5YU3dEM](http://www.constructionweekonline.com/article-23305-parsons-brinckerhoff-wins-deal-for-makkah-metro/#.Uxy_5YU3dEM), accessed March 9, 2014.

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22. "Wheatstone," Chevron Australia website, <http://www.chevronaustralia.com/ourbusinesses/wheatstone.aspx>, accessed December 9, 2013.

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25. "Project Milestones," Chevron Australia website, <http://www.chevronaustralia.com/our-businesses/wheatstone/project-milestones>, accessed March 9, 2014.

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31. "Wheatstone," Chevron Australia website, <http://www.chevronaustralia.com/ourbusinesses/wheatstone.aspx>, accessed December 9, 2013.

businesses and services.<sup>32</sup> Chevron also is spending \$250 million on infrastructure projects in nearby Onslow, including community facilities, roads and water infrastructure and education and health services.<sup>33</sup> That is the result of an agreement with the Thalanyji People, who hold the native title to the region.

In all, the project is expected to provide an estimated \$20 billion in government revenues during the construction phase.<sup>34</sup>

Wheatstone is far from alone. The Ichthys LNG project in Australia's Northern Territory likewise was an international project. Fabrication alone took place in three different countries: Philippines, Korea and Malaysia.<sup>35</sup> Approximately 70 percent of the LNG is to be delivered to Japan, including Tokyo Power, Toho Gas, Chubu Electric Power and INPEX Corporation, the project's ultimate owner. The remaining supply will go to Taiwan. Some two dozen commercial lenders from Japan, Australia, Korea, France, Germany and The Netherlands were involved in financing the project.<sup>36</sup>

Construction is international in scope as well. British firm AMEC Engineering landed the front-end engineering design (FEED) work. Houston, Texas-based KBR joined two Japanese firms—JGC, Inc., and Chiyoda Corp. in landing key construction roles.<sup>37</sup> Korea's Samsung Heavy Industries Co., and two U.S.-based companies, General Electric Co. and McDermott International Inc., were awarded development contracts.

## Suramadu Bridge, Indonesia

The Suramadu Bridge links Surabaya—Indonesia's second largest city—with Madura, a densely populated but impoverished island. A long-standing focus, the project has been under discussion since the 1960s with financial difficulties causing delays.

Groundbreaking finally got underway in 2002, with the project completed in 2009 at a cost of US \$428 million.<sup>38</sup> The toll bridge is symbolic of Indonesia's growth since the 1960s, which has made an effort to more fully develop its rural and agricultural regions.<sup>39</sup>

The bridge project has led to a significant infrastructure development in the region, including a new port and property development projects around the bridge. The bridge and two related toll roads are expected to be sold off through private concessions.<sup>40</sup>

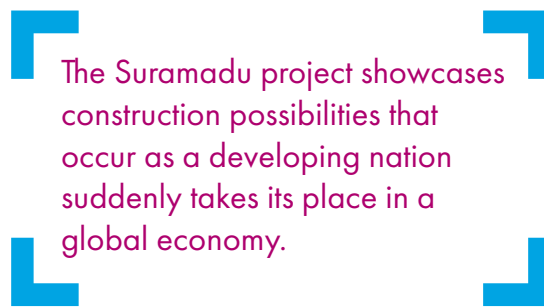
Chinese firms were heavily involved in all aspects of the Suramadu project. Partial financing was provided by the Export-Import Bank of China.<sup>41</sup> While the causeways were built by Indonesian firms, the bridge's main span was constructed by a consortium of Indonesia firms, alongside China Road and Bridge Corp. (CRBC) and China Harbor Engineering Consultant (CHEC). Construction of approaches to the bridges also included a mix of Indonesian and Chinese partners.<sup>42</sup>

The Suramadu project showcases construction possibilities that occur as a developing nation suddenly takes its place in a global economy. With a significant need to increase infrastructure, Indonesia has turned to public-private partnerships (P3) such as the bridge and its related access roads. In 2014 alone, Indonesia plans to approve \$35 billion in new contracts; some 32 of 56 projects are<sup>43</sup> aimed at P3. The country has already streamlined laws to ensure P3 projects attract foreign investors.<sup>44</sup>

Suramadu Bridge also demonstrates the need for creative financing. Until China's Export-Import Bank offered to finance the majority of the project, the needed bridge never got off the ground. It also ensured that Chinese firms could showcase their abilities on the bridge project, designed to be longest in Indonesia.<sup>45</sup>

It also showcases the rising influence of China on Indonesia, the world's fourth largest population; Indonesia provides one-fourth of China's coal supplies and is resource-rich in crude oil.<sup>46</sup>

That is not to say that other countries—particularly Japan and Korea—are missing from construction in Indonesia. Those countries



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42. Ridwan Max Sijabat, "Suramadu bridge finishes in March," Jakarta Post, September 8, 2008, <http://www.thejakartapost.com/news/2008/09/08/suramadu-bridge-finishes-march.html>, accessed December 10, 2013.

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in particular have actively pursued P3 projects. Firms from both countries have been involved in plans for another bridge project, the \$10 billion Sunda Strait Bridge. While the project has yet to be approved, all three countries are competing with Indonesia and U.S. firms with offers of financing.<sup>47</sup> Like Suramadu, the Sunda Strait Bridge has been discussed since 1960. If the bridge is complete, it will open up another viable coal power supply.<sup>48</sup>

## Conclusion

International construction brings both promise and potential peril. "Global...firms are benefiting from the sea of change around infrastructure delivery. Dynamic changes in practices of how vital large-scale project planning, designing and constructing are carried out is creating the greatest opportunities ever seen in the global construction market," explains Roberto Pons, a graduate of Princeton University's engineering school and Oxford's Said Business School. Pons is also the founder and CEO of Brazilian based Projectlab, a project management educational provider.

Still, one claim against a single contractor can put billions of dollars at risk. "The complexities in today's projects: a multitude of international firms performing design, construction, and maintenance services, longer supply chains, thousands of workers in camps on foreign soil, and constructing along accelerated delivery schedules, all give rise to the chances of litigators winning their claims," counsels Pons. "A short while ago, litigators were limited to one or two countries. Now, with numerous international firms involved in a single project, there is a greater chance that lawsuits will have a more costly settlement. A refinery project in Angola may have designers that are European, financiers from the United States, and a joint venture general contractor from Asia. Because one member of a large team is from the United States, the American court system becomes a viable jurisdiction."

Today, the delivery of large scale construction projects is truly a worldwide venture, fueled by accelerated urbanization and development around the globe. As opportunities for cross border project delivery continues to evolve, so do the complexities. From foreign financing to fabrication across multiple countries, success in global infrastructure delivery increasingly depends on effective project management at both the local and international levels. In meeting changing infrastructure needs, firms need to be well versed in recognizing and mitigating potential risk exposures. More global projects likely bring an increased level of risk. When the complexity of multiple jurisdictions is introduced, different legal exposures, contractual obligations, tax and compliance issues, and cultural norms such as worker safety, must be taken into consideration.

For those looking to lead in this increasingly global industry, world-class risk management strategies are key. The most effective protection for construction firms looking abroad is the ability to make well-informed decisions in identifying and mitigating both domestic and foreign risk exposures. That is why it is vital for global construction firms to understand the intricacies involved— from project conception to completion.

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47. "Long and winding road towards Sunda Strait Bridge," Antara News wire service, published November 29, 2012. <http://www.antaraneews.com/en/news/85883/long-and-winding-road-towards-sunda-strait-bridge>, accessed December 12, 2013.  
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