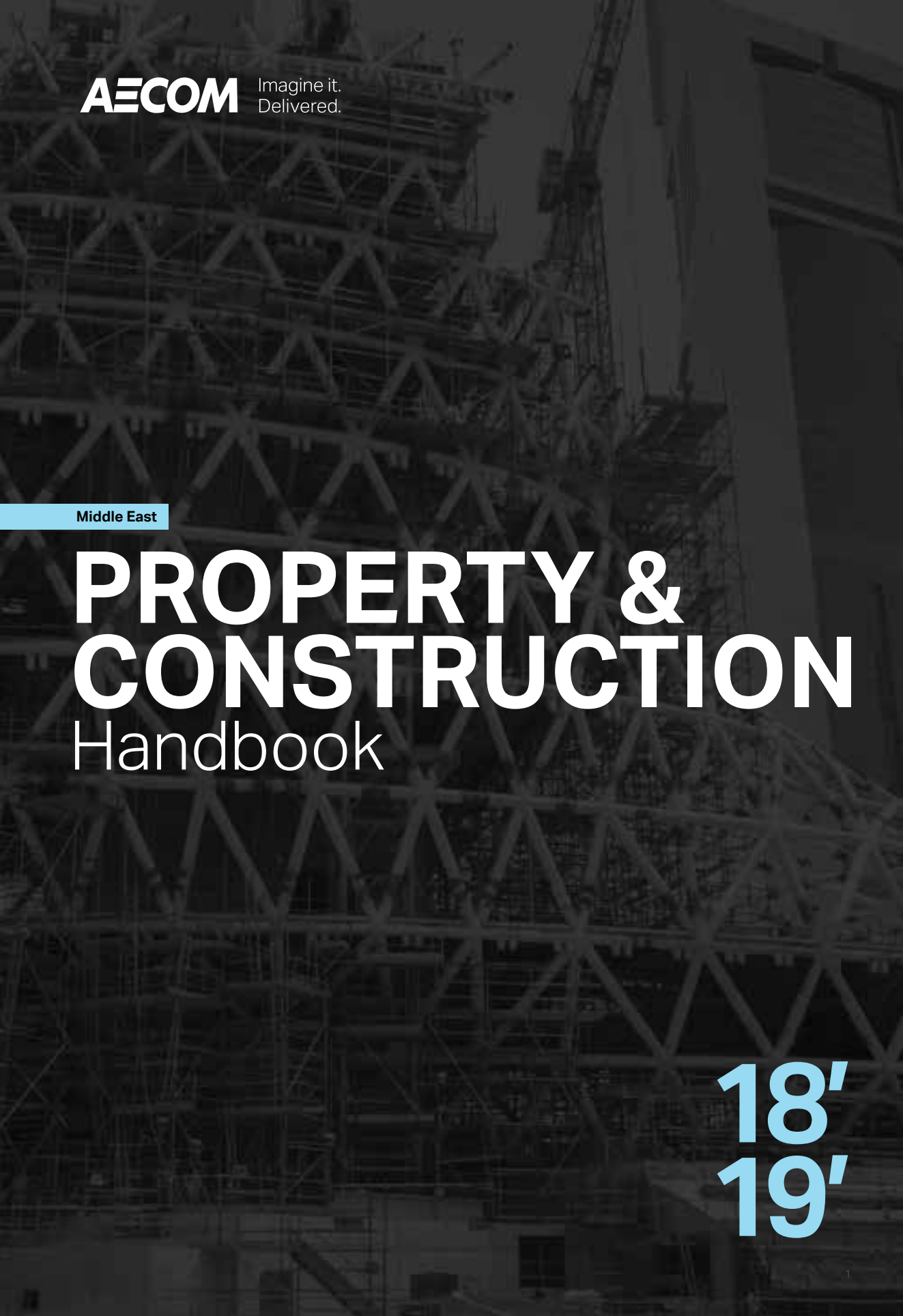

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Middle East

PROPERTY & CONSTRUCTION Handbook

18′
19′

FOREWORD

Welcome to the twelfth edition of the Middle East Property & Construction Handbook. We hope that you will find our assessment of the trends shaping the global and regional construction industry of interest and this year's selection of articles and cost data of value.

This year, we start off by reviewing the global macro-economic factors that categorized 2017 as a better year than 2016 for the world economy; a trend set to continue in the near term. Better than expected performance of key markets in Europe and the US supported an uptick in global economic output in 2017 and early 2018. Increased manufacturing output in Asia also played a part. Section one contains a detailed review of these markets as well as our anticipated trends for the remainder of 2018 and into 2019.

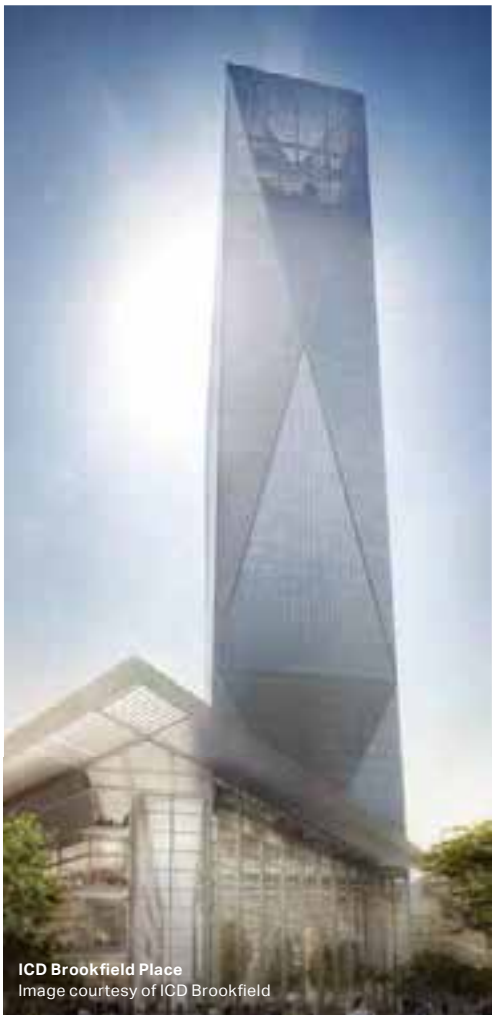
In our articles section we explore three emerging trends in the construction market. We review the adoption of digital construction tools and examine how modern construction techniques are incorporating 3D printing and robotics into their work flows. We look at project management challenges, and the role of value and risk management. Lastly we share our thoughts on the ecology of a city, demonstrating how it is possible to design cities that complement their ecological environments.

If you are new to the Middle East construction industry, section three will provide you with insights into procurement routes, forms of contract in the Middle East and building regulation and compliance. If you are a veteran in the Middle East industry, section three will provide you with a reminder of key contract and regulatory information, a good reference to keep.

The handbook concludes with our reference section, international and regional cost data and a directory of our offices in the region.

As with previous years we continue to seek feedback in everything we do. Please contact the editors, Marc Gibbons & Tulsi Patel via bi_middleeast@aecom.com for further information.

Lusail Expressway
Aerial view of 5/6 arches at 5/6 Interchange
Image courtesy of Ashghal



ICD Brookfield Place
Image courtesy of ICD Brookfield

Sarat Village
Image courtesy of Diyar Al Muharraq

Il Primo
Image courtesy of Emaar

Contents

01 ECONOMIC ROUND UP

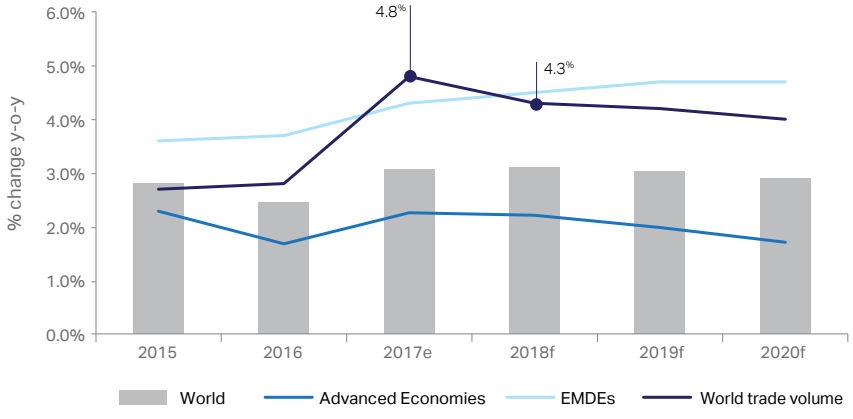
IN BRIEF

GLOBAL ECONOMIC REVIEW

Better than expected performance of key markets in Europe and the US supported an uptick in global economic output in 2017 and early 2018. The favorable market conditions are likely to continue in the near-medium term, however downside risks continue to outweigh upside risks in the near-medium term outlook. Protectionism, vulnerability of financial markets and global tensions are considered the most significant downside risks within the outlook.

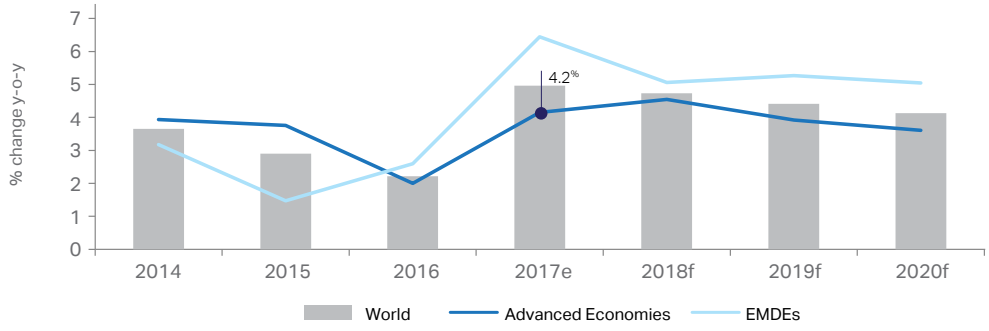
A significant increase in trade levels between 2016 and 2017 contributed to the improvement in global economic forecasts for the near term. According to the World Bank Group, world trade volume increased by 4.8 percent in 2017 and is expected to grow by another 4.3 percent in 2018. IMF estimates a growth in exports of advanced economies by 4.2 percent in 2017, well above their growth levels in 2016. The volume of exports in emerging and developing economies continued to increase at a higher rate from their 2016 levels. These positive trends are supported primarily by increased investment from advanced economies and increased manufacturing output in Asia. However, the impact of recent US tariffs may also factor in the coming periods.

Real GDP growth



Source: World Bank Economic Prospects, June 2018

Growth in volume of exports of goods and services

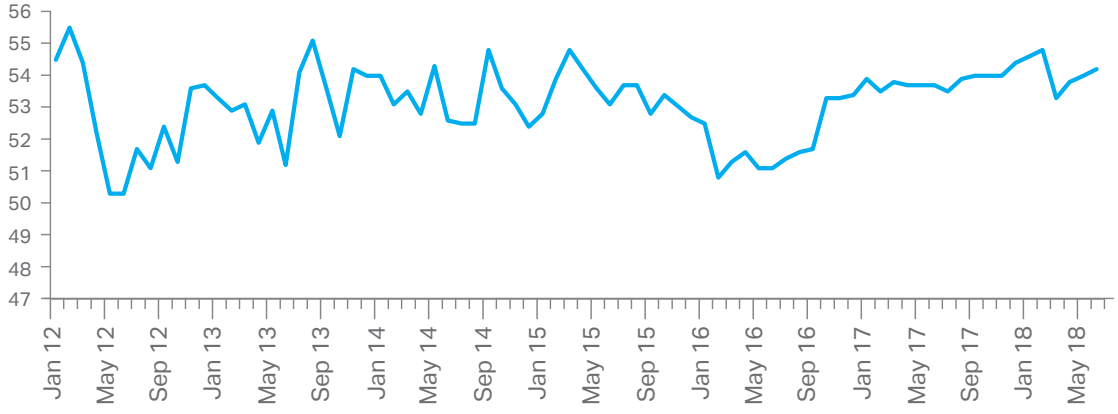


Source: IMF, World Economic Outlook, April 2018

Note: Advanced Economies - United States, Euro Area and Japan
EMDEs - Emerging and developing countries in Africa, Asia and Latin America

The global composite purchasing managers' index for the first quarter of 2018 indicates rising new orders and work backlogs. This movement further supports an acceleration of global economic output growth in the near term. Fiscal stimulus and structural reforms are currently under review or being implemented by many countries around the world. In the US, tax reforms and fiscal stimulus plans have helped support investments and could result in improved market sentiment within the US economy and its major trading partners. To further drive investment in their countries, China and India have revised their investment policies allowing foreign companies more autonomy and opportunities to invest. Nigeria, Malaysia and Indonesia, among many other countries, have also revised laws and policies around corporate regulations and government processing time in order to create more business-friendly environments.

Global Composite PMI

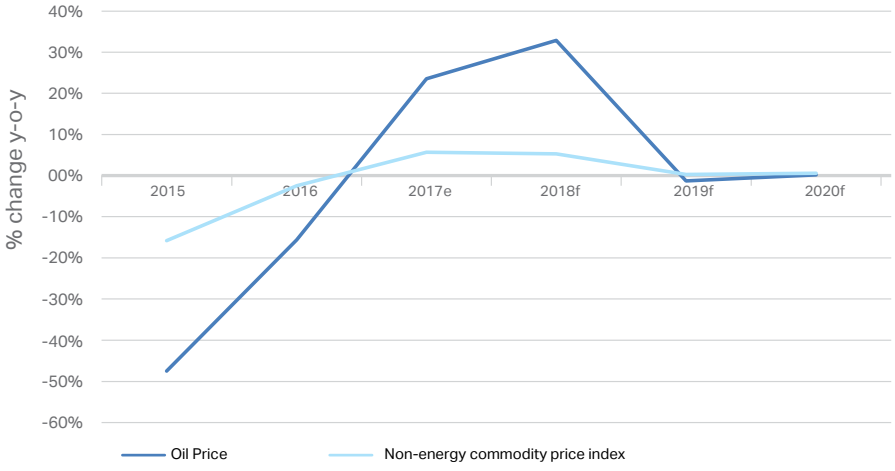


Source: JP Morgan

COMMODITIES

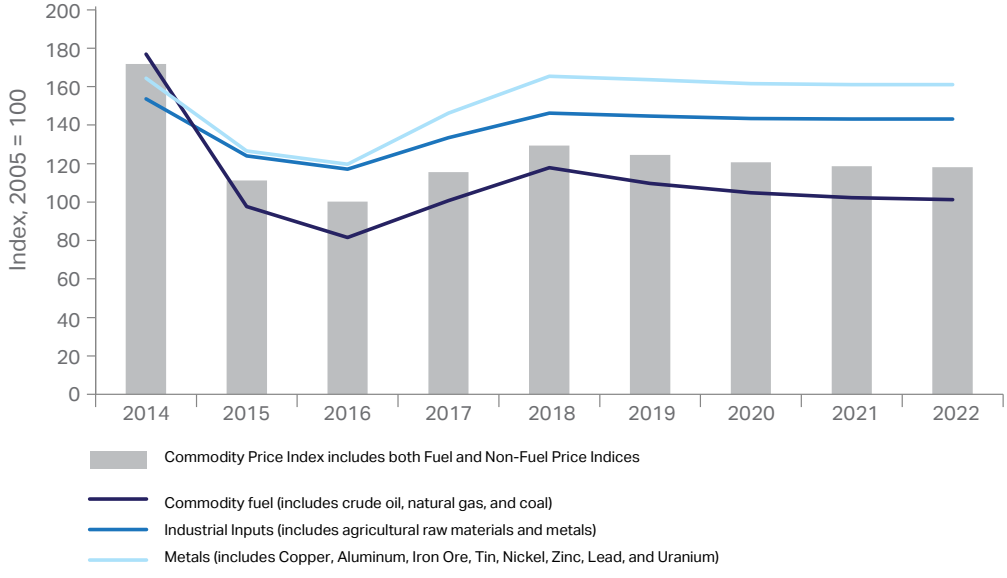
Commodity prices strengthened in 2017 with improving trade levels, increased investments and positive financial conditions. The uptick in prices is expected to continue in the near-medium term, albeit at a slower rate than that recorded in 2017. Prices will remain susceptible to changes in global demand, policy, distribution channels, technological advances and geopolitical conditions.

Growth in commodity prices



Source: World Bank Economic Prospects, June 2018

Commodity indices
Index, 2005=100

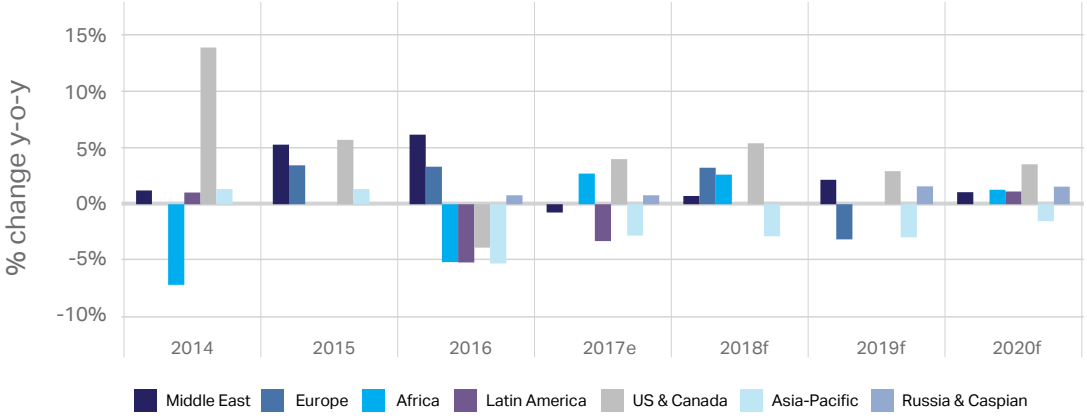


Source: IMF: World Economic Outlook. April 2018

Oil prices

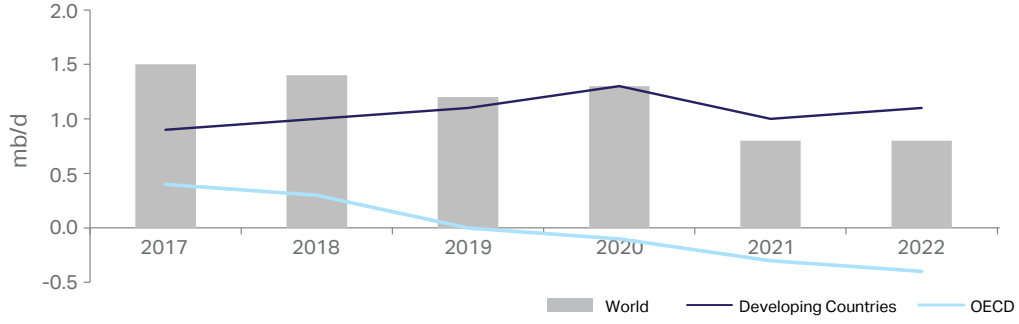
The continued co-operation of OPEC countries and the non-OPEC oil producers in 2017 led to a significant improvement in oil prices. OPEC leadership and non-OPEC members, including Russia, have signed a roadmap for cooperation that extends the existing framework post 2018, without necessarily limiting the production levels of the participating countries. Increased production of shale oil in the US is expected to be partially off-set by reductions in oil extraction in other regions around the world, including Canada and the North Sea. Additionally, increased demand for oil in developing countries is expected to counter reduced demand from OECD countries (mainly advanced economies). This balancing act of supply and demand across the global markets supports stabilization of oil prices in the medium term.

Anticipated changes in crude oil supply



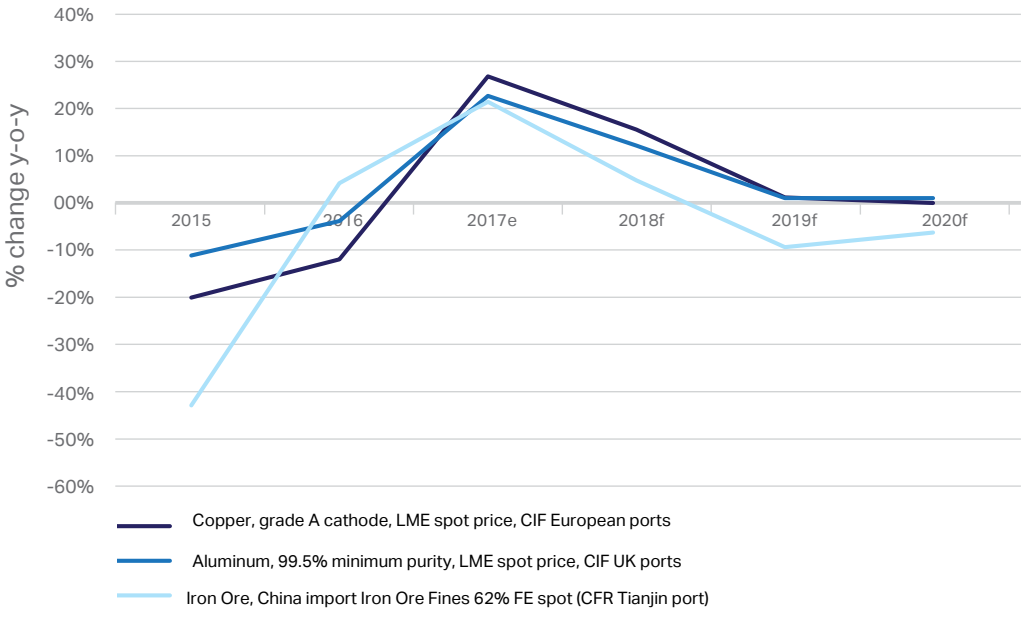
Source: OPEC, World Oil Outlook 2040

Changes in oil demand growth



Source: OPEC, World Oil Outlook 2040

Changes in metal prices



Source: IMF, World Economic Outlook, April 2018

Metals

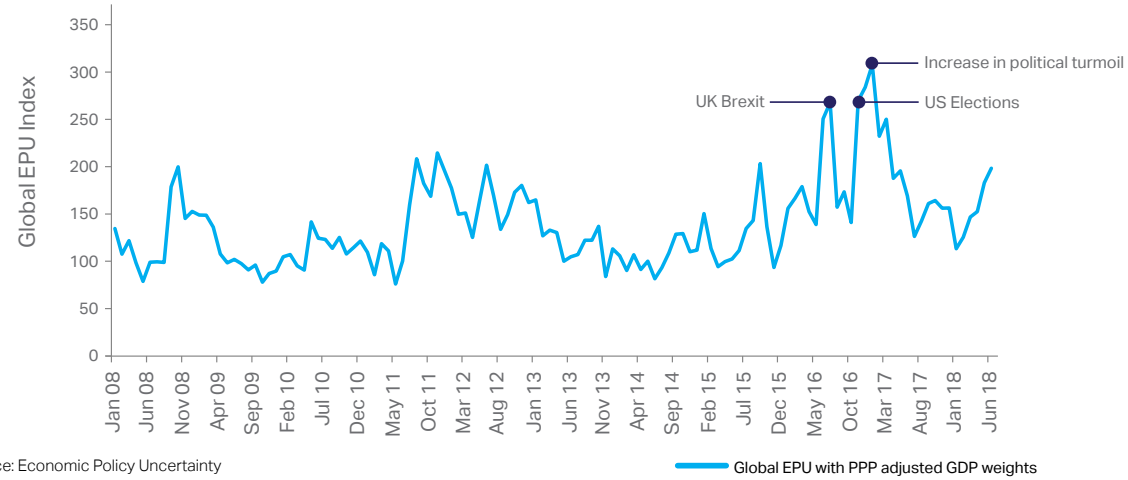
Metal prices improved in 2017 on the back of increased productivity and trade across many countries. Prices remained largely stable in the first quarter of 2018, despite rising inventories, due to the anticipated growth in demand. Growths in the manufacturing and industrial sectors across Asia have helped support prices and avoid any large drop post Q1 2018.

The near-medium term forecasts however are modest due to expected implementation of international trade barriers. US tariffs on steel and aluminum in the first quarter of 2018 helped the US domestic market; however, its full impact on metal prices at a global level is yet to be seen, particularly as the US is a global importer. Forecasts for the remainder of 2018 and for 2019 remain conservative with analysts hesitant to make forecasts in such a volatile market where policy changes can have a significant impact on prices.

GLOBAL ECONOMIC MARKET

- Fiscal stimulus plans in major world economies, including the US and China, and increased investments in emerging markets and developing economies (EMDEs) represent an upward risk. If plans for major projects and spending materialize, this could improve market sentiments, domestic demand and further support economic growth between trade partners.
- With increased trade at an international level, risk of over valuation of assets increases, particularly in a low volatility financial market, and could result in sudden market adjustments. Emerging economies, particularly export-led economies, need to implement structural reforms that strengthen their financial regulations and create financial buffers to guard against sudden market adjustments.
- A rise in protectionist policies poses a downside risk in the medium term, as increases in trade barriers hold the potential to escalate into trade wars between countries and regions. International trade and financing bodies are encouraging governments to work together rather than in silos to promote a more inclusive trade environment that benefits all.
- Geopolitical tensions and unrest continue to provide a downward risk on global economic markets as they dampen market sentiments, particularly in countries closest to areas of conflict. Additionally, elections in India and certain Latin American countries, including Brazil, Mexico and Colombia, could further impact their economic growth as new administrations alter government policies.
- Extreme weather conditions and climate change pose a growing downside risk to the global economy. Natural disasters are becoming more common and can result in significant humanitarian and economic losses.
- Global policy uncertainty is a measure developed (Davis, 2016) to gauge "uncertainty" sentiments by measuring the frequency of articles in domestic newspapers mentioning "economic policy uncertainty". The economic policy uncertainty (EPU) index recorded its highest reading in a decade at the beginning of 2017, however later dropped significantly, reflecting an improvement in market sentiment.

Global EPU index with PPP adjusted GDP weights

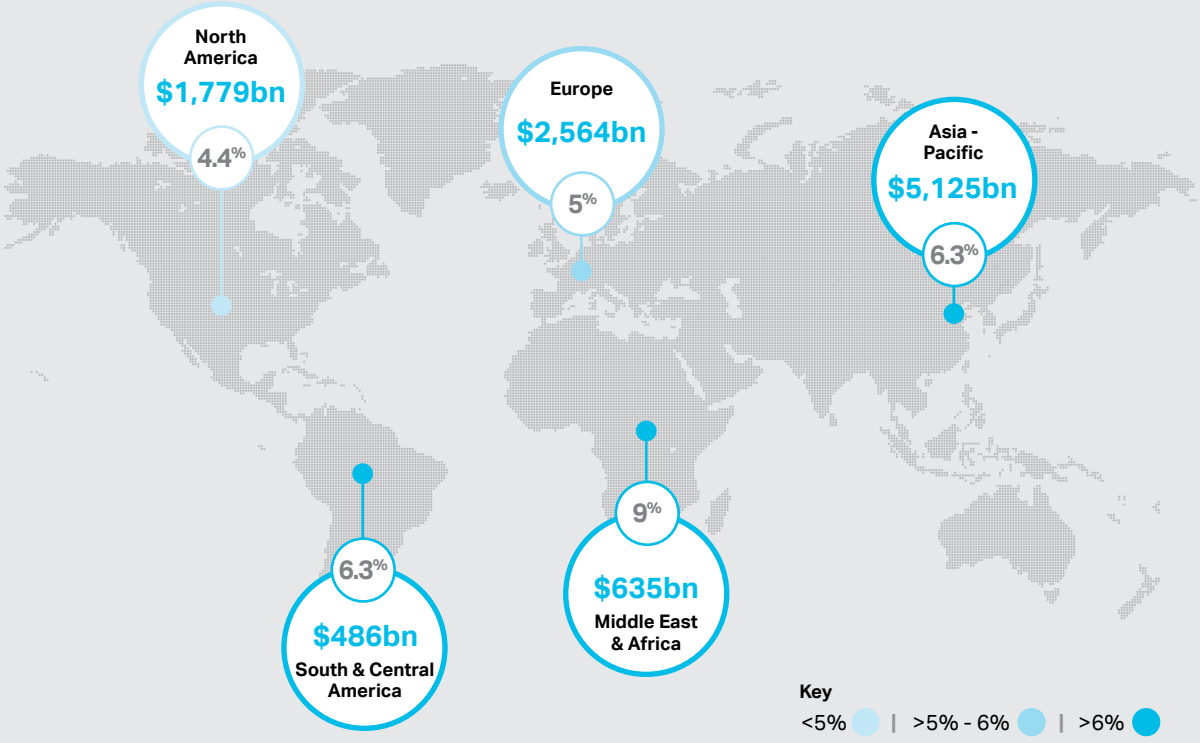


Source: Economic Policy Uncertainty

GLOBAL CONSTRUCTION PROSPECTS

Global construction markets are expected to report an overall growth over the next five years supported by improving market sentiments and realizations of the need to bridge the infrastructure and development gap around the world.

While the Asia-Pacific market remains the largest global construction market, the Middle East and African construction markets are expected to grow the fastest between 2018 and 2022.



Source: Timetric – Construction Intelligence Center

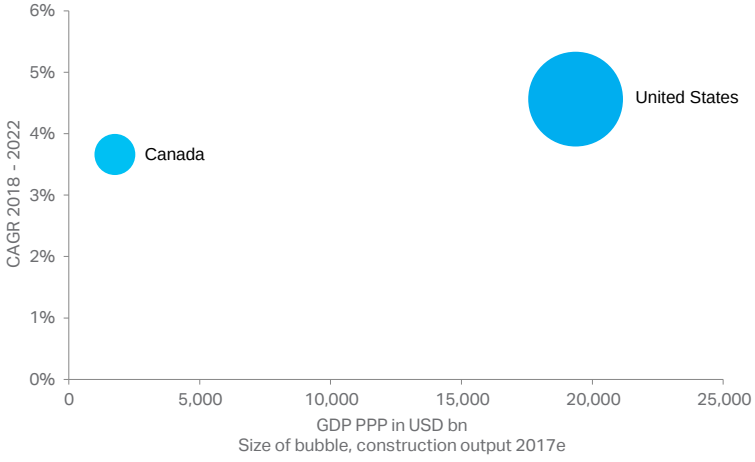
North America

Total construction output in North America for 2017 is estimated to have reached USD 1,779 billion, and according to Timetric Construction Intelligence Center, is expected to grow by 5.3 percent in 2018 and then to maintain a growth rate of around 4.4 percent between 2018 and 2022.

Within North America, the Canadian construction market is dwarfed by the size of its counterpart, the US. While Canadian construction output is expected to grow faster than the US in 2018 at a growth rate of 7.3 percent, the US is expected to outperform the Canadian market during the forecast period between 2018 and 2022. Implementation of fiscal stimulus plans and improving market sentiments help drive growth within both countries.

President Trump's infrastructure plan announced in early 2018 might not have been as generous as previously anticipated, however the plan did include measures to improve permitting procedures, support education and training programs and to allow private investment and financing in new asset classes. Employment within the construction sector has been increasing since the end of 2017. Shortage of manpower in the face of increasing migration barriers is anticipated to be a risk for the sector in the near-medium term, and the effects of tariffs on the market are being monitored.

North America construction market
Total construction output 2017e = USD 1,779bn



Source: Timetric – Construction Intelligence Center, CIA Factbook 2017

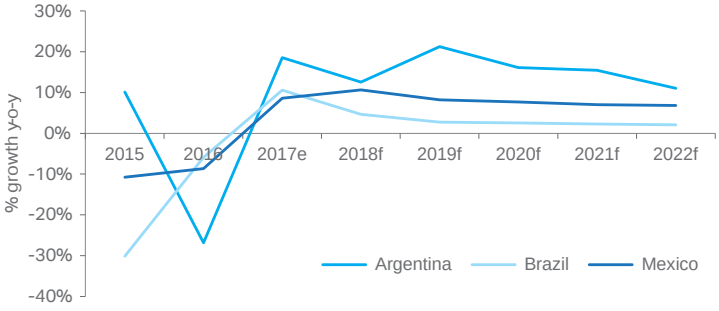
Latin America

Rises in commodity prices and trade levels in 2017 have helped some Latin American countries emerge from recession and are driving increased activity among multiple sectors. Brazil, one of the region's biggest construction markets, reported the most notable improvement within the construction sector, estimated at 11 percent growth in 2017.

Infrastructure needs and inelastic demographic demands are key drivers for the construction sector in Latin America. However, in the past couple of years the drop in commodity prices and its subsequent impact on public budgets, credit costs and investor confidence have all acted as a brake to regional performance. The increased level of trade at a global level is likely to ease funding pressure particularly if investor sentiments continue to improve and increased levels of private sector investment, both local and foreign, are achieved.

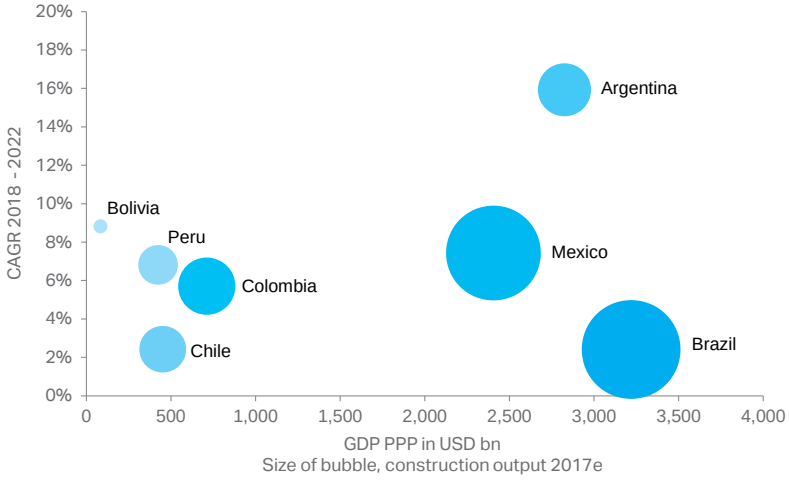
While Argentina's construction sector is anticipated to be one of the fastest growing markets in the region, it still remains to be seen whether the country can succeed in the financial markets while battling high inflation rates and low levels of foreign investment confidence. Fragile political environments across the region further provide a further downward risk on the materialization of projects.

Growth rate of largest Latin American construction markets
Total construction output 2017e = USD 635bn



Source: Timetric – Construction Intelligence Center, CIA Factbook 2017

Latin America + Mexico construction market
Total construction output 2017e = USD 635bn



Source: Timetric – Construction Intelligence Center, CIA Factbook 2017

Europe

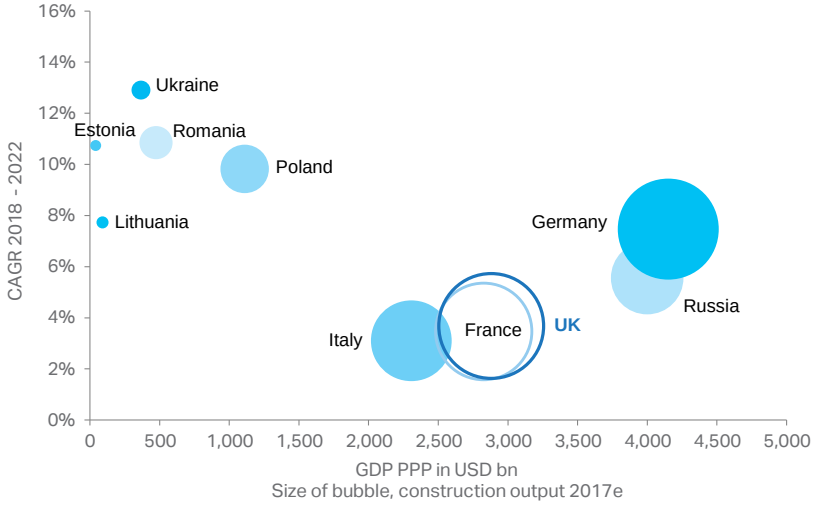
European construction forecasters anticipate growth within the European market in the next few years, supported by strong domestic activity and firm investor confidence. Timetric Construction Intelligence Center estimates the growth in key European construction markets to expand by 8.6 percent in 2018 and to maintain an average of 5 percent between 2018 and 2022. Euroconstruct estimates also point to an expansion in the European market, albeit at a lower rate of 2.6 percent in the Euro Area 19.

Euroconstruct reports note that residential construction grew the fastest in 2017 and is expected to continue in the near term. Civil engineering construction is expected to report a growth of over 4 percent in 2018 and 2019. Growth in the new construction sector is expected to soften in the near-medium term, with the renovation sector gaining prominence particularly post 2020.

Germany, the second largest construction market in Europe, is expected to grow at a rate of 7.5 percent between 2018 and 2022. Germany's strong performance across multiple economic sectors, supported by growing demand for residential developments and government focus on civil engineering, back the sector's growth in the near-medium term.

Pronounced immigration and internal migration; the infrastructure investment gap seen in many European countries in recent years; improving household income; business performance; and improving market sentiments, all play an important role in supporting construction growth.

Europe construction market, largest and fastest growing markets
Total construction output 2017e = USD 1,598bn



Source: Timetric – Construction Intelligence Center, CIA Factbook 2017

Note:
Euro Area,
19 countries:

Austria, Belgium, Cyprus, Estonia, Finland, France, Germany, Greece, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Portugal, Slovakia, Slovenia and Spain

European Union,
28 countries:

Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, UK

Africa

Africa's construction market performance is expected to vary significantly in the near-medium term, with some countries reporting double-digit growth rates while others expected to contract.

The improvements in commodity prices and trade levels, and stabilization of oil prices have helped boost economic growth in Africa, to a modest degree, estimated at 3.2 percent in 2018 and forecast to be 3.6 percent during 2019-2020 as reported by the World Bank Group. Many developments in Africa are susceptible to changes in foreign investment and aid, therefore market perception of the health of the economy and investors' risk appetite play an important role in the delivery of projects. Changes in migration laws also play an important role as remittances impact domestic demand.

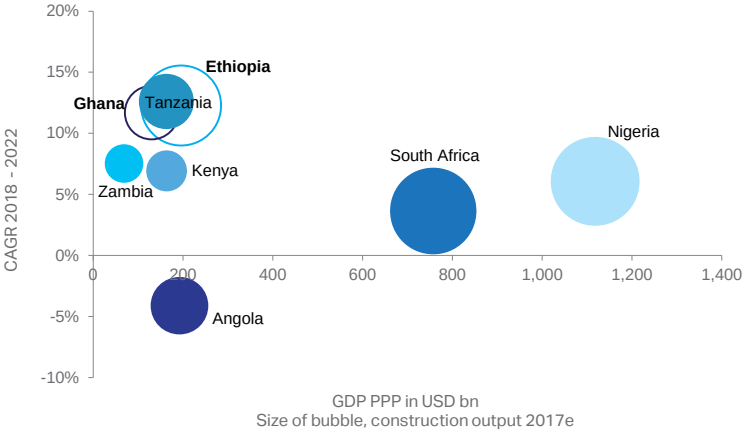
The largest economies in Africa, Nigeria, South Africa and Angola, are expected to grow at a modest rate, with Angola reporting a negative growth rate over the near-medium term. Despite improving commodity prices, the countries remain burdened with low investor confidence levels and less than optimal business operating environments. In contrast Ethiopia, Africa's third largest construction market, is expected to grow at a rate of 16.9 percent in 2018 and average 12.3 percent between 2018 and 2022. This growth is supported by public investments as well as Ethiopia maintaining its status as one of the more attractive African markets for foreign investment.

However, due to increasing government debts, growth rates might soften from those projected over the same time period.

While the region requires investment across an array of infrastructure projects, energy and transportation are seen as key priorities in the region, particularly as they hold an enabler effect that can further promote growth in other sectors.

African construction markets, largest and fastest growing markets

Total construction output 2017e = USD 174bn



Source: Timetric – Construction Intelligence Center, CIA Factbook 2017

Asia

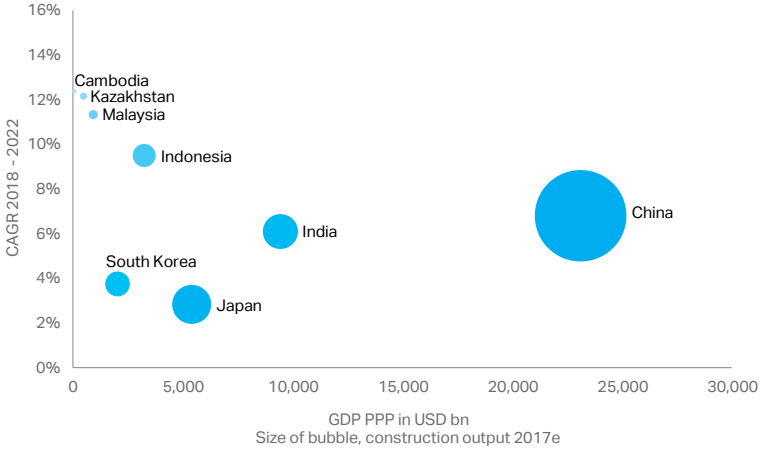
China continues to lead the pack in terms of construction output. However, the smaller Asian markets are forecasted to grow the fastest. Projects in Asia are driven by strong demographic demands and large infrastructure and development gaps in some of the world's fastest growing cities.

The Indian government has expanded its infrastructure budget and is implementing reforms to support growth within the construction market. According to BMI Research, the Indian construction market is well positioned to grow over the next 5-10 years with government support through funding, regulatory reforms and increased private sector participation. In February 2018, India's Union Government announced increased budget allocation for infrastructure and created the new Affordable Housing Fund to further drive growth within the sector. The government also eased regulations regarding private and foreign involvement.

China's construction market, while the largest in the world, is expected to slow down in 2018-2019 as real-estate market-correction measures are taken to curb rising property prices and discourage growing debt within the sector. These measures, which reduce returns on investment, have negatively impacted real estate investor sentiment. However, affordable housing and social infrastructure are still expected to receive funding and move forward, as they are driven by strong demographic demand of aging and urbanizing populations.

Cambodia's fast growing construction market is partially driven by increased Chinese investment in the country, ranging from building condominiums, entertainment centers and office towers to the construction of entire satellite cities. There are doubts as to whether all the announced projects will materialize, particularly mega-projects, such as the new airport and the twin-tower trade center projects, which if executed, are expected to make it to the global top 10 list of largest and tallest projects delivered.

Asia-Pacific construction market, largest and fastest growing markets
Total construction output 2017e = USD 4,777bn



Source: Timetric – Construction Intelligence Center, CIA Factbook 2017

Australasia

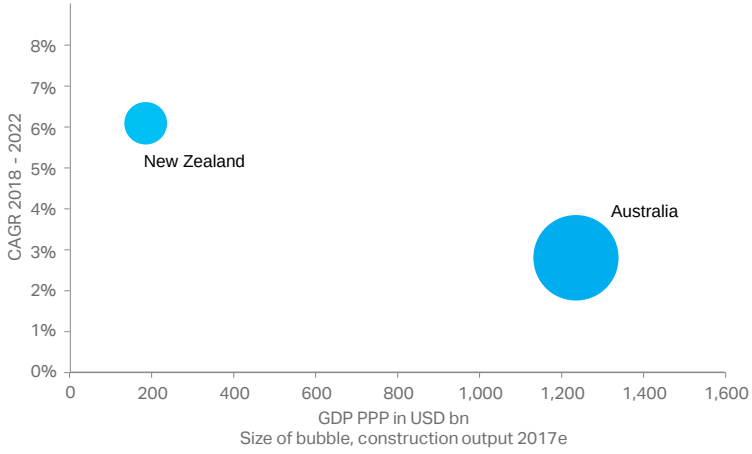
Australasia's construction output is expected to grow by 5.4 percent in 2018 with a forecast of USD 202.7 billion as opposed to the USD 192.4 billion in 2017. While Australia's construction sector remains to be the largest in Australasia, New Zealand's construction sector is expected to output greater growth comparably.

For 2017, Timetric Central Intelligence Center estimates a construction output of USD 154 billion and forecasts a growth of 4.7 percent for 2018 to USD 161.2 billion for 2018. With slow growth in key economic indicators on the back of the fall of the mining boom since 2015, Australia has seen an economic shift to services. State investment in infrastructure has been, and continues to, underpin construction activity nationally. Growth in the non-residential sector is fueled by investment in road, rail, airports and telecommunications, along with, population growth and an aging demographic. However rising input prices, particularly energy prices, difficulty in sourcing skilled labor and materials adequate for major projects could temper healthy growth.

New Zealand's construction industry has been growing on the back of population growth and healthy investment in residential, commercial and infrastructure projects. With an expected output of USD 38.4 billion in 2017 and a forecast of USD 41.5 billion in 2018, growth in the industry is forecast to continue at a rate of 6 percent between 2018 and 2022. The New Zealand Ministry of Business Innovation and Employment (MBIE) reported sustainable growth for residential, non-residential and infrastructure, with residential building activity being the largest contributor by both value and growth.

Australasia construction market

Total construction output 2017e = USD 192bn



Source: Timetric – Construction Intelligence Center, CIA Factbook 2017

MENA ECONOMIC REVIEW

Improvements in global trade levels and commodity prices, particularly oil, have supported economic growth in MENA, however regional conflicts, political unrest and high defense sector spending burden countries' public budgets and impact investor sentiments.

Governments have a difficult balance to maintain between expanding their public expenditure to meet growing demographic demands and controlling their budget deficit to attract investors.

ICD Brookfield Place

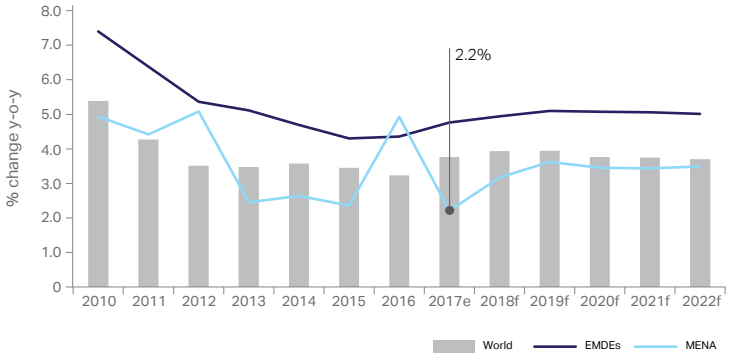
Image courtesy of ICD Brookfield

Middle East construction prospects

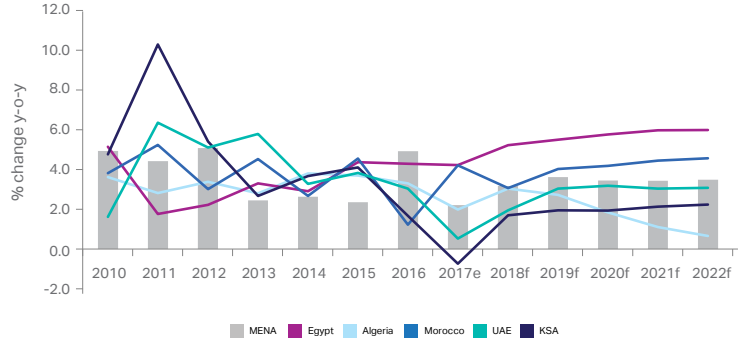
According to recent IMF forecasts, the MENA region is expected to grow at an annual rate of 3.2 percent to 3.5 percent between 2018 and 2022, below the anticipated world and EMDE growth rates over the same time period. GCC countries, which have traditionally led economic growth tables, are now expected to grow at or below MENA average levels.

This subdued performance is in part due to increases in public expenditure despite modest growth in oil revenues and non-oil sector markets. Egypt and Morocco are expected to outperform their MENA counterparts, with an increase in FDI and trade levels contributing heavily to this trend.

World, EMDEs and MENA, GDP growth at constant prices



Selected MENA countries, GDP growth at constant prices



Source: IMF World Economic Outlook - April 2018

EASING AUSTERITY MEASURES

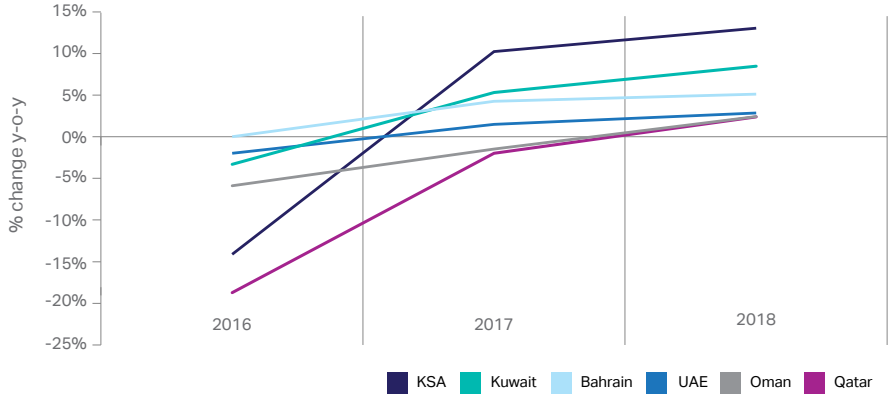
The subdued economic performance of many countries in the MENA region over the past couple of years necessitated governments' adoption of austerity measures, implementing various fiscal adjustments, including introducing value added tax, lowering subsidies and reducing public spending overall. These austerity measures are likely to ease over 2018/2019 due to better economic performance and rising public pressure in some non-GCC MENA countries.

GCC

GCC governments have approved expansionary budgets for 2018/2019, softening their austerity stance since the drop in oil prices. Emirates NBD Research forecasts an increase of 8 percent in public spending in the GCC in 2018/2019, and anticipates that this will promote growth in the non-oil sectors. Improvements in oil prices are expected to help support the expansionary plans, however governments might still need to borrow from international markets or move forward with privatization to deliver intended projects.

Saudi Arabia is expected to report the largest gains in public spending; forecast at a 13 percent increase excluding the priority projects and 30 percent total increase including the priority projects, to be financed by the National Development Funds and the Public Investment Fund. Kuwait's 2018 budget marks the second largest planned increase in public spending, estimated at 8 percent for 2018. While the overall UAE government spending for 2018 is expected to increase by 3 percent; Dubai's total spending is expected to grow by 20 percent in 2018 as the city continues to gear up for the delivery of Expo 2020 projects.

GCC budget expenditure



Source: Haver Analytics, Emirates NBD Research

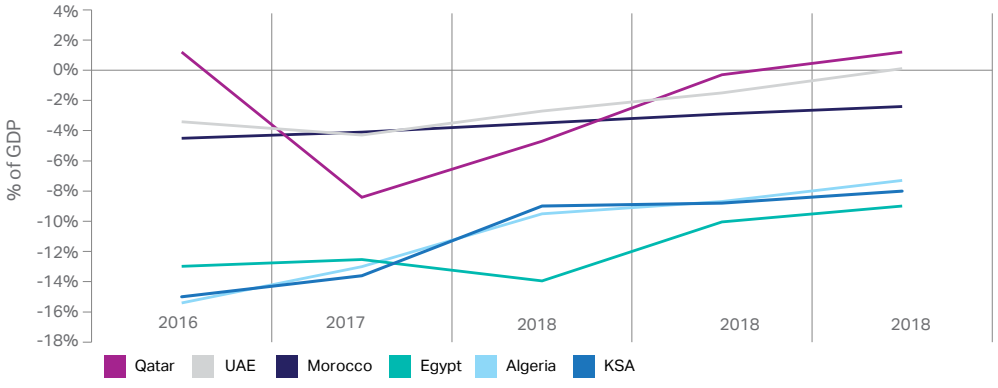
Non-GCC MENA countries

Government budgets across non-GCC MENA remain strained due to low commodity prices over the past couple of years and mixed performance of fiscal adjustment plans. Rising public pressure and impending elections in some countries might require governments to ease their austerity plans.

Algeria is planning to increase spending by 25 percent in 2018, supported by improved oil revenues, whilst also borrowing from its central bank. However, tapping into local funds from the central bank raises the risk of high inflation and makes the country less attractive to investors, particularly foreign investors.

Egypt and Morocco on the other hand are adopting policies and reforms that make them more attractive to foreign investors. Morocco is a key destination for foreign investment in Africa, with foreign direct investments estimated to account for 3.5 percent of the country's GDP in the medium term. Morocco has also made significant gains in the Ease of Doing Business ratings, jumping to 69th position in 2018 from 129th in 2008. Egypt's fiscal and monetary reforms, including the currency float enacted in 2016, are expected to support the country's economic performance in 2018 and make it more attractive for foreign investment flows in the near-medium term. To further strengthen its private sector growth, Egypt has also undertaken a number of banking reforms where microfinancing laws have been ratified; requiring banks to allocate 20 percent of their financing portfolio to small to medium-sized enterprises.

Budget balance for selected MENA countries



Source: Haver Analytics, Emirates NBD Research

Lusail Expressway, Doha

A night view of Al Wahda Interchange's arches before works completion

Image courtesy of Ashghal

PRO-BUSINESS STANCE

To broaden their revenue streams, many governments across the MENA region have moved ahead with the implementation of pro-business and investment reforms. Measures implemented include streamlining the business registration process, providing e-services to reduce operating times, strengthening minority investor rights and increasing credit transparency.

Kuwait serves as a good example for these reforms, where the launch of the New Kuwait 2035 Initiative in early 2017 has helped simplify the business setup process and upgrade the rating of the Kuwait Stock Market to 'emerging' by the FTSE. This upgrade in rating is expected to increase investments by up to USD 822 million as reported by World Finance. A more comprehensive list of the reforms implemented is provided in the adjacent table, published by the World Bank Group as part of their Ease of Doing Business Report for 2018.

Key business-friendly reforms in MENA	
Economy (world ranking)	**Reform**
UAE (21)	Strengthened construction quality control by imposing stricter qualification requirements for professionals reviewing drawings. It also reduced the time and cost to obtain a building permit. Made getting electricity connections easier by streamlining the process and eliminating interactions between the customer and the utility provider to obtain external works permits. Getting electricity was also made less costly by the elimination of the security deposit for connections under 150 kVA. Improved access to credit information by starting to provide consumer credit scores to banks and financial institutions. Made resolving insolvency easier by adopting an insolvency law that introduces a reorganization procedure and facilitates continuation of the debtor's business during insolvency proceedings.
Morocco (69)	Made starting a business easier by combining the stamp duty payment with the application for business incorporation. Made paying taxes easier by improving the online system for filing and paying taxes.
Oman (71)	Made exporting and importing easier by enhancing its online single window system for exports and imports, reducing the time required for documentary compliance.
Qatar (83)	Improved access to credit information by starting to provide consumer credit scores to banks, financial institutions and borrowers. Made exporting and importing easier by inaugurating the new Hamad Port.
Saudi Arabia (92)	Made starting a business easier through the use of an online system that merges the name reservation and submission of the articles of association into one procedure. Saudi Arabia also improved the online payment system, removing the need to pay fees in person. Improved the efficiency of its land administration system by implementing an online platform to check for ownership and encumbrances, and by streamlining the property registration process. Additionally, Saudi Arabia made registering property easier by improving the land administration system's dispute resolution mechanisms. Strengthened minority investor protections by increasing shareholder rights and role in major decisions, clarifying ownership and control structures, requiring greater corporate transparency and regulating the disclosure of transactions with interested parties. Made paying taxes easier by improving its online platforms used by taxpayers for filing and paying taxes. Reduced the time for documentary compliance for exports and imports by reducing the number of documents required for customs clearance. Made enforcing contracts easier by introducing an electronic case management system for the use of judges and lawyers.
Kuwait (96)	Made starting a business easier by establishing a one-stop shop and improving online registration. Made registering property easier by lowering the number of days necessary to register property and by improving the transparency of the land administration system.
Egypt (128)	Strengthened minority investor protections by increasing shareholder rights and role in major corporate decisions.
Iraq (168)	Made starting a business easier by combining multiple registration procedures and reducing the time to register a company. Improved access to credit information by launching a new credit registry.

MENA RISKS AND CHALLENGES

Risks to economic development and stability across the region have dropped due to improvements in oil and commodity revenues; however geopolitical tensions and growing government deficits pose significant risks for the medium-long term outlook.

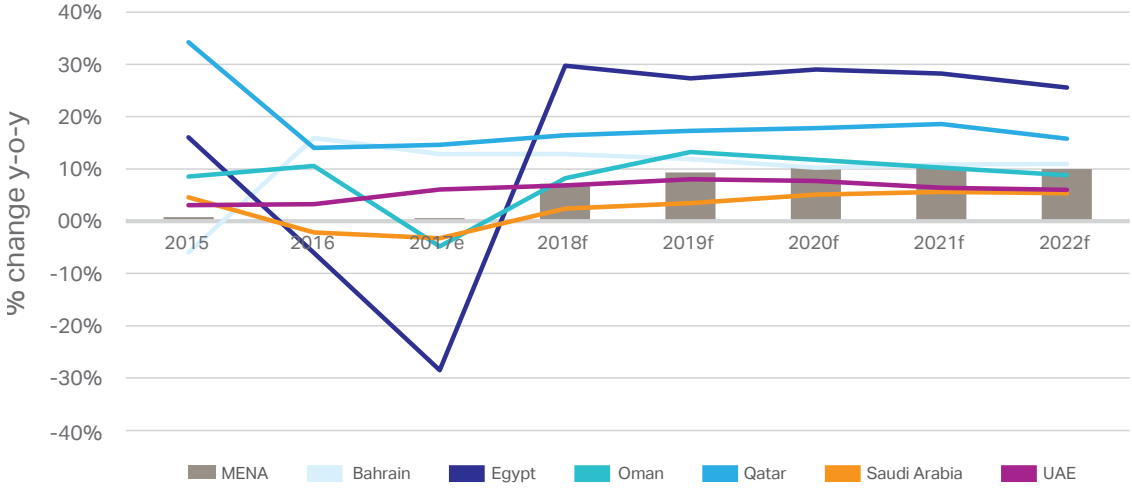
MENA risks and challenges		
Risk category	**Description**	**Severity/timeline**
Political	**Destabilizing forces** Rising political tensions across the region represent key risks for the region's growth and go beyond the armed conflicts in Syria, Iraq and Yemen. The diplomatic situation between Qatar and its GCC counterparts, which remains unresolved, the rising tensions between Saudi Arabia and Iran, and fragile political systems across many of the North African countries further expand governments' budget deficits and impact investor confidence.	Medium in the near outlook but has potential to be a high risk in the medium-long term if not mitigated.
Economic	**Large budget deficits** Saudi Arabia's development agenda indicates that the government has accepted the high budget deficit levels as a necessary evil to meet its Vision 2030 goals. While the Kingdom has noted it will aim to balance the deficit by 2023, the success of this agenda will depend on the government's ability to consolidate at the various levels and achieve the efficiency needed in the long term. MENA countries, including Saudi Arabia, have started implementing fiscal adjustment policies announced over the past year, mainly around reducing subsidies and introducing new tax measures. These policies are anticipated to help narrow the government deficits.	Low in the near outlook but has potential to be a medium-high risk in the medium-long term if not mitigated.
Economic/ social	**High unemployment rates** In a competitive economic global environment, MENA governments are challenged to reduce unemployment rates and reduce their output gap. Unemployment rates are highest in non-GCC countries, with Sudan, Jordan, Tunisia and Egypt reporting levels of 19.6%, 16.5%, 13% and 12.2% respectively (this excludes countries currently at war). Countries across the region are looking at opportunities to attract domestic and foreign investment to create more job opportunities. Furthermore, GCC governments continue to expand on their 'localization' policies to reduce their dependence on the expatriate workforce and provide citizens with more job opportunities. If not carefully mitigated, high unemployment rates hold the potential to create destabilizing forces within the various economies.	Low in the near outlook but has potential to be a medium-high risk in the medium-long term if not mitigated.
Economic	**Market sentiments** Strong demographic demands, positive growth forecasts and pro-business investment reforms increase the region's attractiveness to domestic and foreign investors.	Country specific, ranging from low-medium in the near-medium outlook.

MENA CONSTRUCTION MARKET

Over the past decade, the MENA construction market has been frequently described as one of the fastest growing markets in the world. However, low commodity and oil prices, rising uncertainty, political tensions and waning government budgets over the past couple of years have impacted the region's economic performance and slowed progress within the construction market.

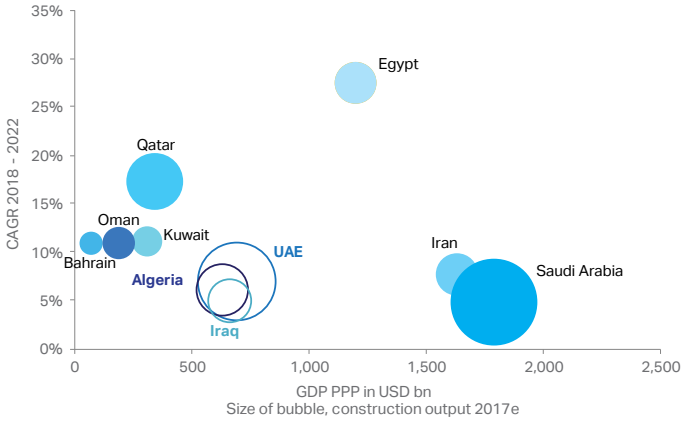
According to the Timetric Construction Intelligence Center, the MENA construction output growth was muted between 2015 and 2017, however it is expected that the region will report positive growth of around 7 percent in 2018. Egypt, which reported the largest drop in outputs since 2015, is expected to grow the most between 2018 and 2022, supported by growth in both domestic and international investments. Within the GCC, Qatar is expected to the grow the fastest between 2018 and 2022 as the country continues to gear up to host the 2022 FIFA World Cup. Kuwait and Oman are also expected to grow at double digit-rates within the same period. The UAE and Saudi Arabia, the largest construction markets in the GCC, are expected to grow at a slower rate than their counterparts. Expo 2020 contributes positively to the project pipeline, however, post-Expo 2020; the UAE's project pipeline is moderate.

Annual percent change in selected MENA construction markets 2015-2022f



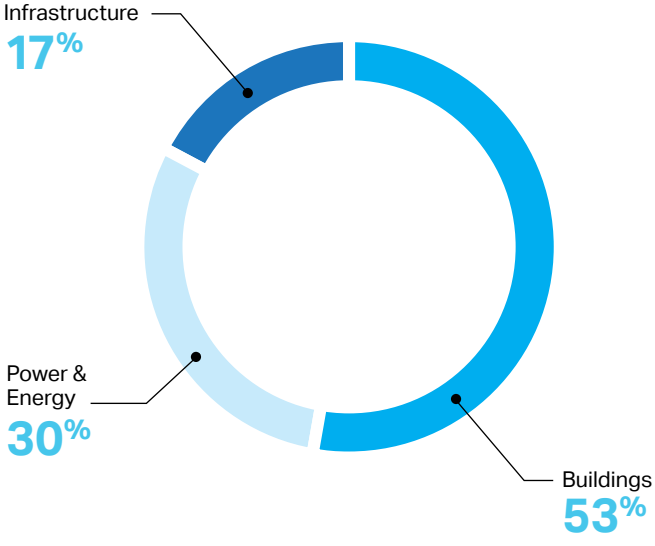
Source: Timetric – Construction Intelligence Center

MENA construction markets, largest and fastest-growing markets
Total construction output 2017e = USD 394bn



Source: Timetric – Construction Intelligence Center, CIA Factbook 2017

Breakdown of construction sector spending in the GCC



Source: Venture Onsite

MEED reports on anticipated construction sector activity in the region further support this revival trend, noting that as of April 2018 there were construction and transportation projects worth USD 715 billion at the design, construction or tendering with projects worth USD 322 billion in the pre-execution phase in the GCC. A combination of improved oil revenues, stronger performance of the non-oil sector and sovereign wealth fund allocations are expected to drive this growth. In the case of Bahrain, funds from the Gulf Development Fund further facilitate the expenditure into the construction sector.

In terms of construction sector spending, recent project estimates by Venture Onsite note that construction contract awards for 2018 will be dominated by building projects, followed by energy and infrastructure projects. Building projects awards are anticipated to be worth USD 79.1 billion, 53 percent of the overall construction awards in 2018 and 10 percent higher than awards in 2017. It is further noted that the UAE will lead the building construction contract awards in 2018 with USD 37.3 billion.

Key regional trends

Mixed-use developments

Mixed-use developments that drive commercial and industrial growth are on the rise. As of early 2018, MEED has forecasted about USD 23.1 billion worth of construction projects in Oman alone that are yet to be awarded or are still in the design and study phases. The majority of the projects are noted to be mixed-use developments and industrial zone type projects including the USD 10 billion Northern and Central Industrial Zone project planned in Duqm. Hessa Al Mubaraka Development City in Kuwait City, Liwan Development project in Bahrain, Jeddah Waterfront and Madina Development in Saudi Arabia are additional examples of upcoming mixed-use development projects in the region. The diverse portfolio of revenue streams within these developments make them an attractive investment opportunity.

Megacity projects

Megacity projects and developments continue to be a trend in the region, including new economic zones aimed at diversifying countries' revenue streams and attracting foreign investments to meet growing demographic demands. What sets megacity projects apart from mixed-use developments is the scale and complexity of the projects. While mixed-use developments do attract foreign investment at times, megacity projects, given their scale, tend to look at foreign investments from large corporations or even governments to help fund and deliver the project. In early 2018, Saudi Arabia and Egypt signed a joint venture to develop a USD 10 billion megacity in the southern Sinai Peninsula. Saudi Arabia has also announced plans to build NEOM, a 25,000 square kilometer business and industrial city that links Saudi Arabia with Jordan and Egypt, and which is to run 100% on renewable energy. Another of the Kingdom's megacity projects includes the Red Sea Project, where 200 kilometers of the Red Sea coastline will be developed into luxury resorts featuring hotels, residences and transport hubs.

Consolidation

In the UAE, 2018 has been named as the Year of Zayed, with many projects in multiple sectors underway to commemorate the achievements, vision and legacy of the father of the UAE. Within the construction industry, federal government projects that boost connectivity and require multi-Emirate cooperation have received greater support in 2018. Etihad Rail Stage 2 and Stage 3 tenders have been issued and plans are moving ahead to boost cargo and trade across the Emirates. Also, the UAE's two largest real estate developers, Emaar (Dubai) and Aldar (Abu Dhabi) have also signed joint ventures for project schemes in Abu Dhabi and Dubai. An increase in cross-Emirate projects will likely provide an advantage to contractors and consultants that have multi-Emirate experience and capabilities.

Market pricing

Industry and anecdotal reports continue to describe the MENA construction market as highly competitive and price conscious. Many consultants and contractors have reported some level of downsizing within their businesses, and in some extreme cases, have chosen to cease operations across the region.

Improving construction sector activity supported by stronger economic performance across the region raises hope of an upward shift in market pricing. However, continued challenges in obtaining funding and payments make it difficult to identify a clear trend in market prices within the region.
In reviewing market fundamentals in the near-medium term, three broad-based scenarios are considered possible.

Scenario 1

Improved economic conditions drive broad-based growth within the sector

Key drivers

Significant increases in project pipeline with realization of projects announced.

Improved economic conditions at the national and regional level improve clients' purchasing powers and allow for more value-driven project awards.

Price shifts

+ 2 to 3%

Scenario 2

Stable economic conditions drive marginal growth within the sector

Key drivers

Priority projects are awarded and stimulate marginal growth in construction supply chain.

Clients continue to be price-focused.

Price shifts

+ 1 to 2%

Scenario 3

Challenging economic conditions burden supply chain

Key drivers

Project market remains largely muted with little year-on-year improvement.

Client budgets remain strained due to unfavourable market conditions, potential risk of prioritizing cost over value.

Price shifts

+ 0 to 1%

Key construction risks

Financing

Financing remains a key challenge within the MENA construction market. More developers are exploring alternative funding schemes and the number of contractors bidding with financing packages is on the rise. The increase in projects requiring contractor financing poses a number of risks for the sector and requires careful evaluation. Financing entities, including banks, seldom look at a contractor's performance on one project, but typically evaluate the contractor's current project portfolio as a whole. Additionally, the revenue stream of the 'pay master,' i.e. the developing body, is also examined to better understand the economics of the future project and risks associated with it. All of these elements contribute to a higher borrowing premium for contractors and need to be evaluated against other funding schemes.

Alternative financing schemes such as public-private partnerships (PPPs) continue to gain popularity within the industry, but their implementation remains a challenge due to various factors, such as the maturity of financial institutions to the stakeholder's organizational framework. Success of PPPs greatly depends on trust within the stakeholder framework and requires a degree of network governance, rather than being solely restricted to the special purpose/project vehicle or a specific government entity.

Change management

In a recent AECOM infrastructure project delivery survey it was noted that with the rise of project complexity, traditional change management procedures are consistently proving to be inadequate. Despite significant investment in project controls, delivering projects on time and on budget remains a challenge within the industry. Large numbers of stakeholders, unclear decision-making hierarchies and changing project requirements and scope are frequently cited as major contributors to this trend.

Inadequate change management procedures further give rise to delays in payment. Securing timely payment for works completed is a challenge for contractors and consultants in the Middle East, particularly on projects where designs are revised or procurement and construction changes are required. In the absence of a robust change management process, these project changes translate into delays in approving works completed, variation orders and extension of time claims.

Change management procedures need to be adapted and upgraded as needed to match the requirements of the new project environment. Facilitating a more inclusive project delivery environment is needed to allow stakeholders to work together in delivering their projects rather than working in silos to achieve specific objectives. Undertaking comprehensive risk and value management sessions early on in the project helps align stakeholders' various objectives and creates a more unified project delivery structure.

Talent acquisition

The high percentage of expatriates in the GCC construction market poses a unique risk to the region with regards to turnover rates and restrictions in hiring and maintaining a large expatriate workforce. High turnover rates within the various levels of the construction industry (client, consultant and contractor included) impacts the strength of relationships formed between the stakeholders and stability of project teams in some cases. Medium-long term staffing plans, proactive knowledge-sharing culture and effective succession planning are some tools that can be adopted to mitigate this risk.

Corinthia Hotel and Residences

Meydan Beach is a luxury 5 star property currently under construction, located on the JBR Walk in Marsa Dubai, UAE. The development consists of a 10-storey podium with an east and west wing in addition to a 55 storey tower accessible from within the podium. The hotel comprises standard and superior rooms, themed suites and serviced apartments for a total of 360 keys. Amenities include a variety of dining facilities with a beach restaurant, F&B and retail spaces, spa, gym, beach, business center and kids club.

Image courtesy of Meydan

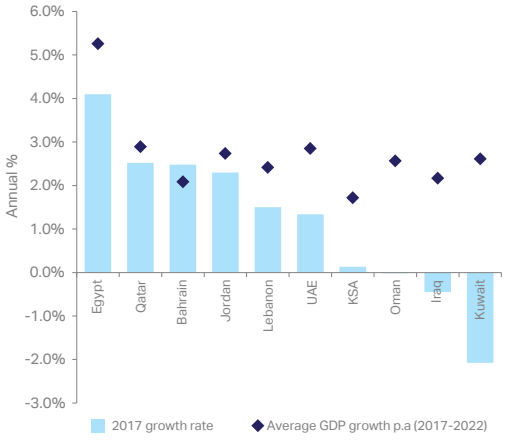
Country statistics 2017

	Bahrain	Egypt	Iraq	Jordan	Kuwait	Lebanon	Oman	Qatar	KSA	UAE
Land area, '000 km2 (1)	0.8	995.5	437.1	88.8	17.8	10.2	309.5	11.6	2,150	83.6
Capital city	Manama	Cairo	Baghdad	Amman	Kuwait	Beirut	Muscat	Doha	Riyadh	Abu Dhabi
Population, million (2)	1.3	92.2	38.9	7.1	4.3	4.5	4.1	2.8	32.3	10.1
Population growth, CAGR 2017-2022 (CAGR %)	2.0%	2.3%	2.6%	2.2%	2.8%	1.0%	3.2%	0.6%	2.0%	3.0%
GDP, USD, billion, current (2)	33.9	332.3*	192.7	40.5	118.3	52.7	71.9	166.3	678.5	378.7
Real GDP growth, % (2)	2.5%	4.1%	-0.4%	2.3%	-2.1%	1.5%	-0.02%	2.5%	0.1%	1.3%
Real GDP growth, 2017-2022 pa forecast (2)	2.1 %	5.3%	2.2%	2.7%	2.6%	2.4%	2.6%	2.9%	1.7%	2.9%
GDP/ capita (PPP), USD (2)	51,846	12,994	17,004	12,487	69,669	19,486	45,464	124,927	55,263	68,245
Construction output, share in GDP (%) (3)	8.10%	5.70%	11.60%	5.70%	2.40%	N/A	2.0%*	11.9%*	4.60%	10.3%*
Value of construction output, USD, billion (4)	7.7	25.3	26.3	N/A	12.6	N/A	15.2	46.4	109	87.7
Consumer price inflation, % (2)	0.92%	23.54%	2%	3.33%	2.50%	3.07%	3.20%	0.86%	-0.16%	2.07%

(1) Source: World Bank Group
(2) Source: IMF
(3) Source: National Accounts
(4) Source: Timetric Construction Intelligence Center
* Estimates only, based on 2016 data

Source: Timetric – Construction Intelligence Center

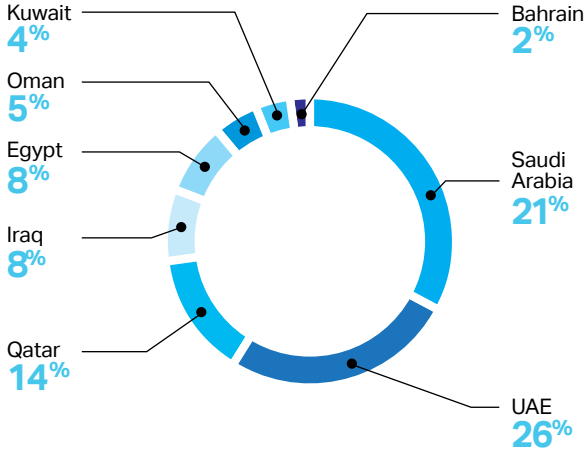
MENA economic growth forecast



Source: IMF

Share in regional construction market

Based on 2017e construction output estimates



Source: Timetric – Construction Intelligence Center

02 ARTICLES

IN BRIEF

DIGITAL CONSTRUCTION

With the volume of construction output set to grow by 85 percent to $15.5 trillion by 2030[1] the engineering and construction (E&C) industry is pivotal to the world economy.

The Middle East and North African construction market is expected to be worth $336 billion by 2020, up from $235 billion in 2016, a net growth of 43 percent.

Deloitte's 'GCC Powers of Construction' 2017 notes that there are more than $2 trillion worth of projects currently in the planning stages in the Gulf Corporation Council (GCC) countries, with construction accounting for more than half the value of the pipeline. To efficiently deliver these projects, technology will have to play a much bigger part than it currently does.

The lack of digitization and uptake of technology in construction is not a problem that is unique to the Middle East. Almost every other industry has seen a significant improvement in productivity, with agriculture the only industry to fare worse. What is common amongst the low productivity gains is the lack of digitization and digital spending see (Figure 1).

Other factors that have limited the digital transformation in construction are the fact that construction is a heavily regulated industry and compliance to these regulations takes time, effort and money. The relative instability in technological evolution can often put off investing in one solution (including the cost of ensuring compliance to existing regulation) for fear that this investment will soon be out of date. Even when systems or solutions are procured, they often aren't they are often not with existing due to a lack of harmonisation and standardisation. Underpinning all of this is the human element, encouraging and retaining the right talent is notoriously difficult with temptations of big paydays and seemingly more relaxed working environments offered in newer industries.

The industry's chronic and previously mentioned lack of productivity growth has itself proved to be a catalyst for change, combined with the irrepressible tide of digital transformation in adjacent sectors and in society as a whole

1 https://www.ice.org.uk/ICEDevelopmentWebPortal/media/Documents/News/ICE%20News/Global-Construction-press-release.pdf

2 http://tradearabia.com/news/CONS_337767.html

3 https://www2.deloitte.com/ae/en/pages/real-estate/articles/gcc-powers-of-construction-2017.html

Figure 1 - Imagining construction's digital future – McKinsey[4]

Historically, the lack of research and development (R&D) spending and Information Technology (IT) investment is believed to be the major contributing factor to the nearly flat productivity growth over the past 20 years. Today, this is no longer the case. Almost every major construction player is embarking on a digital transformation initiative in some shape or form, with companies like AECOM allocating budget to invest in the best and brightest ideas from inside and outside the business. Major clients, both government and private, are demanding more digitally-based solutions. The BIM Mandate from Dubai Municipality and the Dubai 3D printing vision are just two recent examples. Other than productivity gains and client requirements, AECOM is also reacting to a more competitive environment to differentiate itself as an innovation leader in its own right, often developing technological solutions that result in quicker, more cost effective and/or better quality outcomes.

4 https://www.mckinsey.com/industries/capital-projects-and-infrastructure/our-insights/the-construction-productivity-imperative

We see three main themes in the types of technology being used in AECOM, each with automation at its core:

Mobile and cloud technology

Cloud based software platform solutions are being used to digitize paper based processes to streamline tasks that are typically administration intensive. Electronic document management systems are making their way from their established usage in design offices to construction site offices and even the site itself.

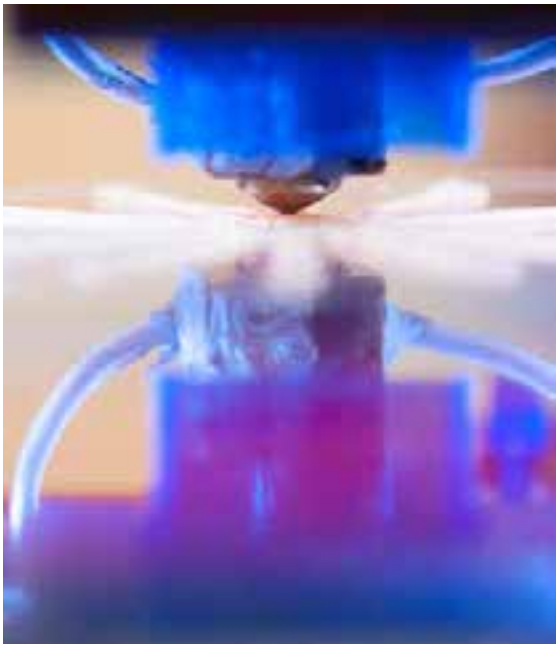
Having the ability to consume project information at the coal face and to create it via tablets and mobile phones brings tangible efficiencies. Engineers don't have to return to the office if they require a drawing or document to be signed, inspectors don't have to download photographs, scan forms and create tracking spreadsheets. We also see a number of additional 'soft' benefits in the form of improved quality due to the amount of information that can be captured and the ease in which it can be analysed, as well as the perception that this leads to greater oversight.

Digital engineering

The use of BIM for all phases of the project life cycle has widely-reported benefits. At AECOM BIM has been business as usual for the past five years and is now being developed to encapsulate more of the project life cycle and to deeper integrate into existing processes. The use of machine learning to identify common issues in models in real time, the integration of virtual reality in the design review process and the development of BIM to facilities management protocols are just a few example of how digital engineering is improving not only internal practices but also adding services that are valuable to clients.

Robotics and 3D printing

The manufacturing industry has seen significant productivity gains through automation and the advancement in robotics. In the construction industry some of the same technology is being used to assist workers lay blocks and to demolish concrete to an extremely high degree of precision.



3D printing is another example that is leaking over from the manufacturing industry. 3D printing has been used for some time to create scaled-down prototypes to validate and demonstrate design intent. Now the technology is being taken to the next level, where we are starting to print at one-to-one scale using both traditional construction materials, such as concrete, and non-traditional ones such as graphene-infused polymers.

Examples of 3D-printed structures include the Office of the Future in Dubai, a steel bridge in De Wallen, Amsterdam and a multi-storey apartment building in Suzhou, China. The advantages of 3D printing also include the ability to take advantage of mass production techniques, whilst still allowing for customization without increasing the unit cost, improving the quality of works by creating a physical replica and improving safety by reducing the time operatives spend on site.

MOBILE AND CLOUD TECHNOLOGY AT AECOM MIDDLE EAST

AECOM's Construction Services team in the Middle East has embarked on an initiative to digitize traditionally paper-based processes. Multiple off-the-shelf systems were tested and the most suitable deployed on two pilot projects. To assess the relative benefits of deploying the systems, benchmarking was conducted on the level of effort and time it takes to carry out paper-based processes. Two of the most time-intensive tasks were chosen; work inspection requests (WIR) and snagging.

The results show that anecdotally the perception on the projects is that there was a 50 percent time saving on the projects for these activities. In the case of the WIRs, the most vocal advocates were the document control staff.

The quantitative analysis broadly correlated with these qualitative figures with a 60 percent time saving in WIRs and almost 40 percent in snagging. Other unintended benefits included improved quality of the works, which admittedly cannot be solely attributed to the deployment of the system. The project management team and the local authority believed that because the system gave greater oversite of the inspection data, more inspections could be conducted. The fact that the information was transparent contributed to the inspections being more thorough and therefore more likely to pick up issues. Simultaneously the quality of the contactor's deliverables improved due to enhanced scrutiny and accountability.

DIGITAL ENGINEERING AT AECOM MIDDLE EAST

AECOM has been engaged on two major projects in the region where BIM has been used at all stages of the construction life cycle; from design through to operations. This unique perspective has allowed us to develop best practice guidance at each stage in order to efficiently and effectively achieve the goals in the next stage. Of particular interest to clients is our knowledge of the process of transferring construction data to operations.

Existing guidelines and data structures such as COBie are a good reference point. However, they rarely cope with the individuality inherent in the 'real world' projects we deliver. Determining what is maintainable and therefore requires data to be transferred to computer-aided facilities management software and having the software tools to enable the data to be transferred reliably is key.

The advancement of virtual reality (VR) and augmented reality in the gaming industry is having unintended consequences in construction. With the cost of virtual reality headsets declining and their capability increasing, combined with the proliferation of BIM, we are seeing a shift in the way that we review designs at all stages of the project. A common complaint from engineers when asked to review 3D models is a lack of understanding of the controls in the software and the lack of scale perspective.

VR walkthroughs eliminate both of these, by providing an intuitive way to interact with the models (you can literally walk around them) and by giving a true human scale perspective. VR also adds benefit to clients during the construction phase, by allowing them to view virtual mock ups of critical spaces, saving time in creating multiple versions in the physical world.

Finally in terms of training during construction and for operational activities, VR is proving to be an invaluable tool. For example, it allows people to experience unsafe conditions in a completely safe and controlled environment. Likewise, studies have shown that people understand complex information 25 percent faster when using VR compared to traditional training environments.

3D printing concept

ROBOTICS AND 3D PRINTING AT AECOM MIDDLE EAST

Modern construction techniques include the use of non-traditional machinery such as robotics; 3D printers are simply a subset of robots. 3D printing has the potential to make the most profound impact on the industry as it will influence the ways assets are designed, procured, constructed (manufactured) and demolished (dismantled). One of the key obstacles to the widespread adoption of 3D printing has been the lack of codes and standards which subsequently make local authority approvals more difficult.

However, mandates such as the Dubai 3D Printing strategy will encourage development of local codes and standards. AECOM has a number of agreements with leaders in the 3D printing space including Winsun of China and Scaled of the UK. Both companies are experienced in delivering 3D-printed products using a variety of materials, from the traditional cementitious to the more exotic carbon fiber reinforced polymers. AECOM employees have already been working with these partners, an example being a design boot camp held on methods to utilize the technology in innovative ways.

The use of 3D printing in construction has numerous potential benefits. Reducing the need for activities such as installing formwork, tying reinforcements and striking formwork decreases the number of operatives required on site and thereby reduces the number of hazards to which they are exposed. 3D printing allows designers to truly free their creativity and not be constrained by the practicalities of construction elements.

Grande
Image courtesy of Emaar

PROJECT, VALUE AND RISK MANAGEMENT TRENDS IN THE GCC

The construction industry in the GCC continues to face challenges when it comes to delivering successful projects. It is not uncommon that many of its mega projects are being run without the appointment of a full-time, designated project manager and without clearly established processes and procedures to manage multi-million dollar contracts.

Millions of dollars and significant time periods are being spent on abortive work and redesign. A fraction of these wasted funds could have secured dedicated professional teams to ensure that the projects were effectively structured to succeed.

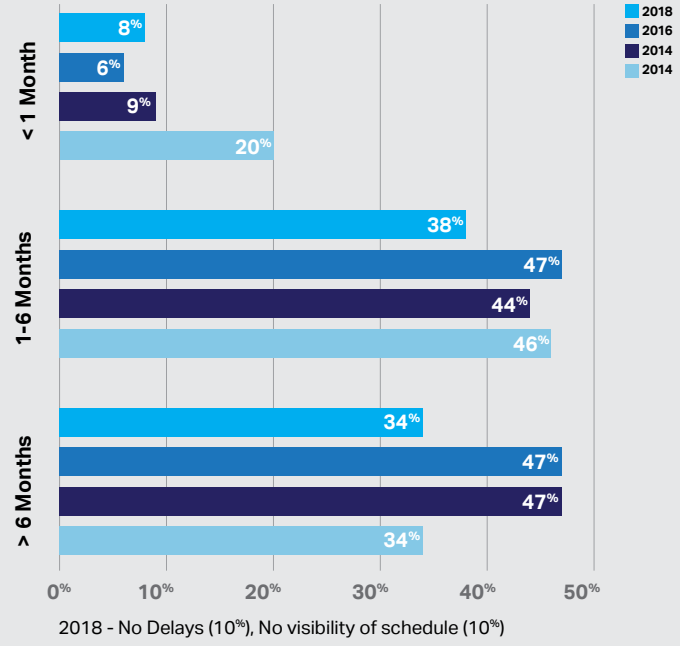
While the first section of this article will look at project management challenges in general, the other sections will focus on value and risk management — considered to be two quite under used project management tools in the GCC.

PROJECT PERFORMANCE IN 2018

According to PWC's 2018 Middle East Capital Projects and Infrastructure Survey, "the main reason for delays and cost overruns remains a constant challenge with capital projects across the region: changes to the scope of projects already started". Respondents to the 2018 survey claimed that 38 percent of their projects in the past 12 months have experienced a delay of 1-6 months, while 34 percent of their projects have experienced a delay greater than six months.

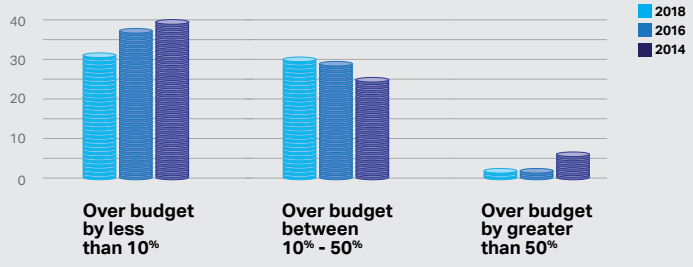
In terms of cost overruns, 31 percent of the respondents' projects were less than 10 percent over budget, while 30 percent of their projects were 10 - 50 percent over budget during the past 12 months.

Percentage of projects that experienced delays in the past 12 months. Base = 91



2018 - No Delays (10%), No visibility of schedule (10%)

Percentage of projects that experienced budget overruns in the past 12 months. Base = 88



*Source: PWC's 2018 Middle East Capital Projects and Infrastructure Survey

AREAS FOR IMPROVEMENT: VALUE AND RISK MANAGEMENT

Respondents to PWC's 2018 Middle East Capital Projects and Infrastructure Survey also claimed that the biggest areas for improvement are project planning, governance and risk management.

The reality is that there are a number of tools and processes to help achieve such improvements, two of which are value management and risk management. But these are typically overlooked for two main reasons:

1. There is a lack of full comprehension with regards to the process and what these two tools can bring to the table in terms of tangible benefits.

2. Perceived added cost to project fees if such services are introduced.

Act I Act II
Image courtesy of Emaar

PROJECT MANAGEMENT CHALLENGES

There is an endless variety of literature published on how projects can be successfully managed, and there are countless tools and resources available to individuals and organizations — yet projects continue to fail. Project management failure in the GCC region can often be attributed to one of the following reasons:

Senior management sponsorship

Projects require senior management sponsorship and direction in order to be successful. In many instances managers do not acknowledge, comprehend, appreciate or support the project management process and therefore do not sufficiently budget for it. Project managers are often frustrated trying to deliver projects where management support is absent. Appropriate resources with the right skillsets are not allocated in a timely manner, people are removed off projects for other work, requirements change and it takes a very long time to resolve conflicts or make decisions.

Project management soft skills

Project managers do not only work with systems and processes, they also work with people. While technical project management skills are unquestionably important, soft kills such as leadership, communication, negotiation, time management and organisation are paramount. A successful project manager has presence and masters the skill of dealing with a wide spectrum of individuals — each with their own respective capabilities and agendas.

Collective planning efforts

One of the biggest challenges often seen in the industry is the tendency to make project plans and commit to deadlines and deliverables without consulting with the wider project team and subject matter experts. Even at the RFP stage and before projects are awarded, there is a tendency to fast forward the planning phase and not engage the right resources. Projects will continue to suffer if the work breakdown structure and execution strategy are not undertaken as a project team.

Communication and stakeholder management

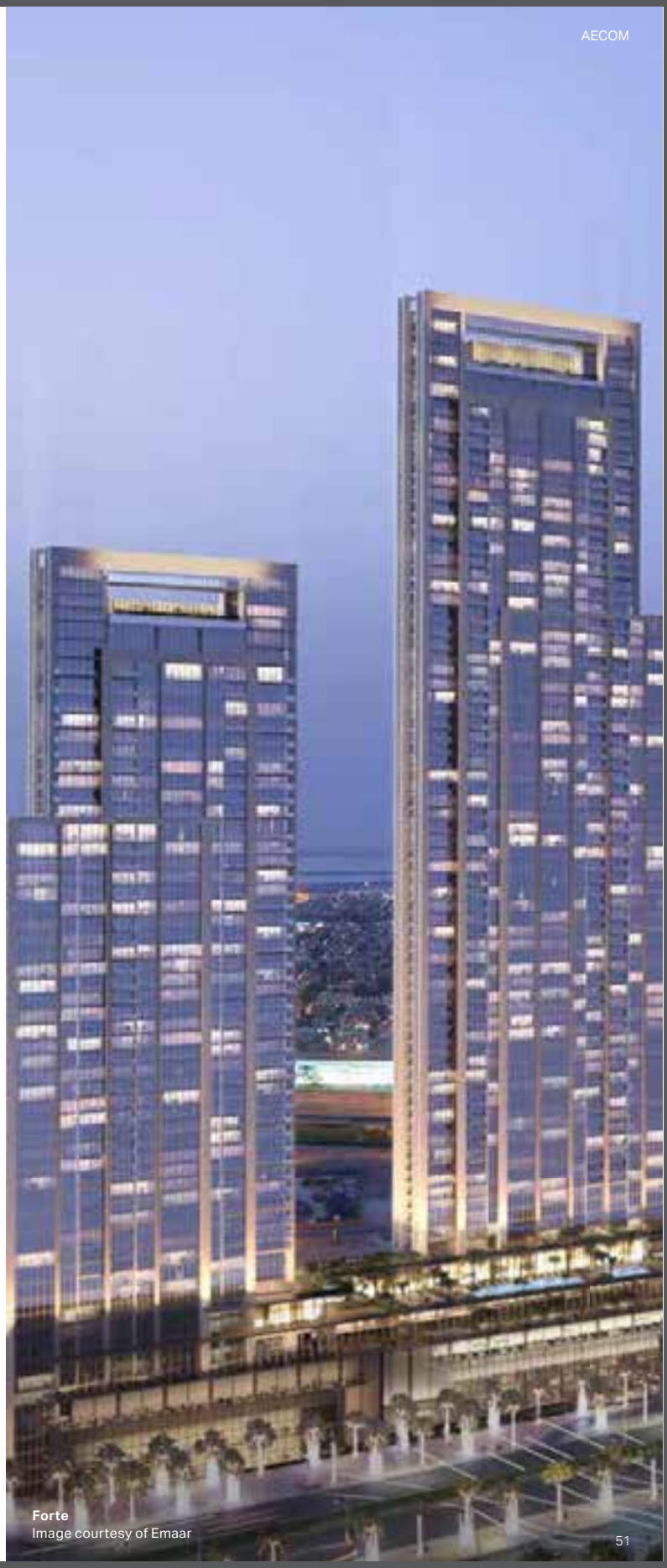
Of a project manager's time, 90 percent is typically spent on communication. A successful project manager needs to be able to clearly articulate project requirements to their team, and have clear communications with everyone associated with the project, from vendors and contractors to stakeholders and clients. Most of this communication is related to negotiating resources, budgets, programs, scope creeps, and other project parameters.

Effective resource allocation

Projects are usually under-resourced, and this often goes back to insufficient collective planning efforts and also to the lack of senior management sponsorship. If required resources are allocated, they are often not assigned clear or reasonable roles and responsibilities. Resource plans and RACI matrices are nice-to-have tools prepared on an ad-hoc basis and as per client requests, but are not actively used in the management of projects.

Implementation of technical tools

There are a number of tools available to prevent common project management failure causes such as scope creeps and variation/change management. These tools can be as simple as maintaining and actively managing a register or a tracker to ensure that all the required information is available in one location is always up to date and clearly communicated.



Forte
Image courtesy of Emaar

RISK MANAGEMENT

All projects have some measure of risk that must be managed, irrespective of their scale or complexity. An effective Risk Management Plan with clear processes and procedures allows for the effective management of project risks in a structured and systematic manner.

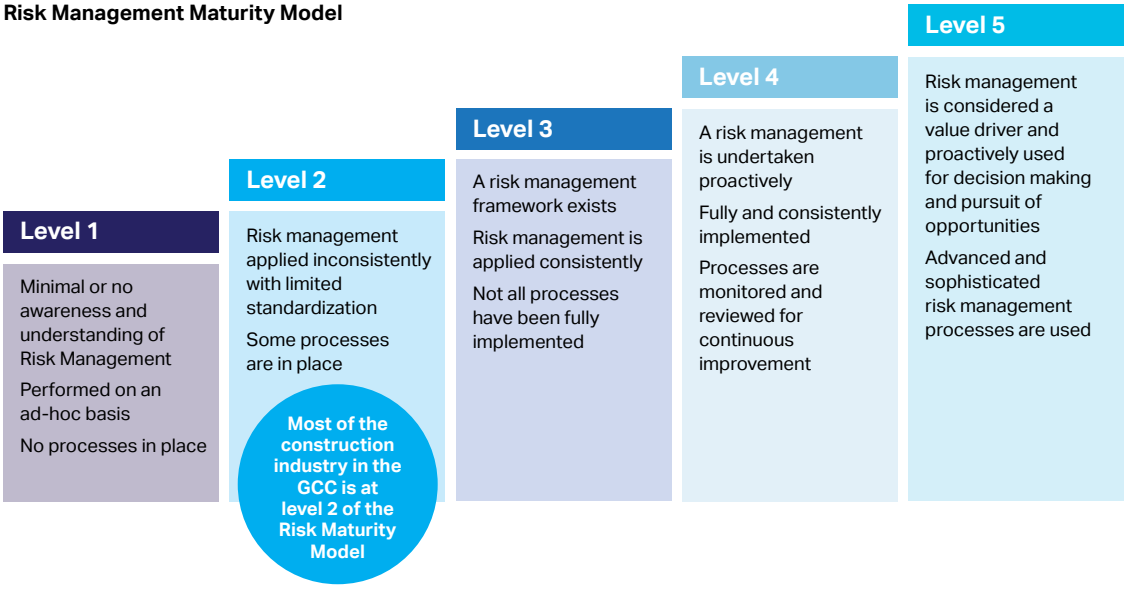
Risk maturity levels

The construction industry in the GCC has not yet fully adopted the culture of risk-driven project management and it typically placed at level 2 of the Risk Management Maturity Model. Although most RFPs state the requirement for Risk Management services, this requirement is usually passive and not emphasized as a core function requiring specialist Risk Management input.

In response to such bids, risk management is typically a tick-in-the-box service that ends up being delivered, if delivered at all, by the project manager in the form of a dormant risk register that is not proactively updated, managed or communicated.

Such indifference to the importance of managing project risks as early as the planning stages is one of the primary reasons that project contingencies are often not robust and budgets are not as accurate as they could be. Failing to manage risk throughout the consequent delivery stages of a project is also the primary reason why projects typically encounter program and budget overruns.

Risk Management Maturity Model



In an improved scenario where risk maturity is at level 3 and Risk Management is undertaken at a qualitative level, the risk register should be, at the very least, a tool to track project risks as they arise from the outset of the project all the way through to handover. It should capture mitigation actions and ensure that those are implemented in the assigned timeframe by the assigned action party. It should also be used as a tool for reporting and communicating project risks to senior management and the wider project team.

Even without quantifying the level of impact in terms of time and cost, many project risks can be mitigated merely by holding certain parties responsible for ensuring that those risks are addressed and closed out. It ensures that senior management is aware of potential threats and opportunities, thus eliminating the culture of blame and element of surprise when things do not go according to plan.

Such management of risks simply cannot be another task that is added to a project manager's long to-do list. Not only does it require time and dedication, it also requires a certain level of expertise to be able to successfully undertake this role. Risk workshops need to be organized and facilitated, the risk register updated, mitigation actions planned and action parties need to be chased. This needs to be done as an ongoing exercise and moreover, outputs and reports need to be prepared and communicated. It therefore warrants a specialist risk manager to perform this role.

In an ideal scenario where risk maturity is at levels 4 or 5, the risk register is used along with the project budget and schedule in order to run a quantitative schedule and cost analysis using modelling tools such as Monte Carlo. Very few projects in the GCC opt for this level of risk detail which could determine the probability of a certain project being delivered according to the planned budget and program. As a result, proper cost and schedule planning is compromised, with informed decision making often becoming quite difficult.

The benefits

Undertaking risk management will unquestionably increase the likelihood of achieving corporate and project objectives. Implementing risk management on a capital project will enable the following:

- Implementation of a formal process for the identification, assessment and evaluation of risks and opportunities, and subsequent risk response planning / opportunity exploitation.
- Establishing a rational method for calculating realistic and defendable contingencies for cost and program.
- Increasing the comprehension and the ability of stakeholders to influence the project outcomes.
- Assisting in decision making and evaluating alternative options.
- Providing managers with the means to decide where best to invest the project's time and money.
- Ensuring the procurement route and contract's conditions reflect the risk appetite and project objectives.

VALUE MANAGEMENT

Another important project management tool, which is often underutilized in the GCC and also often not practiced in its truest sense, is value management. In the current market, value management (VM) and value engineering (VE) are buzz words that are often seen in RFPs and proposals.

Current trends

It is still a challenge in the construction industry to convey and articulate the correct meaning of VM and VE. While many industry professionals claim that they are capable of delivering VM/VE services, they are often referring to exploring other design options to satisfy cost-cutting agendas.

This service is typically delivered by cost consultants who are not VM/VE experts and do not have the skills or certifications to deliver a proper VM/VE strategy or derive and drive the benefits it could provide.

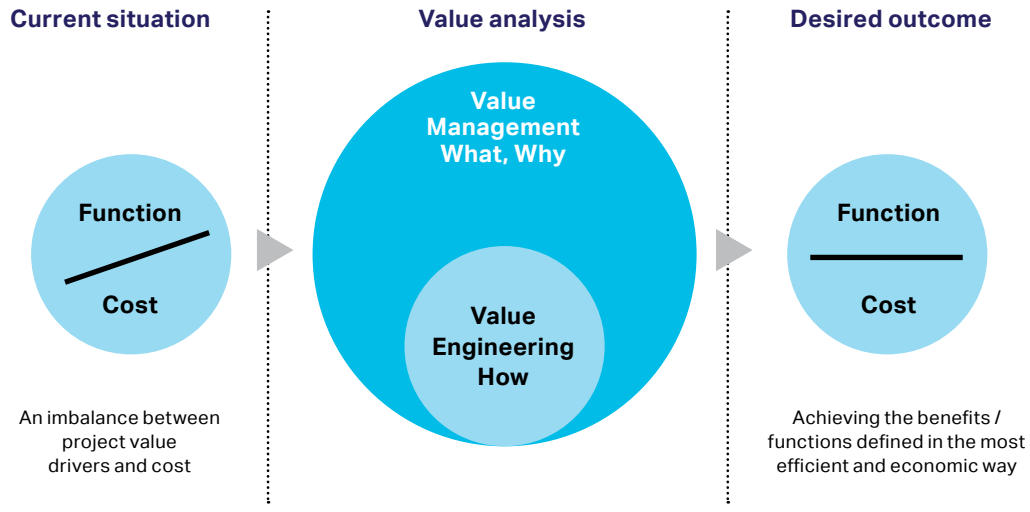
Act I Act II
Image courtesy of Emaar

Back to basics: Setting the record straight

Value management is a function-oriented technique that has proven to be an effective tool for achieving improved design, construction and cost effectiveness in various project elements.

It is important to note that VM is an overarching discipline that encompasses VE as a process. Given the multiple stakeholders, large-scale costs and resource requirements to deliver large-scale projects, VM plays a key role in providing a systematic process to define what value means for the client, while VE provides the tools to deliver the required functionality at lowest costs and to give best value for money.

The value ratio



Value management

- Defining what "value" means to key stakeholders — WHAT and WHY
- What benefit/function are we trying to achieve and WHY

Value engineering

- Establishing how to balance benefits sought with resources required — HOW
- How can we achieve the benefits/functions defined in an efficient and economical way

When applied correctly, VM and VE achieve a balanced value ratio and hence realize the benefits/functions defined in the most efficient and economical way.

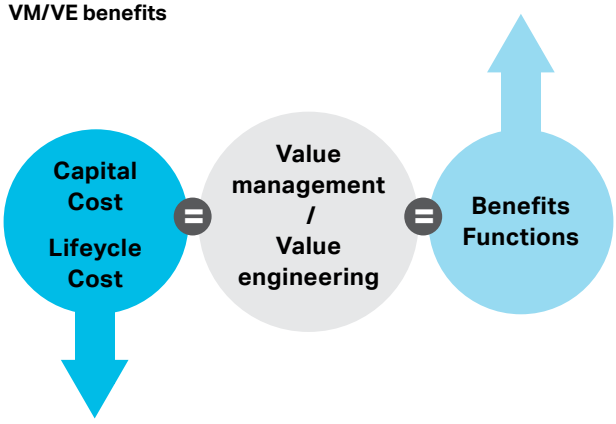
Purpose and benefits

The purpose of value management is to add value and enhance the quality of a project, not simply to reduce costs. VM/VE studies should question project elements that add cost or complexity to a project without improving its overall function. The main goal of VM/VE is to ensure the efficient use of funds (both capital and lifecycle costs) and to attain the best value while meeting project objectives and performance requirements.

The main benefits for applying VM/VE studies are:

- Formalize and add structure to VM/VE work being intrinsically done as part of the design process
- Add value and enhance the quality of a project, not simply to reduce costs
- Structured process for the stakeholders to make and communicate decisions and priorities
- Tool for consultants to communicate and justify basis of design solutions
- Framework for development of innovative design solutions
- Balancing the use of resources according to the client's priorities
- Identifying the client's value drivers.

VM/VE benefits

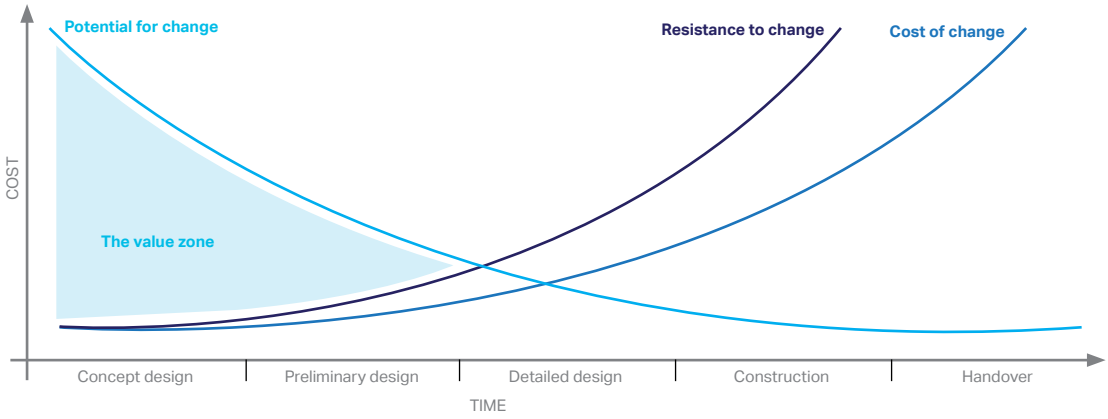


VM / VE Benefits

ICD Brookfield Place

Image courtesy of ICD Brookfield

The value zone



The value zone

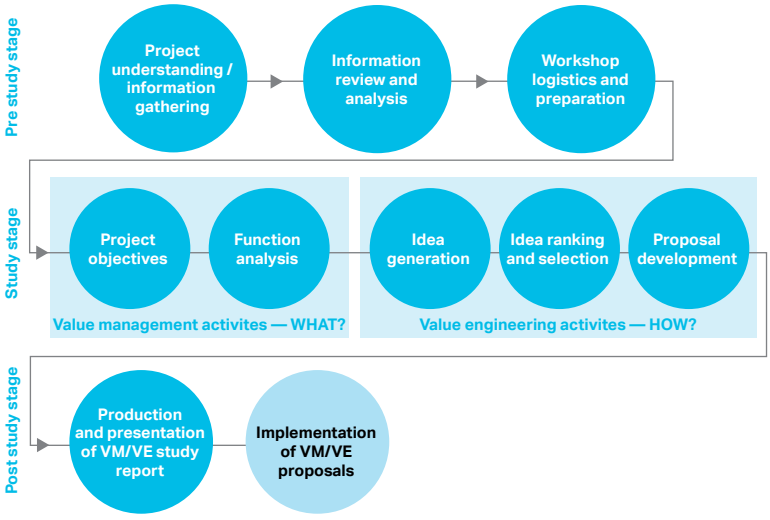
In the GCC, VM is often seen to become popular when there is a budget overrun and the project team seeks solutions to reduce the cost.

While VM studies can be applied during any stage of a project's development cycle, the greatest benefit and savings will be largely achieved early in development during the conceptual stages. At this point, the basic information and objective of the project is established, but major design and other resources have not yet been committed. It is during the early stages of the project that the basic functions can be established, therefore allowing for alternative and creative designs to be developed. As the project progresses, there is a higher resistance to change and the cost of change significantly increases. Therefore, the potential for change and the benefit/value of undertaking VE decreases during the advanced stages of a project.

The process

It is important to note that while VM is an overarching discipline that encompasses VE as a process, the two are shown separately to demonstrate that VM and VE have their own distinct processes and activities, and to better demonstrate how these are applied in the current GCC market.

The value management/value engineering job plan



Value management

- Specific activities include defining the project objective and constraints, and developing the project's value profile through the application of the function analysis technique — therefore defining the "WHAT" and the "WHY".

Value engineering

- Specific activities will include challenging the proposed design by generating creative ideas, idea ranking and selection as well as VE proposal development — therefore answering the question "HOW".

Some important definitions to note when discussing VM/VE are as follows:

Value drivers

Value drivers are elements that must be achieved in full through the design in order to achieve the project objectives. In VM, value drivers are referred to as "functions", and they provide means to develop measures of performance based on outcomes.

'Functions' explain what things must do in terms of contributing to the utility, exchange and esteem of a project rather than what things are. Generally, items do not have value unless they satisfy a need or a function. Value drivers or functions are often referred to interchangeably.

Function analysis

Function analysis is a technique used in order to develop the project's value profile. The primary tool used is the Function Analysis System Technique (FAST) diagram or what is commonly referred to as a "value tree" or "function tree".

When developing a FAST diagram, the study team is forced to make a clear definition of the project by answering the following questions:

- What are we trying to achieve?
- What must we get right if we are to achieve it?
- What consideration do we need to bear in mind while designing it?
- How do various design solutions contribute towards achieving the desired outcome?

Once this value profile has been established, it will enable the VE study team to link the impact of increasing/reducing the cost of a design element to the function it performs as well as the impact on achieving the desired objective of the project.

In all cases, the cost cutting exercises being undertaken and referred to as "value engineering" do not comply with the above process and therefore does not generate the same benefits. In most instances when VM/VE expert facilitators are brought on board — often too late in the project life cycle and when the cost has skyrocketed — they find that there is no clear definition of the project in terms of objectives, constraints and value drivers. In most cases it is too late to go back to establishing these basics and at best, their contribution is limited to structuring VE activities that are usually little more than cost cutting initiatives. Furthermore, these cost cutting initiatives are often administered by cost consultants and not by VM/VE specialists who can provide structure to how different design solutions are generated, shortlisted, further developed and selected.

Lessons learnt

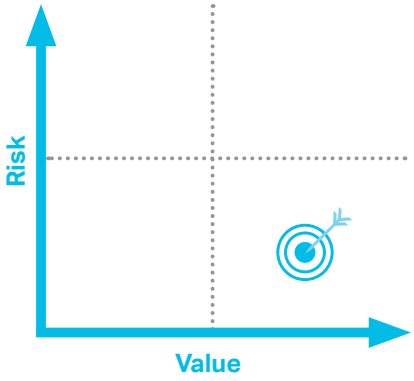
AECOM has learnt a number of lessons from engaging with clients and delivering VM/VE services in the GCC region:

- Value management should be undertaken from the outset of a project and should be supported and driven by higher management, which currently, often is not the case.
- Cost cutting activities should not be labelled as "value engineering". While this might serve as a tick in the box when it comes to their contractual obligations, it does not follow the VE process or job plan. In order to undertake proper VM/VE, the study team should link the impact of increasing/reducing the cost of a design element to the function it performs as well as the impact on achieving the desired objective of the project.
- All concerned stakeholders should be represented as part of the study team, and their functional requirements should be made clear and accounted for in the design.
- The selection of proposed ideas should be done against set criteria and with all stakeholders present.
- It is important to consider operational, maintenance and life cycle costs of selected design elements.
- The design team should have visibility over the costs and the budgets if they are to design to a specific budget.

VALUE AND RISK MANAGEMENT – AN INTEGRATED SERVICE

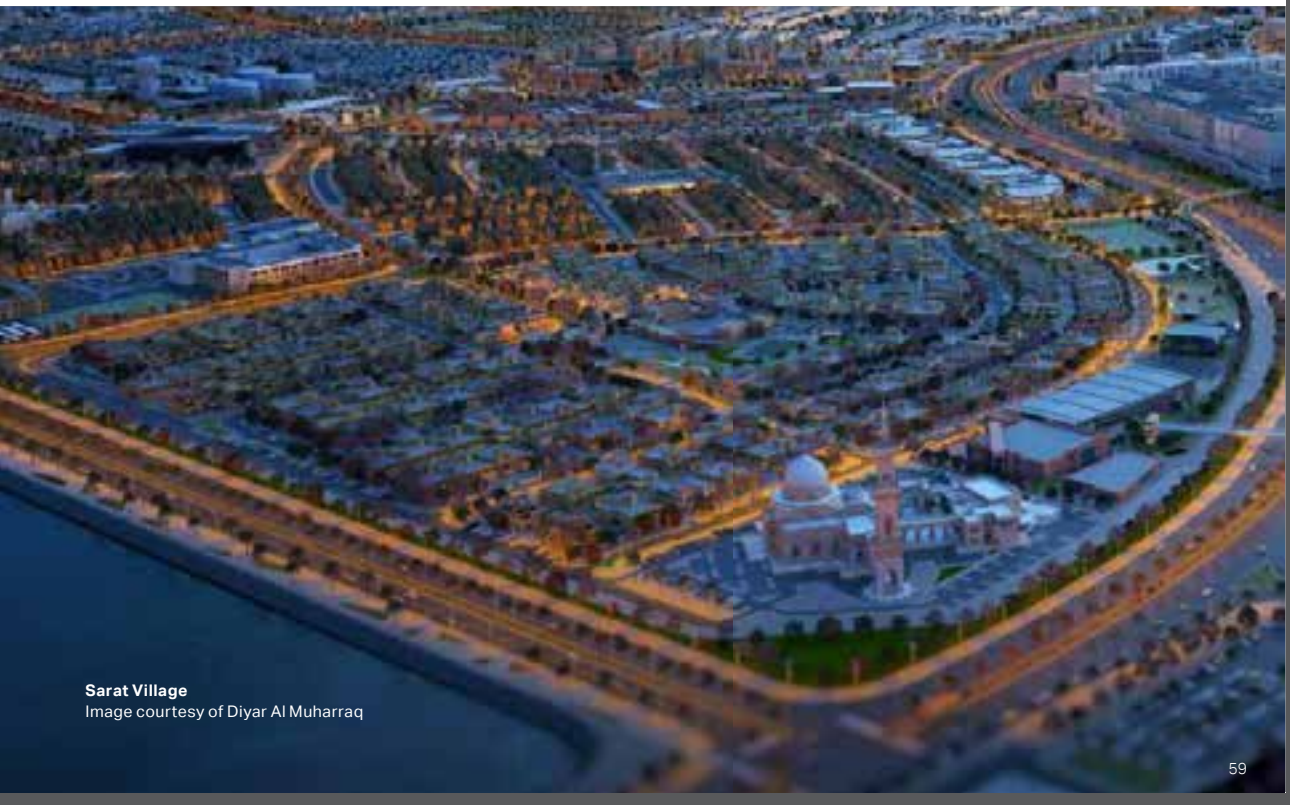
It is important to establish that value and risk management (VRM) processes are complimentary and interrelated. Both processes are integrated in such a way that:

- Value management can reduce risks and risk management provides opportunities for value improvement
- Value management helps to identify the best way to meet the business need, and risk management manages the risks associated with the solution



Both processes are considered industry best practice for effective project management and, if applied correctly, can result in drastic improvements in all aspects of project delivery.

They are not, and should not be considered, a tick-in-the box service and are certainly worth the effort and investment. The biggest challenge remains of how to change mindsets, in particular those of clients and project managers, and to demonstrate the added benefits to these best practice management tools.



Sarat Village
Image courtesy of Diyar Al Muharraq

ICD Brookfield Place

Image courtesy of ICD Brookfield

AN ECOLOGY OF THE CITY

RESILIENCE, RISK MANAGEMENT AND PARAMETRIC DESIGN AS DRIVERS OF 'SMART CITIES'

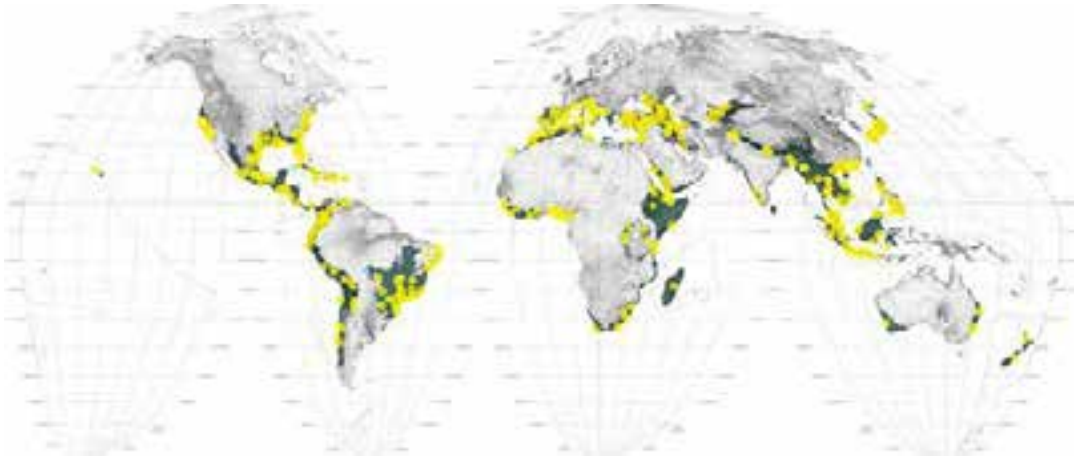
AECOM operates within a world that is transforming at an unprecedented pace. Put simply we are dealing with the types of challenges that the world has never seen before, at a pace that remains unique in the history of humanity.

As one of the world's largest multi-disciplinary design and infrastructure organizations we face a daily challenge of having to balance a disciplinary structure for 87,000 people and the reality of having to answer the world's most complex interdisciplinary design and engineering questions.

In many ways the key to addressing our future challenges is the ability to work fluidly across disciplinary boundaries in interdependent ways. To work in a way that transcends conceptual divisions.

SO HOW SHOULD WE CONCEIVE OF THE CITY?

"The city is no longer something we can understand as architecture; as a mass of formed material that we can distinguish from a non-material void which can be characterized as countryside or periphery – or as in any event 'not-city'"[1]



Map of cities in global biodiversity hotspots

As the above quote from the Urbanist Stephen Read suggests, cities have traditionally been conceived as being in opposition to ecology. Whereas environments such as forests and wetlands are conceived as 'nature', cities are conceived as 'not nature'. This dialectical opposition of cities and nature has led to a separation of urbanism and ecological function under the rubric of urban planning.

This has however put cities at odds with planetary ecology. The recent project led by Richard Weller entitled 'The Atlas for the End of the World" attempts to illustrate this conflict. This project mapped the clear and unequivocal clash between expanding cities and biodiversity hotspots that are to be protected under the United Nations Convention on Biological Diversity (CBD) Aichi target 11. Assessing the considerable growth projected in global populations, the Atlas authors advise that:

'One needs to appreciate the scale of this imminent urban growth. If say an extra 3 billion people move into cities by 2100 (as is entirely likely), it means we need to build 357 New York Cities — 4.25 per year to the end of the century! Much of that growth will occur in the subcontinent and in Africa and South and Central America; much of it up against biodiversity."[2]

[1] Read, Stephen, "Thickening the surface - or, what is an 'ecological landscape'exactly?", Kerb Journal Vol 15 (2007): 197-200

[2] Richard J. Weller, "Essay" in Richard J. Weller, Claire Hoch, and Chieh Huang, Atlas for the End of the World (2017), http://atlas-for-the-end-of-the-world.com., Last Accessed 07 August 2018

The undeniable truth of global climate change is that urbanization, amongst other things, has had a fundamental impact on planetary ecology. As suggested by Read, it is no longer tenable to consider a duality of nature/city. Cities as the main protagonists of consumption and infrastructure therefore must accept their responsibility to act as agents of positive ecological change. This is implicit in the need for urban resilience in the infrastructure and ecological systems of our biome. Only when we start designing cities as functioning ecologies can we claim they are 'smart'.

As an example, the following images illustrate the projected impact of a 7-meter sea level rise, which is consistent with the high-emission long-term scenarios outlined in the Intergovernmental Panel on Climate Change Fifth Assessment Report.[3]

The imperative to address planetary climate change and urban resilience is best served by a unification of a disparate range of disciplines including urban planning, landscape architecture, ecology, economics, sociology, anthropology, security and cyber security amongst others.

This is closely aligned to the increasing importance of the concept of 'urban resilience'.

In some respects this idea has evolved from conceptual expressions variously described as landscape urbanism, metabolic urbanization and ecological urbanism and now includes anthropocentric challenges such as security, cyber-security and socio-economic drivers.

Inspired by a strong desire to reconnect cities with the dynamic landscape and ecological processes that once drove their establishment, these ideological approaches aim to recast the landscape and its attendant processes as formative to cities. This necessarily leads to a demand for a truly multi-disciplinary seamless practice if one is to engage in to the practice of urbanism in the 21st century.

3 IPCC, 2014: Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, R.K. Pachauri and L.A. Meyer (eds.)]. IPCC, Geneva, Switzerland, page 369.

URBAN RESILIENCE AS A PARADIGM SHIFT

AECOM as a firm aims to embody to the very idea of multi-disciplinary resolution of global problems. Through our work on urbanism and infrastructure projects we actively seek resilient urban solutions.

In 2018, AECOM published its position paper on the 'Future of Infrastructure' in which we outlined our responsibility to design for a rapidly changing world. The volume outlines that:

"The industry must play a vital economic and societal role in supporting technological progress and shaping the communities of tomorrow. Our respondents share a willingness to embrace challenges and to develop fresh approaches to long-standing problems — and this must be done sooner rather than later."[4]

[4] AECOM, "The Future of Infratstructure", published on-line at https://infrastructure.aecom.com/hubfs/report/AECOM_FOI_Report_2018.pdf?utm_campaign=Future%20Of%20Infrastructure%20Campaign&utm_source=Direct_download&utm_medium=FOI_Website , Last accessed 12/08/2018.

RISK MANAGEMENT AND PARAMETRIC DESIGN IN THE MIDDLE EAST

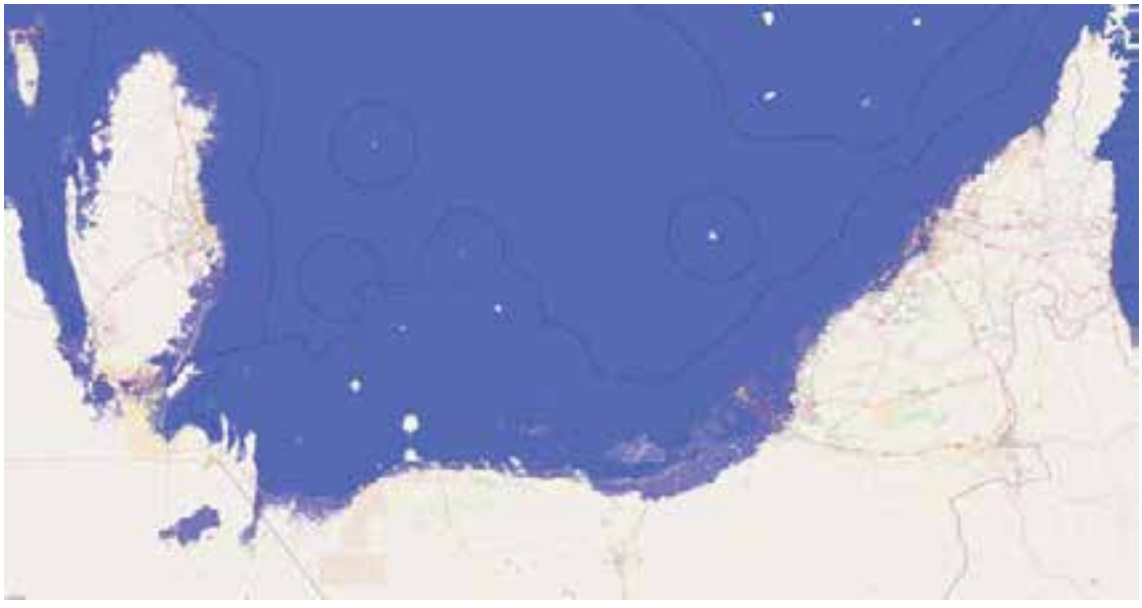
As a global company, AECOM seeks to understand whether the changes being observed in the western world are relevant to the developing regions of the world like the Arabian Gulf. The global nature of the emerging climate crises clearly demand that the responses are equally important in Muscat as they are in Manhattan. When we consider resilience issues such as extreme heat or food security, the challenges are every bit as salient in this part of the world. Put simply they are fundamental existential risks that must be managed.

Throughout history the Gulf has been occupied on its most habitable fringes — the coastal creeks and its hill towns. That urban morphology still exists today despite our contemporary mastery of creating artificial climates.

If the Intergovernmental Panel on Climate Change Report 5 is to be accepted as the scientific consensus on climate change, the Middle East's heavy bias towards coastal development is a fundamental existential crisis and a risk that must be faced immediately.

Increasingly cities in the Middle East are being challenged to consider their continued existence through the lens of urban resilience. While not universally understood, this represents an emerging new paradigm that must be considered. Evidence of that understanding exists through examples such as the Abu Dhabi Environment Agency's report on Climate Change and responses in the UAE[5].

Modeling of flood scenarios immediately highlights the extreme danger posed by sea level rise to the cities of the Gulf, the vast majority of which would be devastated by the IPCCs projected sea level rise. As the illustration below demonstrates the vast majority of every urban settlement in the Gulf would be devastated if this projection were to be realized.



Flood map of Arabian Gulf showing the potential impact of a 7 meter change in sea levels as predicted by the IPCC © 2017
http://flood.firetree.net

Compounding the issue is the impact of increased heat stress likely to arise from climate change. Modeling of likely change of climate in the Middle East has resulted in the projection that suggests that the Arabian Gulf will be unlivable for humans if climate change continues unmitigated[6].

While the landscapes of the Gulf are often dismissed as being devoid of ecological value, the landscape of the Arabian Desert is a rich cultural landscape that must be realistically considered from the perspective of urban resilience. The coastal cities of the Arabian Gulf are arid subtropical desert biomes that push human physiology to its greatest extremes and the challenge must be addressed if we are to protect the cultural landscape of the Gulf.

Interestingly, evidence suggests that contemporary culture has (accidentally) learned to geoengineer the climate of Gulf cities. Counter-intuitively the development of instant cities in the Gulf has led to an inverse urban heat island affect where cities like Dubai are actually 10 degrees cooler than their surrounding hinterland[7]. The degree of temperature land inversion has been directly correlated to the 'greening' of Gulf cities. This has highlighted the potential we have to design in climate response to urban masterplans. This has had the added benefit of enhancing climate resilience and increasing biological diversity. We as a company are learning from this deployment of ecologies towards urban ends.

[5] Dougherty, W. W. etal, "Climate Change: Impacts, Vulnerabilities and Adaptation", published on line at https://www.ead.ae/Documents/RESEARCHERS/Climate%20change%20impacts%20-%20Eng.pdf , last accessed on 11/08/2018

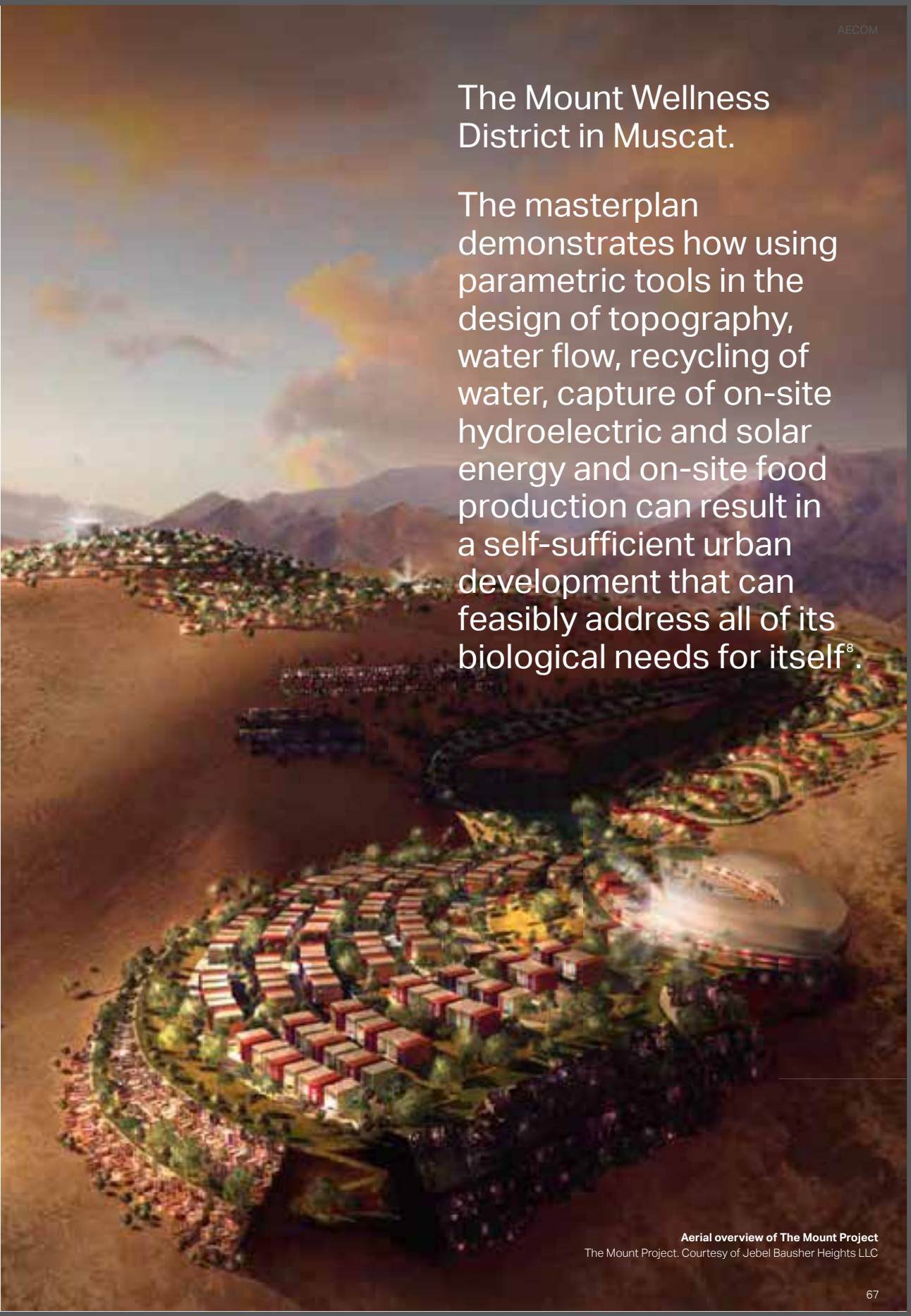
[6] Jeremy S. Pal and Elfatih A. B. Eltahir, "Future temperature in southwest Asia projected to exceed a threshold for human adaptability", Nature Climate Change Journal Vol 6 (2016): 197-200

[7] Lazzarini, M., Marpu, P. R., Ghedira, H., "Temperature-land cover interactions: the inversion of Urban Heat Island phenomenon in desert city areas", Remote Sensing of Environment, Volume 130, 15 March 2013, Pages 136–152

[8] Masterplan led by Steven Velegrinis as part of the JLL Perkins+Will / Cundall Team

The Mount Wellness District in Muscat.

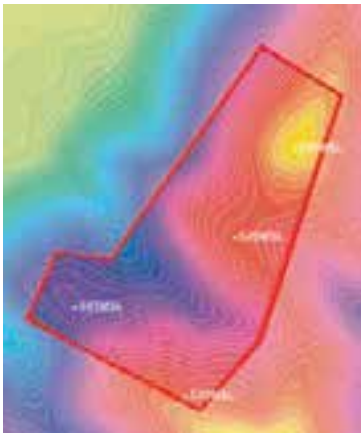
The masterplan demonstrates how using parametric tools in the design of topography, water flow, recycling of water, capture of on-site hydroelectric and solar energy and on-site food production can result in a self-sufficient urban development that can feasibly address all of its biological needs for itself[8].



Aerial overview of The Mount Project
The Mount Project. Courtesy of Jebel Bausher Heights LLC

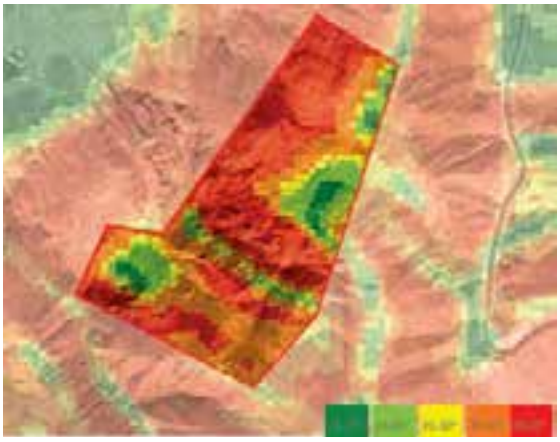
With a steep sloping site that ranged from 350 meters above mean sea level (AMSL) to 595 meters AMSL, the topopgraphy and the pristine conditions of the site were a major concern, but also an enormous asset considering the expansive views over the Muscat plain and the sea. The site conditions call into question whether a site of this nature should even be developed at all. The determination of the design team was to accept that a development, if it was to be proposed, must illustrate how development could be environmentally positive. This was considered to necessarily include ecological, biodiversity, energy, material and water system concerns.

Central to this was a terrain analysis that ensured that hydrological systems and the wadi's on site would not be interrupted but enhanced to provide greater control of water assets falling across the site. This use of hydrology as the first register of the site was of the utmost importance.



TOP - Illustrative masterplan of The Mount Project
BOTTOM - Topographic and surface hydrology analyses
The Mount Project. Courtesy of Jebel Bausher Heights LLC

Following the respect of hydrological regimes an analysis of the slope gradients was undertaken using scripting in Rhino and Grasshopper to identify developable land that would minimize use of land that was steeper than 30 degrees slope.



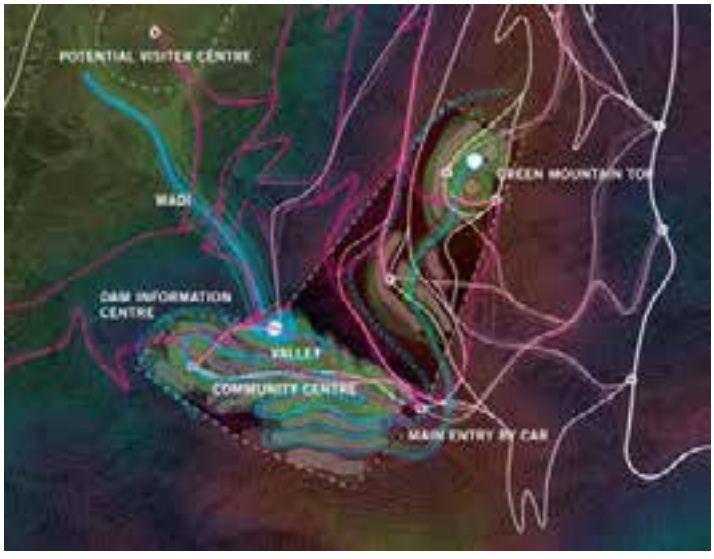
Slope and buildable land analyses
The Mount Project. Courtesy of Jebel Bausher Heights LLC

Parametric analyses to determine least intrusive vehicular routes and hiking routes
The Mount Project. Courtesy of Jebel Bausher Heights LLC

As a consequence of these analyses it was determined that approximately 40 percent of the site should not be developed at all and rather would form the backbone of an ecological framework for the site. This coincided largely with the land that would most positively act to protect the hydrological regimes of the site.

The use of parametric design tools then took center stage again using a script to determine the location of road routes that would result in grades of less than 10 degress without having to substantially cut parts of the site. This was taken further to determine routes that would be suitable for pedestrian access and then more challenging hiking and activity trails that would help to promote healthy lifestyles in the district.

These factors overlayed created a site development framework and neighborhood structure that grows out of the land and delineates a development of the site that maximizes the greatest assets of the site without requiring their destruction in order to achieve it.

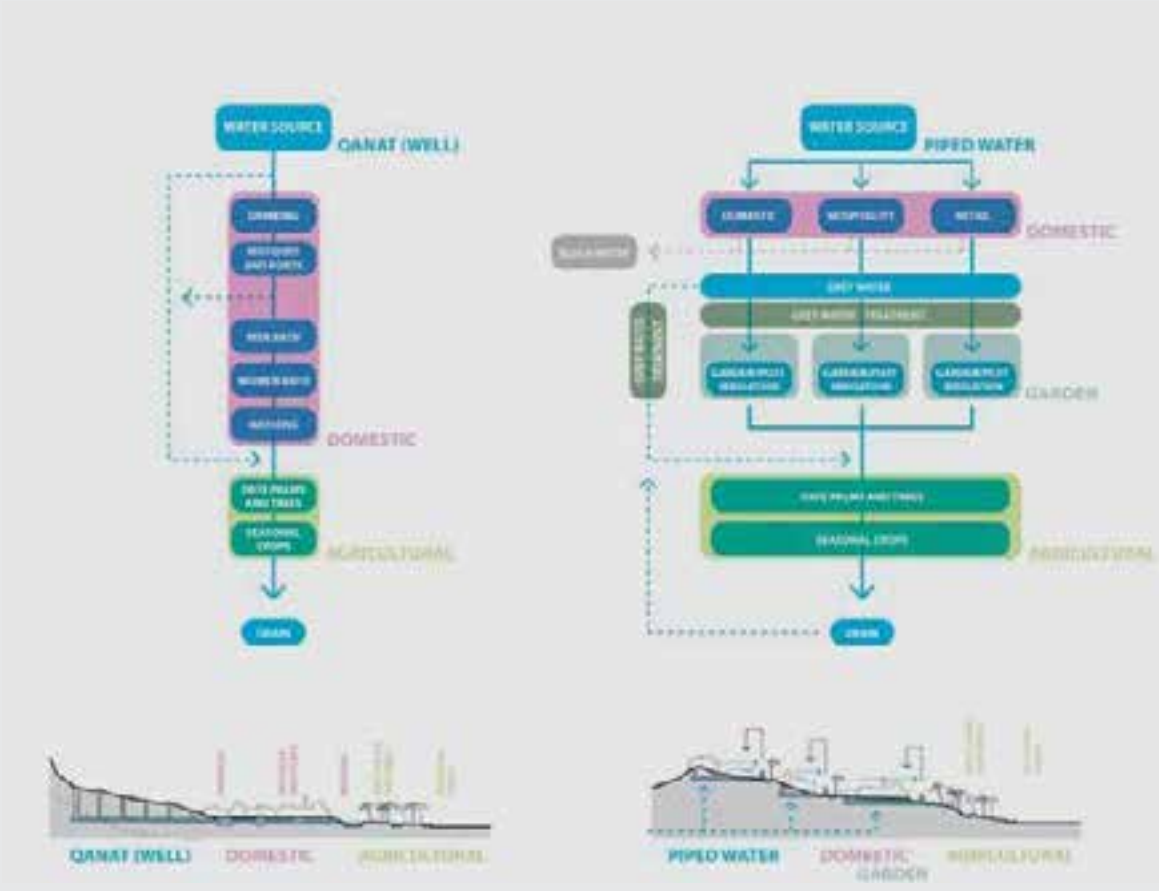


Neighbourhood Structure Diagram and Water, Energy and Movement Systems Diagram
The Mount Project. Courtesy of Jebel Bausher Heights LLC

This in turn was enhanced by the creation of an environmental framework and an enhanced version of the qanat irrigation systems traditionally employed in the Gulf. By enhancing the conceptual model with 100 percent onsite water recycling through reed beds, the creation of a wadi dam that would control downstream flooding and create a hydroelectric power source, and overlaying of onsite energy harvesting systems, the scheme was conceived of as a potentially off-grid project that required only the introduction of potable water from the municipal network.

Rather than driving the masterplan from its inception, the eventual buildings, comprising mainly hospitality and residential uses then were folded into the masterplan. A modular building system using prefabrication of formwork-as-finish construction provided a flexible construction system that worked for a site that was extremely challenging to access.

In this sense the project actively engaged with the landscape dynamics to grow and subsequently shape a coherent ecological system that enhanced site ecology while providing significant development and amenity. It is an example of how development need not be a net destroyer of ecological function.



Conceptual deployment of qanat model to provide water recycling and food production on site
The Mount Project. Courtesy of Jebel Bausher Heights LLC

These initiatives are by no means a complete solution for the considerable challenges that humanity face but they do map a trajectory towards more resilient ecological futures. This remains the very focus of AECOM's efforts.

In our view, projects like The Mount demonstrate the way all city design must happen in future. They are part of a continuing effort to improve the social dimension of projects. This need not mean that projects are encumbered with unreasonable commercial burden — to the contrary this promises to improve profitability.

We at AECOM continue to explore such ways for cities to become positive ecological forces of change.

03 REFERENCE ARTICLES

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PROCUREMENT ROUTES

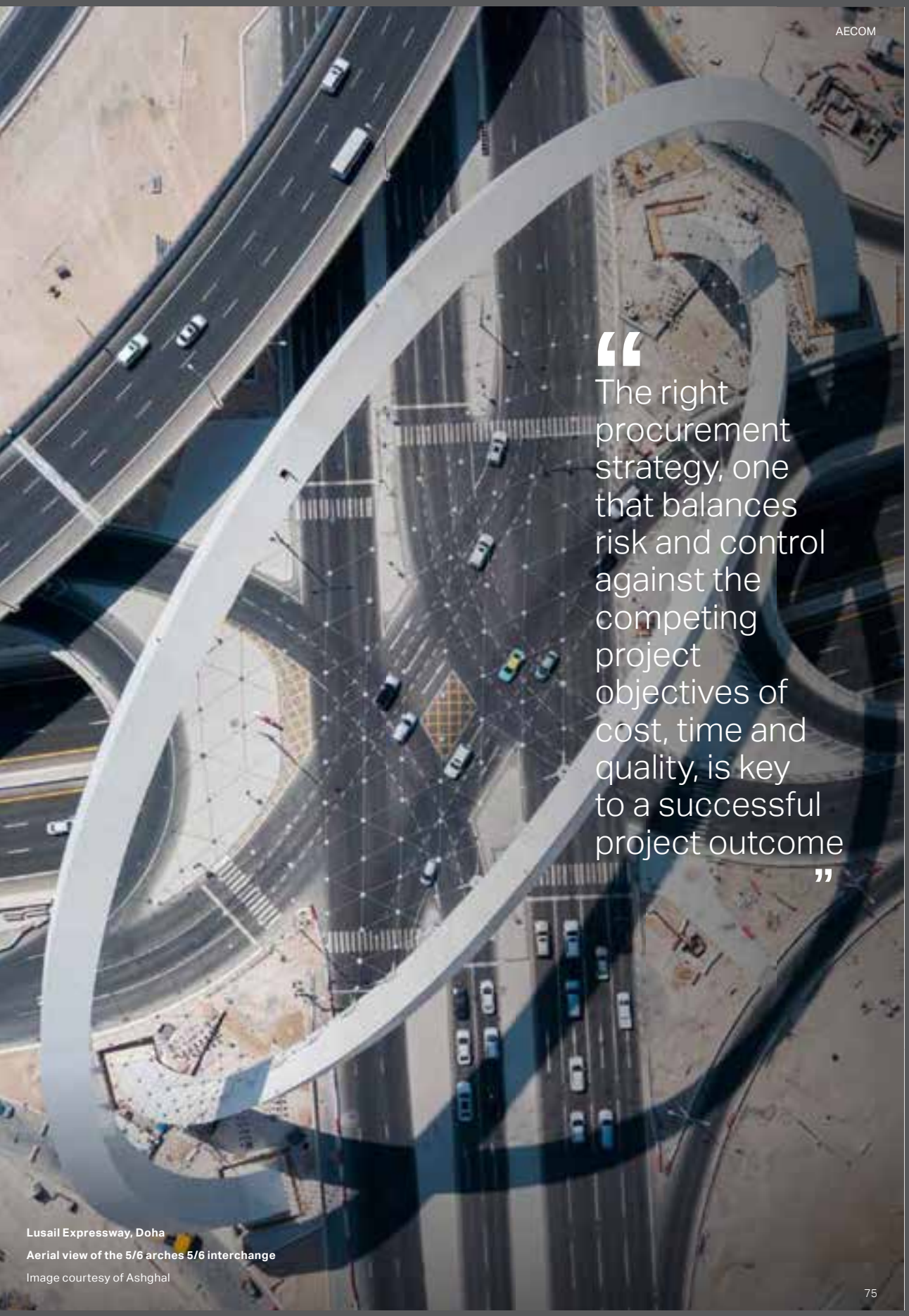
All clients expect projects to be on time and within budget with an agreed level of quality and with the risk rightly managed by their professional and contracting team.

However, most clients and construction professionals can name at least one project that was not delivered to budget, time or the quality levels expected. This is why the right procurement strategy, one that balances risk and control against the competing project objectives of cost, time and quality, is key to a successful project outcome.

AECOM has developed strategies for the delivery of projects that we know work, successfully delivering hundreds of projects over our long history. New and existing developers have the opportunity to learn from this knowledge and maximize the value from their time, cost and quality mix, whilst adhering to a process that increases the likelihood of their projects being successfully procured by their team involved.

Studies conducted with our key clients who regularly undertake development work have shown that projects can be delivered for 12-15 percent less cost when procured correctly with no impact on quality or time. Projects are more likely to be on time and meet clients' expectations when procured correctly. So what is the right procurement approach for your projects?

Which funding strategy, funding partner, team behaviors, attitudes, communication channels, budget and program delivers the best approach and how can we best combine these to lead our clients to ultimate success?



> “The right procurement strategy, one that balances risk and control against the competing project objectives of cost, time and quality, is key to a successful project outcome”

Lusail Expressway, Doha

Aerial view of the 5/6 arches 5/6 interchange

Image courtesy of Ashghal

AECOM MANAGEMENT OF THE PROCUREMENT PROCESS

AECOM offers important early advice to help determine the right procurement approach, adding value throughout the building process. This understanding of our clients' time, cost and quality requirements maximizes the value we can offer. Some of the procurement strategies followed in the industry are listed below, but the real challenge is selecting the right approach for an individual client's needs:

Traditional lump sum

The design by the client's consultants is completed before contractors tender for and then carry out the construction. The contractor commits to a lump sum price and a completion date prior to appointment. The contractor assumes responsibility for the financial and program risks for the carrying out of the building works, whilst the client takes responsibility and accepts the risk for the quality of the design and the design team's performance. The client's consultant administers the contract and advises on aspects associated with design, progress and stage payments which must be paid by the client.

Accelerated traditional

As per traditional lump sum, but procured in the market place before being fully designed (normally 80-85 percent designed), leaving more simple elements of the building to be procured once the contractor has been appointed. It is important to understand how a client procures the remaining elements of work with a contractor under this approach and to design out those areas that carry inherent risk early in the process. It may also involve the procurement of an early works package for enabling and/or piling works.

Two stage

A contractor is invited to become part of the project team in stage 1, usually by way of a pre-construction fee or commitment to preliminaries and mark-up percentage. They jointly procure the project with of the client, until such time that a second stage lump sum offer can be agreed, which should be before construction begins on site. An understanding of the original appointment and the subsequent framework, under which the second stage is agreed, are the important aspects of this approach, as well as working with transparency and trust preventing an early commitment to a full scheme that a client cannot afford.

Design and build

Detailed design and construction are both undertaken by a single contractor in return for a lump sum price. There are variants on this option depending on the degree to which initial design is included in the client's requirements. Where a concept design is prepared by a design team employed directly by the client before the contractor is appointed (as is normally the case), the strategy is called develop and construct. The contractor commits to a lump sum price, for completion of the design and the construction and to a completion date, prior to their appointment. The contractor can either use the client's concept design to complete the design or use their own team to finalize it. With design and build it is important to design out or specify in detail those parts of the building the client wants to see perform a particular function or provide a particular visual impact.

Management contract

Design by the client's consultants generally overlaps with the construction. A management contractor is appointed early to tender and let elements of work progressively to subcontractors and specialists in work packages. The contracts are between the management contractor and the trade contractors, rather than between the client and sub-contractors. The management contractor will not carry out construction work, but is employed to manage the process. The management contractor in theory assumes responsibility for the financial (and program) risks for the works, but in reality this is normally diluted by the terms of the contract so their liability is similar to that of a construction manager.

Design, manage and construct

Similar to the management contract, with the contractor also being responsible for the production of the detailed design or for managing the detailed design process.

'Turnkey' contract

A form of a design and build contract, in which a single contractor or developer is responsible for all services, possibly also including finance. Under a turnkey project, the client enters into a contract with one party to deliver the entire project. The project is handed over once it is complete and fully operational. The client is normally not involved in any of the decisions throughout the building process. There are several variations of 'turnkey' contracts, including Engineer-Procure-Construct (EPC), Build-Own-Lease-Transfer (BOLR), Design-Build-Operate-Transfer (DBOT), or PFI.

AECOM

Public Private Partnerships (PPP)

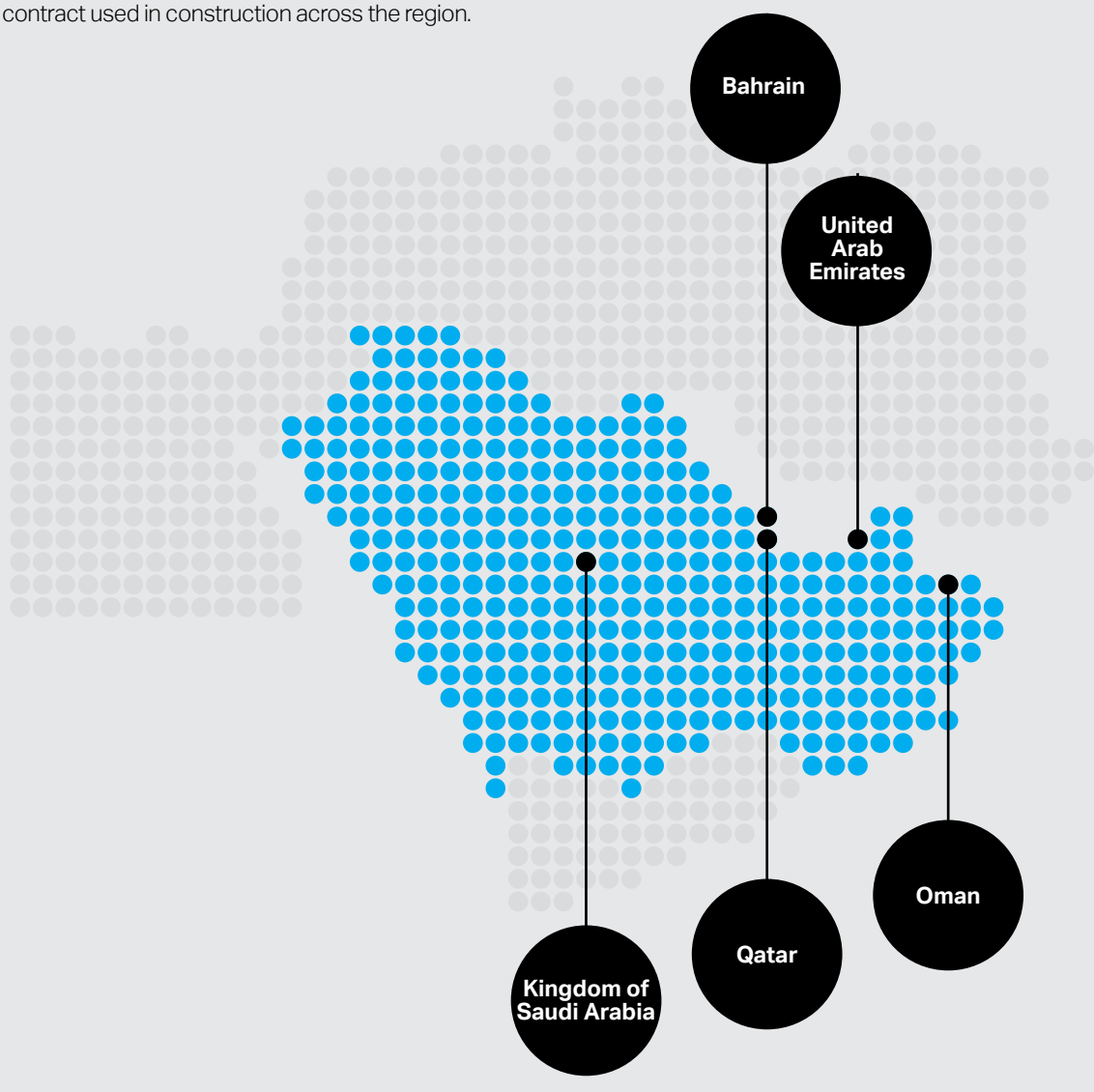
A detailed and complicated form of procurement used predominantly for public services when the private sector feels it is advantageous to design, build, finance and operate a particular service or building type. It is becoming more popular in the Middle East as a way to limit public sector spending whilst meeting the demands of a growing population. AECOM has been involved with PPPs for over 20 years. We have successfully completed many projects worldwide and use this global knowledge to benefit clients locally.

Engineer, procure and construct (EPC)

EPC is a form of "turnkey" contract. This form of procurement places risk in the right hands and offers solutions to clients' engineering requirements from those specialized to meet the performance requirements set by a client team. Many of the large utility companies procure work in this way, bringing high levels of certainty from the supply chain which helps to achieve business critical benefits over the long-term.

MIDDLE EAST FORMS OF CONTRACT

This article considers the different forms of contract used in construction across the region.



Bahrain

Government work in the Kingdom of Bahrain is undertaken using a bespoke suite of contract forms which were issued in 2009.

Private developers predominantly use the current FIDIC Conditions of Contract for Construction, the 1999 edition of the 'red book', which is well understood in the local market but often heavily amended for specific use.

Most of the work completed in Bahrain is under a traditional lump sum form of contract, where the design is completed upfront and price agreed with a contractor before work begins on site.

Design and build and two-stage procurement are in use across the Kingdom but are not considered to be the industry norm. As more international private developers have started working in Bahrain with time constraints as their main driver, the market has adjusted to accommodate this demand. Design and build contracts, however, are not routine. This is largely due to the Committee for Organising Engineering Professional Practice (COEPP) restrictions on contractors undertaking in-house design which necessitates the novation of the client's architect or a sub consultant appointment.

Kingdom of Saudi Arabia

Construction contracts in the private sector are generally based on FIDIC forms of contract and are amended to suit the particular conditions for each project.

Employers prefer lump sum versus remeasured contracts and normally exercise great control in the administration of the construction process by imposing various restrictions on the engineer's (consultant) authorities under the contract. All contracts are subject to Saudi laws where Islamic Sharia is the prime source of legislation. Litigation and arbitration are both available for resolution of disputes in the private sector.

Within the public sector, however, construction contracts are based on the Standard Conditions for Public Works, which are amended to suit particular projects. These conditions are generally based on those given in the 4th edition of the FIDIC Conditions of Contract for Works of Civil Engineering Construction, the FIDIC 4 'red book', but with greater control given to the employer for the administration of the contract. All public work contracts are let on remeasured basis and subject to the Saudi Government Tendering and Procurement Regulations, as issued by Royal Decree.

Oman

Public works in Oman are undertaken using a bespoke government contract known as the Standard Documents for Building and Civil Engineering Works, 4th edition, 1999.

The document is based on early FIDIC contracts with the 4th edition containing only minor changes from the previous 3rd edition, 1981. The most important change is that the contract is now printed in Arabic. The Ministry of Legal Affairs is in the process of preparing a new edition but its launch date is yet to be published. The Standard Document facilitates both a remeasurement and a form of lump sum contract dependant on choice of clauses (although it is recognised that under the lump sum clause the employer retains the risk with respect to BQ errors), and is based upon a fully completed design, specification and bill of quantities.

The RICS Principles of Measurement (International) are the most widely used method of measurement although quasi-government and private clients are exploring alternatives and RICS New Rules of Measurement are increasingly being used. Infrastructure projects have their own method of measurement, as detailed within the Ministry of Transport and Communications document, Highway Design Standards.

Oman Tender Board laws require all government projects to utilise the Standard Documents on every project, without amendment.

In addition, the Tender Board facilitates all government tenders, centrally, through the tender board process. Only Royal Office and Royal Court of Affairs projects are exempt from this process although they do go through a similar internal tender process. Standard documents are commonly used by private sector clients in the local market, particularly for small-to-medium sized contracts. Private clients tend to prefer the 3rd edition as this is written in English, but varies only in a minor way from the Arabic 4th edition — preferred by the government ministries. International and private sector clients with large project contracts, USD150 million-plus, commonly use an amended version of the FIDIC "red book."

$150m+

Commonly use an amended version of the FIDIC "red book."

Whilst some of the larger integrated tourism developments have used a design build form of contract, design and build as a procurement route is not routinely used.

As part of the 9th five-year plan (2016-2020) and as a key initiative of the Government's Tanfeedh program to involve the private sector and reduce the Government debt burden, the Government is in the process of drafting a PPP framework, regulations and law which may be accompanied by the introduction of further forms of contract designed to suit PPP projects.

Qatar

In Qatar the most common forms for building works are those issued by the Public Works departments through the Ministry of Municipal Affairs and Agriculture (MMAA) and the Qatar Petroleum Company (QP).

These are lump sum contracts, generally using bills of quantities or specifications and drawings.

These contracts are usually more biased towards the client, but are generally administered in a reasonable manner

In the private sector, similar contractual arrangements are adopted. However, there are now some construction projects being let using cost plus or design and build arrangements. This now includes a number of the 2022 FIFA World Cup stadia which have been procured on a developed design stage and contracted on a D&B basis.

The market has seen an increase in the number of FIDIC-based contracts being implemented for both private and key public sector clients. In addition, in some very long duration contracts, the government is beginning to introduce a price adjustment mechanism to allow compensation for fluctuations in market prices.

Before any contract is awarded, there are commonly a number of rounds of negotiation, during which the price and other contractual terms can be modified to respond to a reduction in contract price.

United Arab Emirates

Construction contracts in the UAE are predominantly based upon the FIDIC forms of contract.

The growing number of large scale developers and major repeat clients in the region has led to the development of bespoke forms of contract, tailored to each individual client. Such contracts generally use the FIDIC 4 'red book' form as a basis, amended to a greater or lesser degree depending upon the risk profile of each client. This also applies to works procured by Dubai Municipality. Abu Dhabi Municipality, however, bases its contracts on a modified FIDIC 3 form, taken from the 3rd edition of the FIDIC conditions of Contract for Works of Civil Engineering Construction.

Contracts based on the 1999 'red book' are now starting to be used in the UAE, but in general the market remains firmly rooted in the FIDIC 4 form.

Civil works contracts within the UAE are mostly procured on a remeasurable basis, whereas building works will generally be based on a fixed price lump sum.

However, there are exceptions. More and more clients are procuring projects using a fast track approach and will therefore incorporate a remeasurable element, reflecting those parts of the design that are incomplete at tender stage.

Opera Grand
Image courtesy of Emaar

BUILDING REGULATIONS AND COMPLIANCE

This section outlines the procedures for obtaining building permission across the region.

AECOM's project management team is experienced in the procedures for obtaining building permits across the region and is able to oversee this process.

BAHRAIN

Procuring a Municipal Building Permit in Bahrain is done through a three-stage process:

Stage 1
Seeking the Preliminary Building Permit

This is preliminary permission sought from the Municipality of Bahrain. To complete the application it is generally sufficient to include simple outline plans, cross-sections to indicate overall heights and an area statement. The main authorities involved at this stage are the Municipality, the Physical Planning Directorate and the Roads Directorate.

Stage 2
Informing the various Directorates

This should be done in writing to the Town & Village Planning Directorate, Roads Directorate, the Civil Defence and Fire Services Directorate, the Electricity Distribution Directorate (EDD), EDD Damage Protection and Control Unit, the Sanitary Engineering Operations and Maintenance Directorate, the Water Distribution Directorate and Batelco. The initial contact should be made through the Central Planning Office (CPO) of the Ministry of Works.

Copies of the Title Deeds must be submitted at this stage. All relevant information and documentation is given to each of the above Directorates, until the final Building Permit is in hand.

Stage 3
Obtaining the Final Municipal Building Permit

This is the third and last stage and is processed through each of the Directorates in specific sequence. The initial contact should be made through the Municipality One Stop Shop. All documents, drawings and Municipality forms must be filled in and submitted together with the appropriate fees for each Directorate.

Municipal charges must be paid for the following elements:

1. Site sign board.
2. Insurance on the site sign board.
3. Insurance for Construction Contract (refundable).
4. Fee for occupying road.

If the Environmental Affairs Department are involved in the process, they will charge a reviewing fee.

KINGDOM OF SAUDI ARABIA

Obtaining a Building Permit in the Kingdom of Saudi Arabia varies from region to region, however they tend to follow the same basic principles. The various procedures and approvals from the Main Municipality, the Branch Municipality and the Fire Department need to be obtained. Obtaining these approvals typically takes between three to four months depending on the nature and size of the building/project.

The following is a general outline of the steps needed to obtain a Building Permit:

Stage 1
Obtaining letter from the Main Municipality

A letter from the owner is submitted to the main Riyadh Municipality, along with a copy of the land deed. The Municipality checks the masterplan of the area to ensure the suitability of the plot for the construction of a building. The Municipality then writes a letter to the Branch Municipality of the area where the plot is located. This process takes five days and does not incur a charge.

Stage 2
Obtaining Preliminary Location/Permit from Branch Municipality

The owner submits a c opy of the letter obtained previously from the Main Municipality to the Branch Municipality, requesting an inspection of the plot to ensure that the plot length, width and total area are as indicated on the deed. The Branch Municipality then issues an approval to use the land. This process takes five days and does not incur a charge.

Stage 3
Obtaining approval from the Fire Department

The Branch Municipality writes to the Fire Department, or Civil Defence, to obtain its approval of the plan submitted by the owner for the fire-alarm and fire-fighting systems. The Fire Department approves these plans and sends them back to the Municipality. This process takes ten days and does not incur a charge.

Stage 4
Obtaining a Final Building Permit

The Branch Municipality issues a Building Permit and sends it to the Main Municipality for approval, which is given dependent on the nature of the building. The owner can collect the Permit from the Main Municipality after one to three months. The cost of this Permit is SAR 1,200.

OMAN

The following is a general outline of the procedure for obtaining a building permit in the Sultanate of Oman but there are many further obligations and procedures to be completed within each of the stages. It is generally the responsibility of the lead consultant to obtain the building permit, although all applications must be signed off and submitted by locally registered consultants.

Stage 1
Submitting concept design/ masterplan stage application

The applicant submits a Concept Design/Masterplan application to the Ministry of Housing - Directorate General of Planning for approval of the proposed usage. At the same time utility requirements are identified and indicated to the relevant utility providers. If the project is tourism related, further approvals are required from the Ministry of Tourism and the Supreme Committee for Town Planning.

Stage 2
Obtaining No Objection Certificates (NOCs)

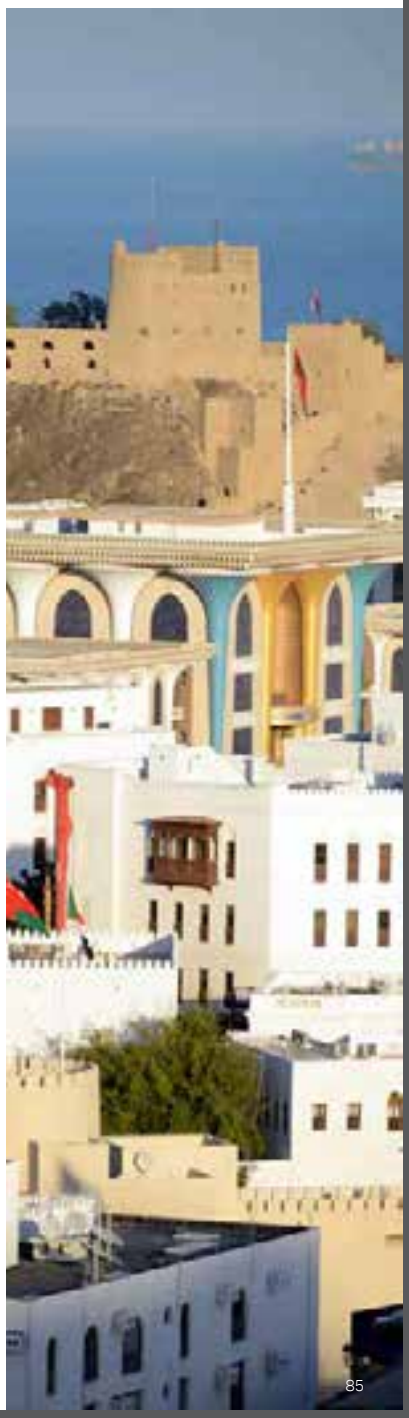
No Objection Certificates are obtained from various governmental and municipal departments, including, Royal Oman Police, Security Department, Traffic Department and Civil Defence, Ministry of Environment, Municipality Road Department, Ministry of Transport & Communications, Civil Aviation, and many more project-specific ministry departments, e.g. Ministry of Education if the project is a school or university.

Stage 3
Submitting a building permit application

The full building permit application, including all NOCs, is submitted to the relevant municipality or statutory authority.

Stage 4
Obtaining building occupancy certificate

Upon completion of the building works, it is the responsibility of the construction contractor or lead consultant to obtain the occupancy permit. This is achieved by having the building permit signed off, effectively closing it out. To obtain this closure, the contractor must obtain certificates and signatures from various government departments, including Civil Defence, Food and Hygiene, etc, prior to presenting these to the municipality or statutory authority for final approval.



QATAR

Compared with many countries, the planning and building approval process in Qatar is relatively clear and structured.

Land ownership, other than by Qatari nationals and the state, is still extremely limited. The key process in securing development rights is obtaining a land title or 'PIN' number; since without it all other permits and applications cannot be commenced. Once the land is secured, the project masterplan is submitted for approval to the Planning Department and local Municipality offices.

Stage 1
DC1 approval

General overviews and strategies for the utilities and primary infrastructure are submitted to the relevant utility service providers for comment. During this process each department generally issues a series of reference numbers which are then used as the file number for all future submissions. The culmination of this round of submissions is the DC1 approval. As the design develops, a second round of submissions is made to the same utility departments for final approval. In addition, a submission is made to the Qatar Civil Defence (QCD) department who review the fire and life safety aspects of the project.

Stage 2
DC2 approval

As the design develops, a second round of submissions is made to the same utility departments for final approval. In addition, a submission is made to the Civil Defence department who review the fire and life safety aspects of the project.

Depending upon the scale and nature of the project, separate traffic studies may be required and these would be submitted to the Road Affairs Department for approval. Qatar Civil Defence may request modifications to ACMV, FF. FA at this stage

Stage 3
Final stage/building permit

OOnce the DC2 approval is secured a further set of standard forms are circulated with a consolidated set of documents for final signing and approval. These documents constitute the Building Permit.

As a general guide the whole process usually takes at least 80 days (duration for private sector is stated in the KPI document issued by MME in relation to the corresponding size and type of the project), depending upon the quality of the submission, although in practice if often takes much longer due to comments from different departments and progressive design revisions.

During the whole of this process, it is generally not advisable to revise or modify any submission as it may delay the approval process.

All submissions have to be either in Arabic or bilingual and endorsed by locally registered and approved design companies. International companies cannot make these submissions by themselves.

There are some parts of Qatar which are exempt from the Building Permit approval process, but these are generally related to the oil and gas production facilities.

Recently a number of revisions have been made to the design standards of buildings, in particular high rise structures. These address issues such as fire safety, refuge areas, the use of lifts in the event of fire, and the nature and extent of façade glazing.

Fit-out and refurbishment projects now follow a similar DC1 and DC2 process, a change from the requirement to obtain a Maintenance Permit before work commenced. The approval process is now under the control of the Ministry of Municipality & Approvals.

This submission must be made by a registered local consultant and failure to do this can significantly delay the approval and permitting process.

The Statutory Approval process comprises of multiple stages that in turn, dictate the program parameters.

The stages are as follows:

Opening of the File –
Submission of MME Documents /Forms & Architectural Preliminary Drawings

DCI –
Fire/Life Safety (consists of Egress Paths, Occupancy Load, Emergency Lighting, Fire Ratings, etc) and Kharamaa drawings.

DC2 –
Fire Fighting, Fire Alarm, ACMV (upon request), Emergency Lighting and Kharamaa Loads confirmation (if requested by MME)

Building Permit –
MME Forms for Construction

Following approvals from all of the required Stages, and receipt of the Municipality Building Permit, it is only then that officially marks the time works may then commence on site. However, at the Landlord's discretion, mobilisation & demolition works may commence.

The main risks associated with Civil Defense approvals & Municipality Building permits are as follows:

- Submission of incorrect information, resulting in rejection of the application.
- Administrative delays within the Civil Defense Department.
- Public Holidays & Governmental Shutdowns.

Lusail Expressway, Doha,
Aerial view of the 5/6 arches 5/6 Interchange
Image courtesy of AshgHal

UAE

The following is a general outline of the procedure for obtaining a Building Permit in the UAE, but there are many further obligations and procedures to be completed within each of the stages. Building Permit application Stage 3, for example, requires no less than 15 different forms, documents and separate approvals to be submitted as part of the application.

It is the responsibility of the construction contractor or lead consultant to obtain the Building Permit, although all applications must be signed by locally registered consultants.

Stage 1
Submitting preliminary application

The applicant submits a preliminary application to the relevant municipality or statutory authority and pays a deposit.

Stage 2
Obtaining No Objection Certificates

No Objection Certificates (NOCs) are obtained from various governmental and municipal departments including Civil Defence,

Fire Department, Drainage, Communication, Water and Electricity, Civil Aviation, Oil and Gas, Coastal and Military.

Stage 3
Submitting building permit application

The full Building Permit application, including all NOCs, is submitted to the relevant Municipality or statutory authority.

Stage 4
Obtaining building permit

On approval, the applicant collects the Building Permit and applies for a Demarcation Certificate.

Stage 5
Obtaining building occupancy certificate

Application Form 1,2 and 3 must be submitted for a building license with a series of documents (including deed of title, contracts with accredited engineering firm, original copies of plans, original soil test report, approval from all relevant authorities, compliance forms for all regulations.

ICD Brookfield Place

Image courtesy of ICD Brookfield

04 REFERENCE DATA

IN BRIEF

INTERNATIONAL BUILDING COST COMPARISON

The international cost data shown is a comparison of local construction costs converted to US Dollars to enable comparison.

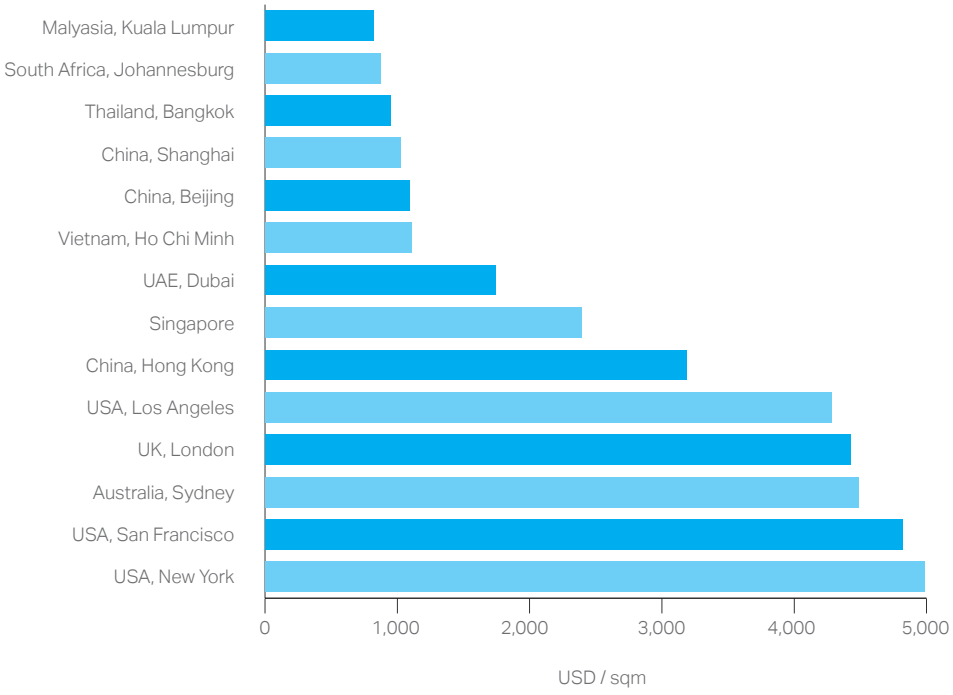
The building costs for the respective asset types are averages based on local specifications. The actual cost of a building will depend on its unique site conditions, design attributes and applicable tariffs, among other things. In addition, the standard for each building varies from region to region, which may have a significant impact on costs.

Costs are subject to considerable variations due to factors such as:

- **Local marked conditions**
- **Complexity of project**
- **Commodity price movements**
- **Building specifications**
- **Exchange rates**

COMMERCIAL BUILDING COST COMPARISON

Average building cost for standard offices — high rise



Average buiilding costs (USD/sqm)

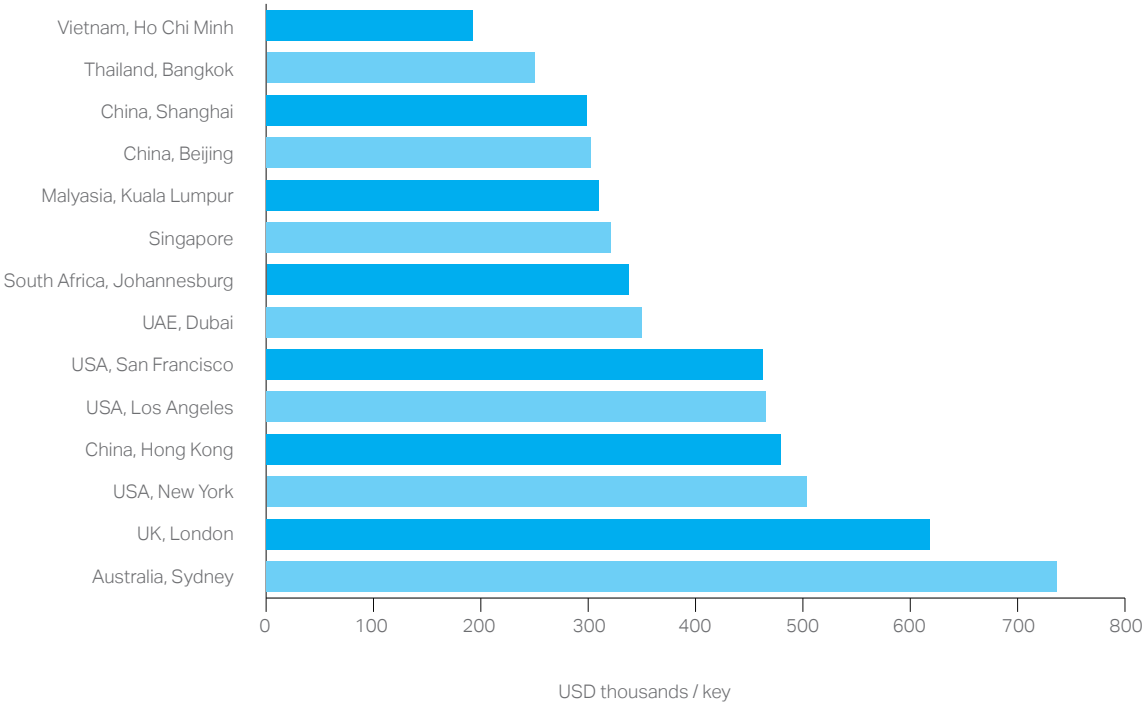
Building type	**Sydney** Australia	**Hong Kong** China	**Beijing** China	**Shanghai** China	**Kuala Lumpur** Malaysia	**Singapore** Singapore	**Johannesburg** South Africa	**Bangkok** Thailand	**Dubai** UAE	**Los Angeles** USA	**San Francisco** USA	**New York** USA	**London** UK	**Ho Chi Minh City** Vietnam
Average standard offices high rise	**4,439**	**3,200**	**1,115**	**1,030**	**875**	**2,400**	**1,092**	**954**	**1,750**	**4,300**	**4,500**	**5,000**	**4,833**	**824**
Prestige offices high rise	5,191	4,000	1,513	1,560	1,338	3,100	1,408	1,134	2,100	4,600	4,800	5,200	5,974	1,250
Major shopping center (CBD)	3,730	4,600	1,274	1,500	1,400	3,400	1,075	905	1,679	3,500	3,900	4,000	5,268	850
(As at 1 April 2018)	**AUD**	**HKD**	**CNY**	**CNY**	**MYR**	**SGD**	**ZAR**	**THB**	**AED**	**USD**	**USD**	**USD**	**GBP**	**VND**
US $1 =	1.30	7.85	6.28	6.28	4.00	1.40	11.86	31.00	3.68	1.00	1.00	1.00	0.72	22786

Source AECOM

Note: Prices exclude land, site works, professional fees, tenant fit out and equipment. Rates exclude GST/VAT. Costs based on 1 July 2018. Exchange rates to USD as at 1 April 2018

HOTELS BUILDING COST COMPARISON

Average building cost for a five-star luxury hotel



Average building costs (USD/key)

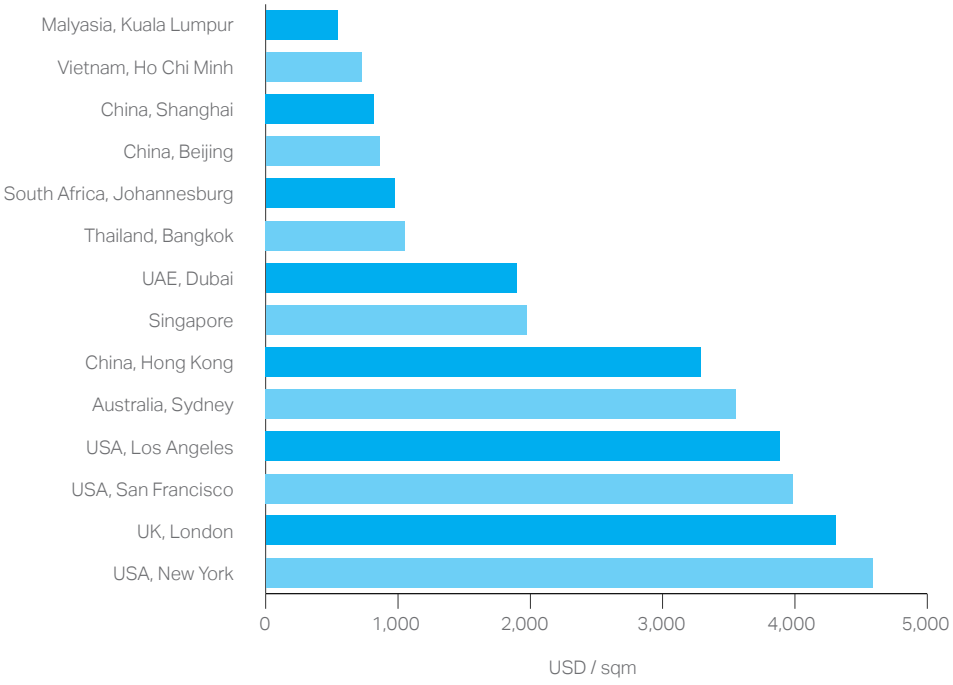
Building type	**Sydney** Australia	**Hong Kong** China	**Beijing** China	**Shanghai** China	**Kuala Lumpur** Malaysia	**Singapore** Singapore	**Johannesburg** South Africa	**Bangkok** Thailand	**Dubai** UAE	**Los Angeles** USA	**San Francisco** USA	**New York** USA	**London** UK	**Ho Chi Minh City** Vietnam
5 Star luxury	**736,336**	**480,000**	**302,548**	**298,500**	**310,000**	**321,400**	**337,265**	**250,000**	**350,000**	**465,700**	**462,600**	**503,500**	**618,463**	**192,777**
3 Star budget	362,020	225,000	139,331	NA	166,900	57,100	189,713	65,000	90,000	80,500	81,200	84,600	101,992	NA
Resort style	NA	NA	421,975	NA	281,300	214,300	NA	300,000	650,000	290,800	289,900	300,100	379,758	231,333
(As at 1 April 2018)	**AUD**	**HKD**	**CNY**	**CNY**	**MYR**	**SGD**	**ZAR**	**THB**	**AED**	**USD**	**USD**	**USD**	**GBP**	**VND**
US $1 =	1.30	7.85	6.28	6.28	4.00	1.40	11.86	31.00	3.68	1.00	1.00	1.00	0.72	22786

Source AECOM

Note: Prices exclude land, site works, professional fees, tenant fit out and equipment. Rates exclude GST/VAT. Costs based on 1 July 2018. Exchange rates to USD as at 1 April 2018

RESIDENTIAL BUILDING COST COMPARISON

Average building cost for standard residential — high rise



Average buiilding costs (USD/sqm)

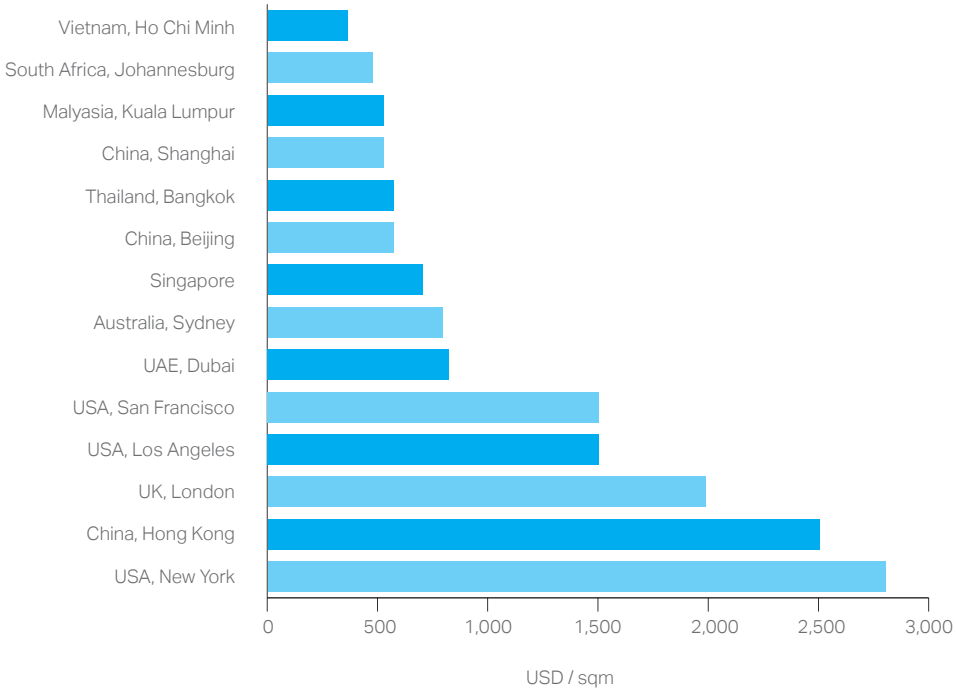
Building type	**Sydney** Australia	**Hong Kong** China	**Beijing** China	**Shanghai** China	**Kuala Lumpur** Malaysia	**Singapore** Singapore	**Johannesburg** South Africa	**Bangkok** Thailand	**Dubai** UAE	**Los Angeles** USA	**San Francisco** USA	**New York** USA	**London** UK	**Ho Chi Minh City** Vietnam
Average multi-unit high rise	**3,566**	**3,300**	**860**	**820**	**544**	**1,900**	**978**	**1,057**	**1,975**	**3,900**	**4,000**	**4,600**	**4,322**	**724**
Luxury unit high rise	4,167	4,600	1,672	1,530	913	3,300	1,442	1,572	2,380	4,900	5,100	5,900	6,059	890
Individual prestige houses	4,850	6,300	955	900	788	3,100	1,408	1,649	N/A	4,600	5,200	5,500	6,012	650
(As at 1 April 2018)	**AUD**	**HKD**	**CNY**	**CNY**	**MYR**	**SGD**	**ZAR**	**THB**	**AED**	**USD**	**USD**	**USD**	**GBP**	**VND**
US $1 =	1.30	7.85	6.28	6.28	4.00	1.40	11.86	31.00	3.68	1.00	1.00	1.00	0.72	22786

Source AECOM

Note: Prices exclude land, site works, professional fees, tenant fit out and equipment. Rates exclude GST/VAT. Costs based on 1 July 2018. Exchange rates to USD as at 1 April 2018

INDUSTRIAL, HEALTHCARE AND OTHER BUILDING COST COMPARISON

Average building cost for light duty factory



Average buiilding costs (USD/sqm)

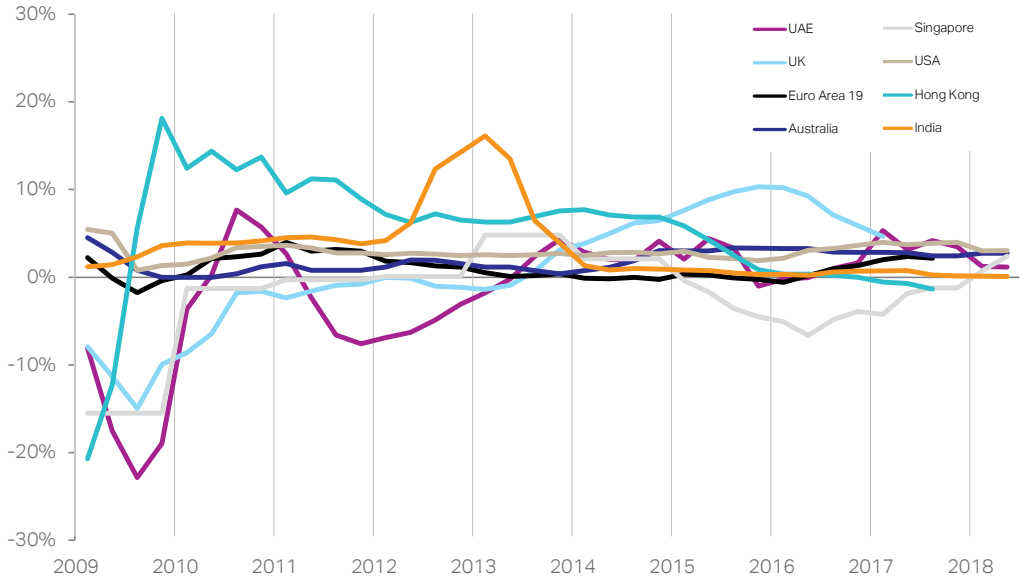
Building type	**Sydney** Australia	**Hong Kong** China	**Beijing** China	**Shanghai** China	**Kuala Lumpur** Malaysia	**Singapore** Singapore	**Johannesburg** South Africa	**Bangkok** Thailand	**Dubai** UAE	**Los Angeles** USA	**San Francisco** USA	**New York** USA	**London** UK	**Ho Chi Minh City** Vietnam
Light duty factory	**792**	**2,500**	**570**	**525**	**525**	**700**	**472**	**567**	**822**	**1,500**	**1,500**	**2,800**	**1,981**	**360**
Heavy duty factory	997	NA	NA	NA	575	900	531	902	1,454	1,900	2,000	3,600	3,400	463
Multi-storey car park	1,024	1,700	NA	NA	345	700	333	593	601	1,300	1,600	1,500	971	360
District hospital	6,386	5,800	NA	1,500	1,025	2,900	2,192	NA	2,700	6,500	6,900	8,400	4,882	N/A
Primary & secondary schools	2,623	2,800	NA	NA	375	NA	613	NA	1,510	4,200	4,100	4,600	3,128	N/A
(As at 1 April 2018)	**AUD**	**HKD**	**CNY**	**CNY**	**MYR**	**SGD**	**ZAR**	**THB**	**AED**	**USD**	**USD**	**USD**	**GBP**	**VND**
US $1 =	1.30	7.85	6.28	6.28	4.00	1.40	11.86	31.00	3.68	1.00	1.00	1.00	0.72	22786

Source AECOM

Note: Prices exclude land, site works, professional fees, tenant fit out and equipment. Rates exclude GST/VAT. Costs based on 1 July 2018. Exchange rates to USD as at 1 April 2018

INTERNATIONAL CONSTRUCTION COST INFLATION

International construction cost inflation
Quarter y-o-y change; Q1 2009 - Q2 2018



Source: Based on AECOM Indices for UK, UAE; ENR USA Construction Cost Index; Singapore Building Construction Authority, Hong Kong Building Works Tender Price Index, EuroaArea Eurostat Construction Output Index, India CIDC Construction Cost Index, AIQS Building Cost Index

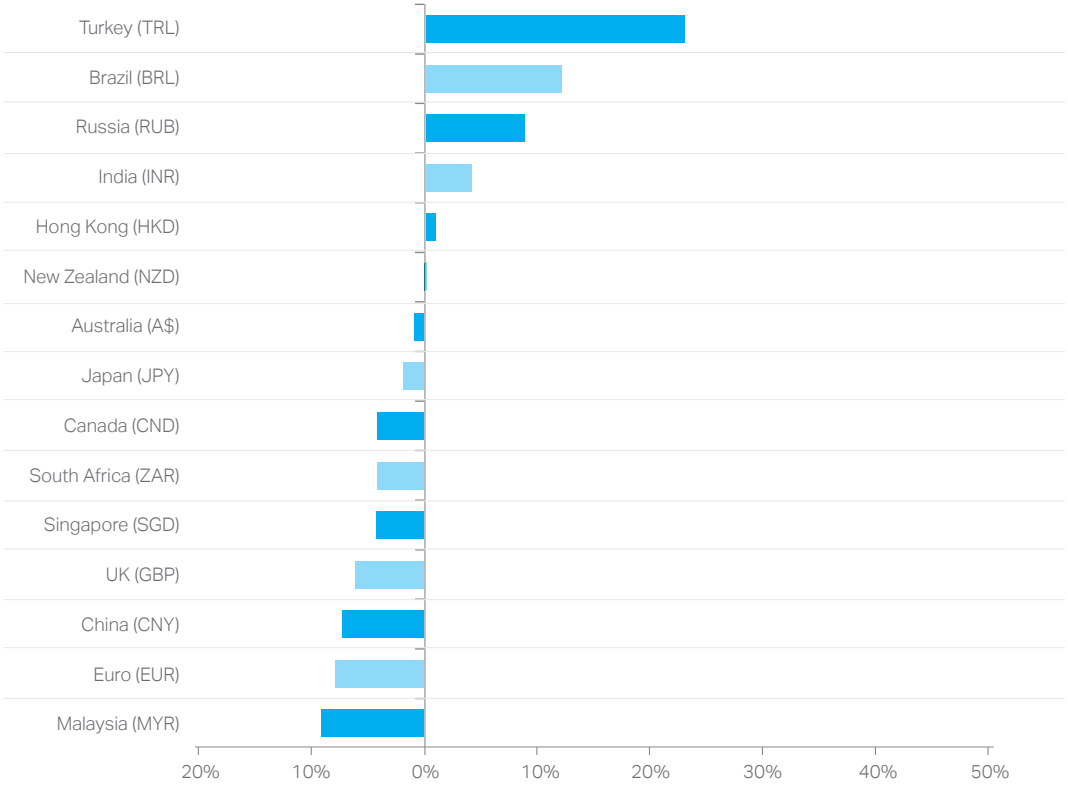
EXCHANGE RATE TRENDS

In recent years, exchange rate movements have been significant, as diverging economic performance has led to many major currencies experiencing major shifts against the US Dollar. Current exchange rate trends are being impacted by:

- Trade uncertainty and tariffs
- US Federal Reserve monetary policy shifts
- UK Brexit
- Elections in large, developing economies
- Political developments
- Corporate debt issues in China
- Global commodity price recovery

Currency depreciation against the US Dollar translates into a relative drop in building costs when expressed in US Dollar, making these locations/ regions relatively cheaper in US Dollar terms.

Exchange rate trends up to June 2018
Currency movements of the US Dollar against major currencies
June 2018 compared to June 2017



Source: Bank of England, www.xe.com

Grande
Image courtesy of Emaar

REGIONAL BUILDING COST COMPARISON

Building cost (US$/sqm)	UAE (Dubai)		KSA (Riyadh)		Qatar (Doha)		Bahrain (Manama)		Oman (Muscat)	
Typology	**Low**	**High**	**Low**	**High**	**Low**	**High**	**Low**	**High**	**Low**	**High**
Residential										
Low rise	1,000	1,550	800	1,350	1,300	1,600	800	1,350	850	1,000
Medium rise	1,050	1,550	1,250	1,500	1,600	1,850	1,050	1,600	1,050	1,300
High rise	1,550	2,400	1,650	2,050	1,900	2,150	1,450	2,000	N/A	N/A
Commercial										
Low-rise office (shell & core)	1,100	1,400	700	1,250	1,300	1,600	1,050	1,450	650	750
Mid-rise office (shell & core)	1,250	1,550	1,250	1,650	1,600	1,950	1,200	1,600	700	1,000
High-rise office (shell & core)	1,400	2,100	1,650	2,200	1,900	2,300	1,450	2,050	N/A	N/A
Fit-out — basic	1,000	1,550	700	950	1,300	1,800	650	950	400	500
Fit-out — medium	1,550	1,950	950	1,250	1,700	2,200	950	1,200	650	750
Fit-out — high	1,950	2,500	1,250	1,650	2,000	2,750	1,200	1,600	N/A	N/A
Retail										
Community	1,300	1,550	700	950	1,200	1,450	1,050	1,350	1,100	1,200
Regional mall	1,350	1,650	1,100	1,500	1,300	1,750	1,200	1,600	N/A	N/A
Super regional mall	1,500	1,900	1,250	1,800	1,300	1,900	1,450	1,850	1,100	1,250
Industrial										
Light duty factory	750	950	800	1,100	900	1,050	800	1,050	700	950
Heavy duty factory	900	1,100	1,100	1,200	1,050	1,300	950	1,200	900	1,200
Light industrial unit	650	750	700	800	750	900	650	950	N/A	N/A
Data center — Tier 3 (based on AED/kW(IT)	19,650	22,450	18,700	21,450	21,150	24,100	N/A	N/A	N/A	N/A
Hotel										
Budget	1,800	2,250	1,350	1,650	2,500	2,650	1,550	1,800	N/A	N/A
Mid market	2,250	2,800	1,650	2,200	2,700	3,650	1,650	2,250	2,300	2,950
Up market	3,350	3,800	2,600	3,000	3,700	4,400	2,100	2,650	2,650	3,100
Resort	3,200	3,900	3,000	3,550	4,100	4,950	2,500	3,350	N/A	N/A
Car parks										
Multi storey	550	650	600	750	800	950	450	650	300	300
Basement	800	950	800	950	900	1,050	650	1,000	650	700
Other										
Schools - primary, secondary academy	1,350	1,700	800	1,350	1,600	2,200	1,400	1,800	950	1,550
Healthcare - district hospital	2,200	3,200	1,950	2,750	2,350	2,950	2,500	3,050	2,150	2,750
Exchange rate to 1 US$	AED	3.67	SAR	3.75	QAR	3.64	BHD	0.37	OMR	0.38

Note: All costs are based on Q2 2018.
For typology definitions, inclusions and exclusions see pages 101 and 102.
Relative cost of construction are based on typical build costs in USD.
No investment or other business decision should incorporate the rates in the above table without first contacting AECOM for further information / clarification.
Influence of foreign exchange fluctuations, unique site conditions, design attributes and applicable tariffs must be considered when comparing actual projects.
Relative costs are based on an average across all sectors.

Inclusions and exclusions by asset typology

Asset class	Cost inclusions	Cost exclusions
Residential	– Fit-out works – MEP services Installations – Lift services Installations	
Commercial offices	– Internal finishes — lobby and core areas only – Fit-out works — lobby and core areas only – MEP services installations — lobby and core areas only – Lift services installations	– Internal finishes to offices – MEP services installations to offices – Active IT and phone equipment
Fit out (commercial offices)	– Fit-out works — architectural – Fit-out works — MEP services – Specialist installations (AV, IT, security) – FF&E	– Active IT and phone equipment
Retail	– Front of house fit out – Loose furniture and operators equipment – Kitchen and laundry equipment – Active IT equipment	– Tenant fit out
Industrial (light duty factory)	– Internal services – FF&E	– Storage/racking systems – IT and CCTV active equipment – OS&E – Production, process and laboratory equipment – Waste water treatment plant, compressed air plant – Process water and drainage systems – N+1/2 redundancy – Humidity/environmental control/conditioning other than standard air conditioning – Ultra flat slabs
Data centers		– Active equipment – FF&E – Utilities outside the building outline – Modular construction (based on one complete data center)
Hotel	– Fit-out – Loose furniture and operators equipment – Kitchen and laundry equipment – Active IT equipment	
Healthcare, education	– Fixed fit-out works only	– All loose fit out and ICT – All medical equipment

Note: All costs are based on Q2 2018

BASIS OF CONSTRUCTION COSTS

General notes

- The building costs for the respective asset types are averages based on competitive tenders analyzed by AECOM. It must be understood that the actual cost of a building will depend on the design and many other factors and may vary from the figures shown.
- Due to the volatile nature of the current market, it is possible that tenders will be received outside these ranges. Professional advice should be sought for specific projects.
- The standard for each building varies from region to region.
- General and specific cost inclusions and exclusions are listed below.
- Relative costs of construction are based on typical build costs in USD. Influence of foreign exchange fluctuations, unique site conditions, design attributes and applicable tariffs must be considered when comparing actual projects.

General cost inclusions

Construction works

Main contractor preliminaries and OH&P

General cost exclusions

External works and landscaping

Site infrastructure

Enabling works

Basements podiums and car parks

Contingencies

Undefined provisional sums

Utility connection charges

Statutory fees and charges

Professional fees

Client direct costs

Land acquisition

Finance charges

LEED silver or above

Staff accommodation

Pre-opening expenses

Mock ups

VAT

Basic specification of assets

Asset type	Residential		
Typology	Low rise	Mid rise	High rise
Specification	Basic, medium and high	Basic, medium and high	Basic, medium and high
Key design characteristics			
Building height	G+1 to G+3	G+4/5 to G+20	G+20 and above
GIA	80,000 - 140,000	50,000 - 80,000	90.000 - 120,000
BUA	85,000 - 155,000	55,000 - 90,000	105,000 - 135,000
Efficiency (%)	85 - 100%	80 - 85%	70 - 80%
Units per core	1 - 2	10 - 20	4 - 6
Wall:Floor ratio	0.50 - 0.80	0.45 - 0.65	0.45 - 0.55
Net to gross	80 - 100%	75 - 85%	65 - 75%
GIA per unit	200 - 450m²	90 - 200m²	145 - 165m²

Asset type	Offices		
Typology	Low rise (shell and core)	Mid rise (shell and core)	High rise (shell and core)
Specification	Basic, medium and high	Basic, medium and high	Basic, medium and high
Key design characteristics			
Building height	G+1 to G+5	G+5 to G+20	G+20 and above
GIA	10,000 - 25,000	25,000 - 75,000	100,000 - 250,000
BUA	13,000 - 30,000	30,000 - 100,000	130,000 - 280,000
Efficiency (%)	70 - 85%	70 - 85%	70 - 85%
Wall:Floor ratio	0.40 - 0.70	0.40 - 0.60	0.40 - 0.50
Net to gross	50 - 60%	50 - 60%	50 - 70%
Slab to slab height	4.0 - 5.0m	4.0 - 4.5m	4.0 - 4.5m
Grid spans	7 - 12m	9 - 12m	9 - 12m

Asset type	Retail		
Typology	Community	Regional	Super regional
Key design characteristics			
Finishes	Mid range	High	High
GFA (m²)	Not exceeding 30,000	30,000 - 100,000	> 100,000

Asset type	Industrial			
Typology	Light duty factory	Heavy duty factory	Light industrial unit	Data center — Tier 3
Specification	Basic	Basic	Basic	Basic
Key design characteristics				
Building height	8	10	6	6
GIA	10,000	20,000	6,000	4,000
Wall : Floor ratio	0.33	0.30	0.38	0.35

Asset type	Industrial			
Typology	Budget	Mid market	Up market	Resort
Specification	Basic	Mid range	Luxury	High end
Key design characteristics				
Building height	G+10	G+10	G+15	G+6
GIA	16,000 - 18,000	13,500 - 15,500	56,000 - 60,000	39,000 - 41,000
Wall:Floor ratio	70%	75%	75%	55%
Functional units	350	200	350	200

Asset type	School	Healthcare
Typology	Primary/secondary academy	District hospital
Specification	Mid range	Mid range
Key design characteristics		
Building height (m)	10	24
GIA (m²)	21,000 - 22,000	50,000
No of lift core	1	4
No of stair core	9	6

MECHANICAL & ELECTRICAL COST

Building Cost (US$ / sqm)	UAE (Dubai)		KSA (Riyadh)		Qatar (Doha)		Bahrain (Manama)		Oman (Muscat)	
Typology	**Low**	**High**	**Low**	**High**	**Low**	**High**	**Low**	**High**	**Low**	**High**
Residential										
Low rise	280	360	290	480	390	480	230	360	330	390
Medium rise	370	470	430	520	470	570	360	500	390	500
High rise	590	760	650	820	570	710	540	700	N/A	N/A
Commercial										
Low-rise office (shell & core)	360	430	200	370	390	480	370	510	240	310
Mid-rise office (shell & core)	420	500	370	490	470	570	470	560	280	370
High-rise office (shell & core)	470	580	570	870	570	820	660	900	N/A	N/A
Fit-out — basic	370	500	200	290	390	570	240	330	160	160
Fit-out — medium	500	650	290	370	570	730	300	420	240	290
Fit-out — high	650	830	430	570	720	910	390	600	N/A	N/A
Retail										
Community	360	430	240	340	410	480	360	450	480	530
Regional mall	430	560	380	520	460	610	410	500	N/A	N/A
Super regional mall	450	590	490	700	460	760	450	590	450	520
Industrial										
Light duty factory	260	310	250	330	260	310	540	740	300	380
Heavy duty factory	350	430	250	330	300	390	670	940	400	520
Light industrial unit	160	200	200	250	220	260	330	470	N/A	N/A
Data center — Tier 3 (based on AED/kW(IT)	14,430	16,490	13,610	15,780	15,860	18,340	N/A	N/A	N/A	N/A
Hotel										
Budget	450	560	540	650	860	1,050	470	560	N/A	N/A
Mid market	560	700	650	870	1,040	1,460	510	680	770	1,070
Up market	840	950	1,030	1,190	1,450	1,600	680	860	1,020	1,190
Resort	800	980	1,190	1,420	1,450	1,600	750	1,090	N/A	N/A
Car parks										
Multi storey	120	150	200	250	240	290	80	130	50	50
Basement	200	230	250	290	350	410	180	280	200	220
Other										
Schools - primary, secondary academy	540	670	290	480	640	880	370	490	340	430
Healthcare - district hospital	910	1,420	770	1,220	750	1,310	1,160	1,410	N/A	N/A
Exchange rate to 1 US$	AED	3.67	SAR	3.75	QAR	3.64	BHD	0.37	OMR	0.38

Note: All costs are based on Q2 2018.
For typology definitions, inclusions and exclusions see pages 101 and 102.
Relative cost of construction are based on typical build costs in USD.
No investment or other business decision should incorporate the rates in the above table without first contacting AECOM for further information / clarification.
Influence of foreign exchange fluctuations, unique site conditions, design attributes and applicable tariffs must be considered when comparing actual projects.
Relative costs are based on an average across all sectors.

MAJOR MEASURED UNIT RATES

Item (Unit rates in US$)	Unit	Description	UAE (Dubai)	KSA (Riyadh)	Qatar (Doha)	Bahrain (Manama)	Oman (Muscat)
Excavation	m^3	Standard/minimum specification Excavation for trench foundation; depth not excessive, i.e. no greater than 1-2 meters	7.1	8.1	11.4	6.6	4.7
Disposal of excavated material	m^3	Standard/minimum specification for disposal away from site	6.1	5.5	8.3	4.0	4.1
Filling	m^3	Imported fill	15.3	17.4	33.3	21.2	10.5
Poured concrete, reinforced	m^3	Standard/minimum specification Grade 20 or 30; superstructure, walls or slabs; reinforced	110.2	132.0	179.8	158.7	111.8
Reinforcement	tn	Standard/minimum specification 20mm bars	1,080.2	1,373.9	1,142.3	1,031.7	1,178.4
Formwork/shuttering	m^2	Standard/minimum specification Superstructure standard; fair face finish to walls	29.6	38.5	42.8	17.2	25.0
Blockwork	m^2	Standard/minimum specification 200mm solid blockwork, usually internal walls	35.7	36.0	55.4	24.1	35.5
Doors	no.	Standard/minimum specification for single leaf door, fire rated, timber, basic finish, usually 900mm wide, generally excluding ironmongery	1,087.3	1,135.0	1,373.6	846.6	972.5
Tiling to floors	m^2	Standard/minimum specification 300 x 300mm ceramic tiles	33.7	55.0	71.4	31.7	46.5
Plaster to internal walls and ceilings	m^2	12.5mm thickness	15.3	11.0	15.1	7.9	10.2
Painting to internal walls and ceilings	m^2	Standard/minimum specification Emulsion	7.1	8.3	6.9	6.6	5.1
Exchange rate to 1 US$			AED 3.67	SAR 3.75	QAR 3.64	BHD 0.37	OMR 0.38

Note: All costs are based on Q2 2018

MAJOR MATERIAL PRICES

Item	Description	Unit	UAE (Dubai)	KSA (Riyadh)	Qatar (Doha)	Bahrain (Manama)	Oman (Muscat)
			USD	USD	USD	USD	USD
Cement	Ordinary Portland Cement	Tonne	85	81	83	85	85
Sand	Sand for concreting	m^3	13	13	15	22	16
Aggregate	19mm aggregate	m^3	18	15	44	38	10
RMC	Grade 50 (OPC)	m^3	76	79	112	101	79
	Grade 40 (OPC)	m^3	71	73	108	95	69
	Grade 20 (OPC)	m^3	65	63	97	90	56
Reinforcing steel	High tensile	Tonne	735	543	999	688	556
	Mild Steel	Tonne	714	543	829	661	482
Hollow concrete blockwork	100mm thick	m^2	41	9	10	9	6
	200mm thick	m^2	49	12	16	11	7
Structural steelwork	Mild steel grade 50 to BS 4360	Tonne	1,035	1,601	2,495	1,058	1,247
Timber	Hardwood	m^3	792	800	1,206	934	2,997
	Softwood	m^3	303	467	804	331	520
Fuel	Diesel	Litre	0.48	0.15	0.56	0.40	0.53
	Petrol Premium 95	Litre	0.48	0.55	0.58	0.53	0.51
Exchange rate to 1 US$			AED 3.67	SAR 3.75	QAR 3.64	BHD 0.37	OMR 0.38

Note: All costs are based on Q2 2018.
For typology definitions, inclusions and exclusions see pages 101 and 102.
Relative cost of construction are based on typical build costs in USD.
No investment or other business decision should incorporate the rates in the above table without first contacting AECOM for further information / clarification.
Influence of foreign exchange fluctuations, unique site conditions, design attributes and applicable tariffs must be considered when comparing actual projects.
Relative costs are based on an average across all sectors.

LABOUR COSTS

Description	Unit	UAE (Dubai) USD	KSA (Riyadh) USD	Qatar (Doha) USD	Bahrain (Manama) USD	Oman (Muscat) USD
Skilled operatives						
Concreter	Hour	5.9	6.8	5.5	5.9	3.8
Steel fixer	Hour	5.9	7.3	5.5	6.5	3.9
Bricklayer	Hour	6.5	7.3	7.5	5.9	3.8
Carpenter	Hour	6.5	7.3	7.5	5.9	4.1
Mechanical installer	Hour	8.4	9.5	6.9	7.2	4.4
Electrician	Hour	9.0	9.0	9.0	8.0	4.4
Laborer (skilled)	Hour	5.7	5.4	5.5	5.0	3.5
Foreman	Hour	11.2	12.2	12.5	8.2	8.7
MEP foreman	Hour	12.6	15.0	12.5	7.8	9.0
Site engineer	Month	7,013	4,898	5,480	5,514	2,509
Construction manager	Month	11,221	14,150	12,329	11,690	5,292

Note: All costs are based on Q2 2018
These rates (US$) are indicative and represent an all-in unit cost for each of the disciplines listed; and are
- inclusive of: wages, salaries and other remunerations prescribed by local labour legislation; average allowances for costs of employment; recruitment; visas/permits; paid leave; travel; accommodation; health and welfare
- exclusive of: overtime working; contractor mark-up for overheads and profit;

VAT (Value Added Tax) or similar where applicable.
These rates should not be misinterpreted as contractors' daywork rates.

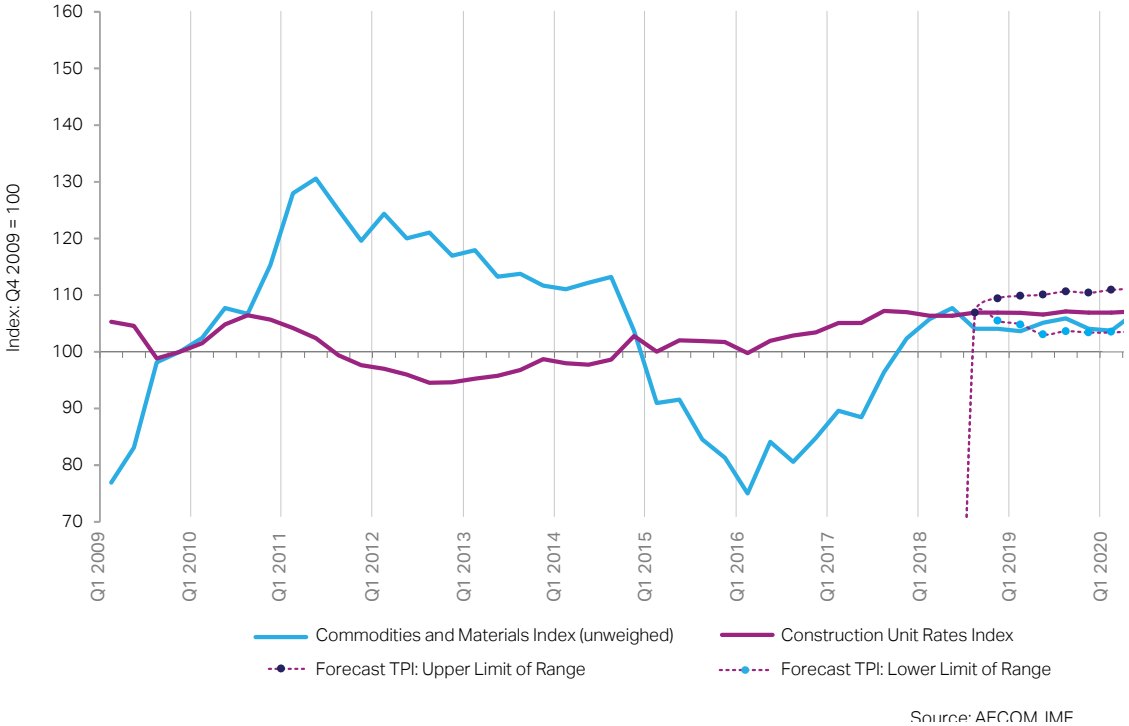
MIDDLE EAST INDICES

The UAE Tender Price Index is AECOM's assessment of construction tender prices in the UAE. It is compiled by AECOM's Middle East Business Intelligence team based on actual returns of projects. It is based on new build and refurbishment projects across a variety of construction sectors and covers all emirates of the UAE.

The Index is therefore a measure of average price increases across differing project types and locations. It should be regarded as a guide only when looking at any specific project, as the pricing of individual projects will vary depending on such factors as their complexity, location, timescale, etc.

The relative cost of construction in the Middle East is based on typical build costs in USD. High and low cost factors for each building type have been calculated relative to the UAE (Dubai), where average costs equal 100. The relative cost bars plotted in the chart represent the average high and low cost factor for each location, based on the costs of the buildings included in the sample (excluding commercial fit-outs).

AECOM UAE tender price inflation index and forecast

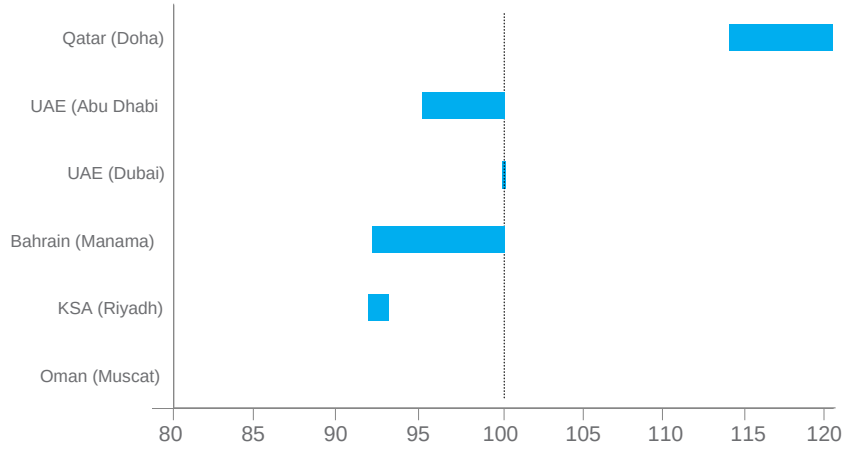


Source: AECOM, IMF

UAE tender prices annual percentage change

2008	2009	2010	2011	2012	2013	2014	2015	2016	2017 H1	2017f	2018f
-17.1	2.4	-3.5	-5.3	1.1	2.7	2.1	1	1.9	2.7	-0.5 - 2	1 - 3

Middle East relative cost of construction



Note: Relative costs of construction are based on typical build costs in USD. High and low cost factors for each building type have been calculated relative to the UAE (Dubai), where average costs equal 100. The relative cost bars plotted in the chart represent the average high and low cost factor for each country, based on the costs of the buildings included in the sample (excluding commercial fit-outs).

TYPICAL BUILDING SERVICES STANDARDS FOR OFFICES

Subject	BCO (UK) specification 2014	Bahrain specification	UAE specification	Qatar specification	Oman specification
Net : Gross Ratio (Typical)	80 - 85%	70 - 80%	75 - 80%	70 - 80%	70 - 80%
Occupancy standards — typical	1:8 - 1:13/m²	1:10 - 1:14/m²	1:10 - 1:15/m²	1:10 - 1:14/m²	1:10 - 1:15/m²
Occupancy standards — toilets	Single sex 1 person to 10m² using 60/60 male/ female ratio based on 120% ratio.	Single sex 1 person to 12m² using 50/50 male/ female ratio based on 100% population.	Single sex 1 person to 12m² using 50/50 male/ female ratio based on 100% population.	Single sex 1 person to 12m² using 50/50 male/ female ratio based on 100% population.	Single sex 1 person to 12m² using 50/50 male/ female ratio based on 100% population.
Heating and air conditioning internal criteria	"24oC, +/- 2oC (Summer) 20oC, +/- 2oC (Winter)"	24oC, +/- 2oC	24oC, +/- 2oC	24oC, +/- 2oC	24oC, +/- 2oC
Fresh air supplies	12 - 15 L/s per person	8.5 - 10 L/s per person	8.5 - 10 L/s per person	8.5 - 10 L/s per person	8.5 - 10 L/s per person
Ventilation - WCs (Extract)	none stated	10 Air Changes per Hour	10 Air Changes per Hour	10 Air Changes per Hour	10 Air Changes per Hour
Lighting load allowance	10 W/m²	10 W/m²	10 W/m²	10 W/m²	10 W/m²
Small power load allowance (based upon 1 workspace every 10m2)	20-25 W/m²	12 - 25 W/m²	12 - 25 W/m²	12 - 25 W/m²	12 - 25 W/m²
Acoustics — open plan	NR 40	NR 40	NR 40	NR 40	NR 40
Acoustics — cellular offices	NR 35	NR 35	NR 35	NR 35	NR 35
Lighting - VDU use	300 - 500 lux	400 - 500 lux	400 - 500 lux	400 - 500 lux	400 - 500 lux
Passenger lifts — capacity	0.8	0.8	0.8	0.8	0.8
Passenger lifts — waiting time (up-peak)	< 25 seconds	< 30 seconds	< 30 seconds	< 30 seconds	< 30 seconds

EXCHANGE RATES

	Euro zone	UK	India	China	Japan	UAE	KSA	Qatar	Oman	Bahrain	Kuwait	Egypt	Lebanon	Jordan
1 USD =	EUR	GBP	INR	RMB	JPY	AED	SAR	QAR	OMR	BHD	KWD	EGP	LBP	JOD
H1 2012	0.77	0.63	52.1	6.3	79.7	3.67	3.75	3.64	0.38	0.376	0.278	6.0	1,490	0.707
H2 2012	0.79	0.63	54.6	6.3	79.8	3.67	3.75	3.64	0.38	0.376	0.281	6.1	1,483	0.707
H1 2013	0.76	0.65	55.0	6.2	95.5	3.67	3.75	3.64	0.38	0.376	0.284	6.9	1,486	0.707
H2 2013	0.75	0.63	62.0	6.1	99.6	3.67	3.75	3.64	0.38	0.376	0.283	6.9	1,489	0.707
H1 2014	0.73	0.60	60.8	6.2	102.4	3.67	3.75	3.64	0.38	0.376	0.282	7.0	1,489	0.707
H2 2014	0.78	0.62	61.2	6.2	109.2	3.67	3.75	3.64	0.38	0.376	0.287	7.2	1,492	0.707
H1 2015	0.90	0.66	62.8	6.2	120.3	3.67	3.75	3.64	0.38	0.376	0.299	7.5	1,491	0.707
H2 2015	0.91	0.65	65.4	6.3	121.8	3.67	3.75	3.64	0.38	0.376	0.302	7.8	1,488	0.707
H1 2016	0.90	0.70	67.2	6.5	112.8	3.67	3.75	3.64	0.38	0.376	0.302	8.4	1,508	0.709
H2 2016	0.91	0.78	67.2	6.7	105.9	3.67	3.75	3.64	0.38	0.376	0.303	11.6	1,508	0.709
H1 2017	0.92	0.79	65.7	6.9	112.4	3.67	3.75	3.64	0.38	0.376	0.305	18.0	1,508	0.709
H2 2017	0.85	0.76	64.5	6.6	111.9	3.67	3.75	3.64	0.38	0.376	0.302	17.8	1,508	0.709
H1 2018	0.83	0.73	65.7	6.4	108.7	3.67	3.75	3.64	0.38	0.376	0.301	17.7	1,508	0.709

Source: Bank of England, www.fxtop.com

WEIGHTS & MEASURES

Metric measures and equivalents

Length

1 millimeter (mm)	=	1 mm	=	0.0394 in
1 centimeter (cm)	=	10 mm	=	0.3937 in
1 meter (m)	=	100 cm	=	1.0936 yd
1 kilometer (km)	=	1000 m	=	0.6214 mile

Area

1 square centimeter (cm^2)	=	100 mm^2	=	0.1550 in^2
1 square meter (m^2)	=	10 000 cm^2	=	1.1960 yd^2
1 hectare (ha)	=	10 000 m^2	=	2.4711 acres
1 square kilometer (km^2)	=	100 ha	=	0.3861 $mile^2$

Capacity / Volume

1 cubic centimeter (cm^3)	=	1 cm^3	=	0.0610 in^3
1 cubic decimeter (dm^3)	=	1000 cm^3	=	0.0353 ft^3
1 cubic meter (m^3)	=	1000 dm^3	=	1.3080 yd^3
1 liter (liter)	=	1 dm^3	=	1.76 pt
1 hectoliter (hl)	=	100 liter	=	21.997 gal

Mass (weight)

1 milligram (mg)			=	0.0154 grain
1 gram (g)	=	1000 mg	=	0.0353 oz
1 kilogram (kg)	=	1000 g	=	2.2046 lb
1 tonne (t)	=	1000 kg	=	0.9842 ton

USA measures and equivalents

USA dry measure equivalents

1 pint	=	0.9689 UK pint	=	0.5506 liter

USA liquid measure equivalents

1 fluid ounce	=	1.0408 UK fl oz	=	29.574 ml
1 pint (16 fl oz)	=	0.8327 UK pt	=	0.4723 liter
1 gallon	=	0.8327 UK gal	=	3.7854 liter

Imperial measures and equivalents

Length

1 inch (in)			=	2.54 cm
1 foot (ft)	=	12 in	=	0.3048 m
1 yard (yd)	=	3 ft	=	0.9144 m
1 mile	=	1760 yd	=	1.6093 km
1 int. nautical mile	=	2025.4 yd	=	1.853 km

Area

1 square inch (in2)			=	6.4516 cm^2
1 square foot (ft2)	=	144 in^2	=	0.0929 m^2
1 square yard (yd2)	=	9 ft^2	=	0.8361 m^2
1 acre	=	4840 yd^2	=	4046.9 m^2
1 sq mile (mile2)	=	640 acres	=	2.59 km^2

Capacity / Volume

1 cubic centimeter (cm^3)	=	1 cm^3	=	0.0610 in^3
1 cubic decimeter (dm^3)	=	1000 cm^3	=	0.0353 ft^3
1 cubic meter (m^3)	=	1000 dm^3	=	1.3080 yd^3
1 liter (liter)	=	1 dm^3	=	1.76 pt
1 hectoliter (hl)	=	100 liter	=	21.997 gal

Mass (weight)

1 ounce (oz)	=	437.5 grains	=	28.35 g
1 pound (lb)	=	16 oz	=	0.4536 kg
1 stone	=	14 lb	=	6.3503 kg
1 hundredweight (cwt)	=	112 lb	=	50.802 kg
1 ton	=	20 cwt	=	1.016 tonne

Temperature conversion

C = 5/9 (F – 32) F = (9/5 C) + 32

Forte
Image courtesy of Emaar

05 DIRECTORY OF OFFICES

DIRECTORY OF OFFICES

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06
FUTURE OF INFRASTRUCTURE

Resilient and sustainable infrastructure is critical to economic growth and social progress.

Looking at the challenges and opportunities ahead, the Future of Infrastructure report harnesses the views of more than 500 industry decision makers globally, all of whom work on projects of +US$100 million.

FUTURE OF INFRASTRUCTURE SURVEY

AECOM surveyed more than 500 senior industry decision makers, all of whom work on infrastructure projects valued at more than US$100 million. We also conducted detailed interviews with more than a dozen key figures in our industry. The aim was to better understand the problems, priorities and potential in delivering major infrastructure projects. A snapshot of the survey results is provided overleaf.

For more details, please refer to infrastructure.aecom.com

Appreciating the importance of infrastructure developments

The survey demonstrated that economic benefits and societal gains obtained from infrastructure developments are undervalued and the infrastructure community needs to work together on highlighting the importance of infrastructure in achieving national prosperity depends. Strong transport connections enable urban regeneration, new job creation, and the delivery of goods and services. Ignoring the importance of infrastructure will burden economies with congested roads, unreliable and overcrowded rail services, power outages, drought, flooding and cyberattacks.

When respondents were asked about the obstacles to delivering projects, financial obstacles were the most common followed by public opposition and shortcomings in decision making.
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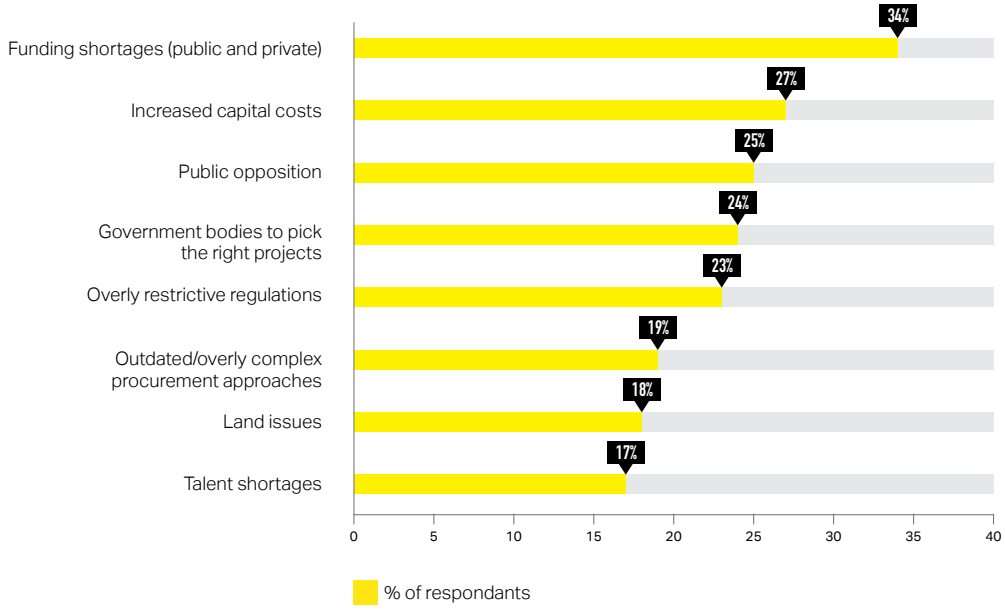
African construction markets, largest and fastest growing markets
Total construction output 2017e = USD 174bn



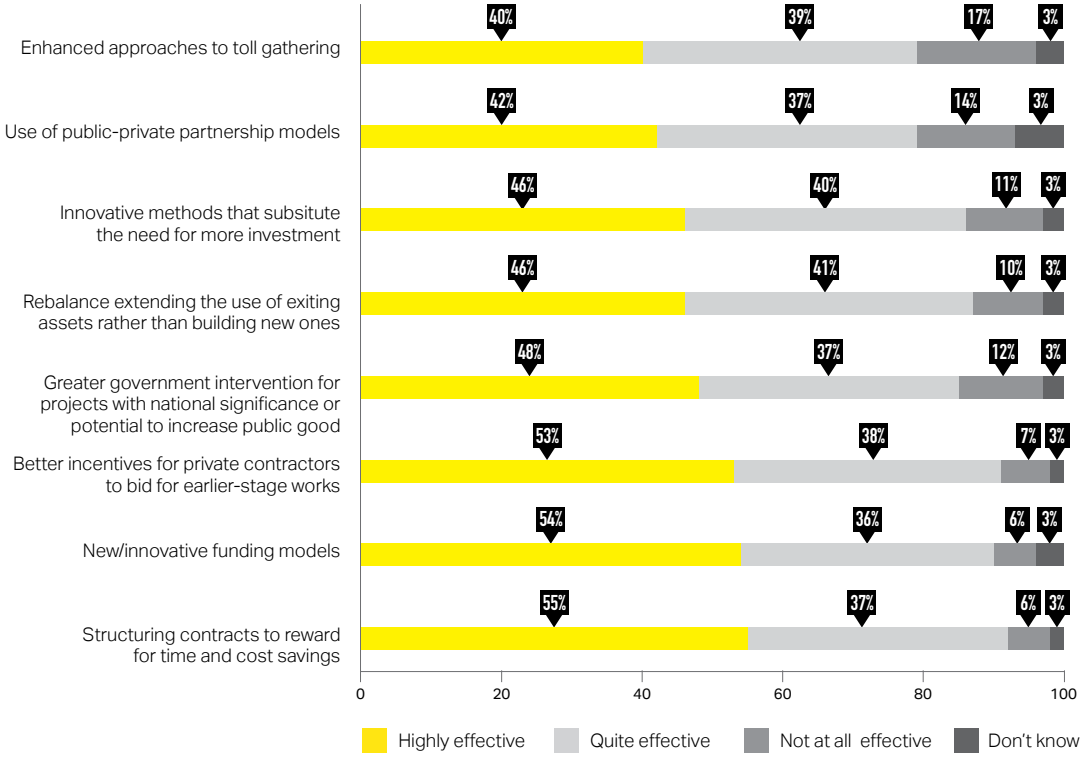
Source: AECOM Future of Infrastructure, 2018

Delivery of infrastructure projects is typically seen as the responsibility of the public sector. However, collaboration with the private sector and other project stakeholders is possible and has many benefits. Private sector involvement can help generate greater innovation, accountability, and long-term performance. The recent engagement of influential business figures — notably Elon Musk and Richard Branson — highlights the potential for attracting private enterprise.

When asked about effective solutions to bridge the funding gap for projects, respondents supported the collaborative project delivery approach. From the responses, 'structuring contracts to reward for time and costs savings' received the most support, followed by 'new innovative funding models' and 'better incentives for private contractors to bide for earlier stage projects'.

For more details on the AECOM survey, please refer to infrastructure.aecom.com

Effective solutions to the infrastructure gap



Source: AECOM Future of Infrastructure, 2018

ARE YOU READY FOR THE FUTURE OF INFRASTRUCTURE?

Is your organization ready for the challenges and opportunities ahead?

Use our five-minute tool to find out how you compare with infrastructure organizations around the world.

Discover more
infrastructure.aecom.com/benchmarking

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See how we deliver what others can only imagine at aecom.com and @AECOM.

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