

Middle East Handbook

Property and Construction Handbook 2016 Edition



FOREWORD

Welcome to the tenth edition of the Middle East Construction Handbook. We hope that you will find this year's review of the construction industry from 2015 to 2016 of interest and the selection of articles and cost data of value.

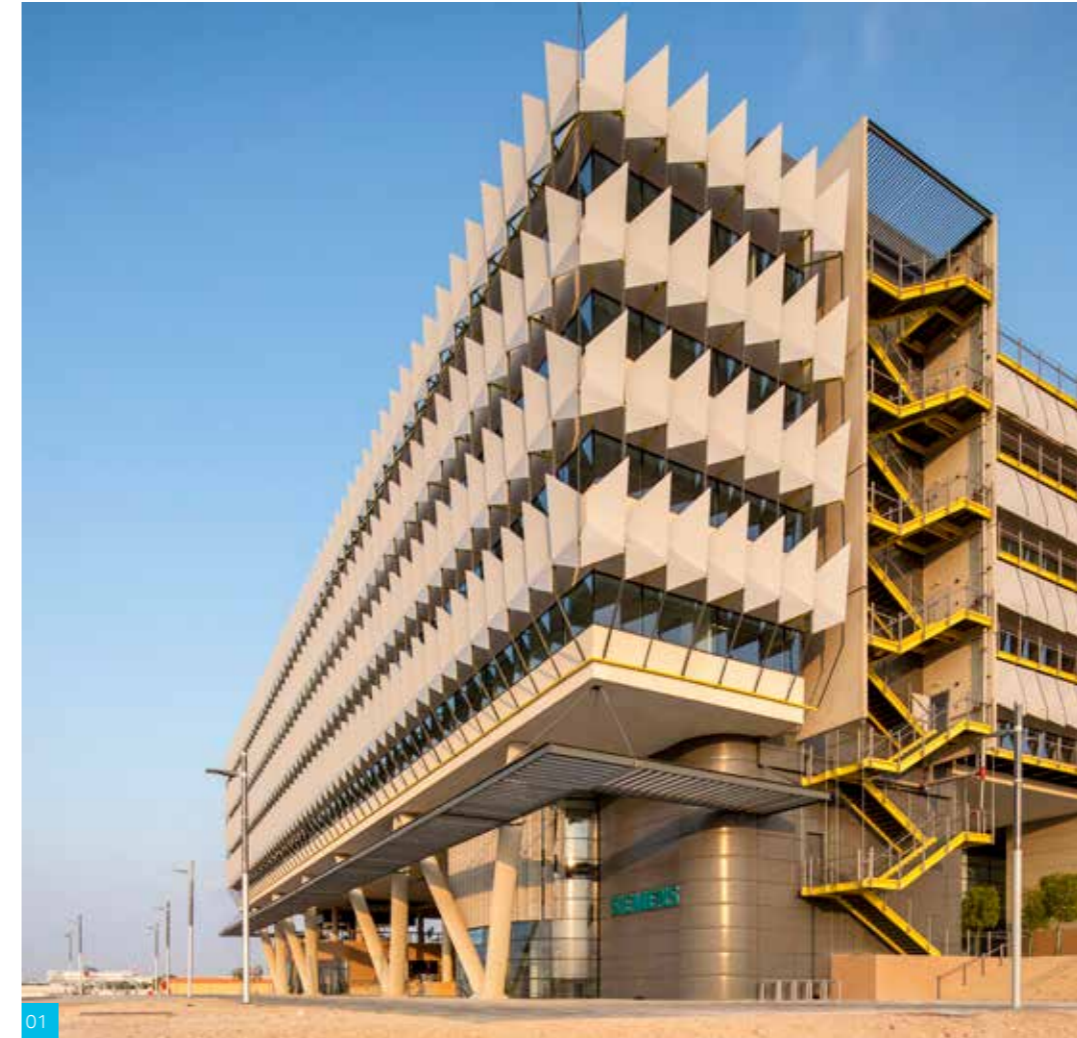
In 2016, we conducted our third Middle East Construction Survey with the aim to assess the state of the regional construction industry, to examine the drivers and barriers currently at play and to reflect on concerns expressed by our client organizations and other industry stakeholders. The survey findings have informed our review of the Middle East construction industry as outlined in the economic review.

Overall, concerns over a slowdown in regional construction work expressed last year materialized for the majority of the industry over the period to the second quarter of 2016, with both clients and the supply chain reporting that tougher business conditions are impacting on investment priorities and decision making. Nevertheless, the industry is moderately optimistic that whilst business conditions are tougher, work-flow will be sustained over the next few years. Governments, now more than ever, are under pressure to deliver the promises they have committed to in terms of investments in social and economic infrastructure to provide their populations with opportunities for growth.

As a company that designs, builds, finances, and operates infrastructure worldwide, and a company that thinks deeply about what infrastructure is and needs to become in this rapidly changing world, AECOM is engaged in exploring key questions that shape our world. This handbook is divided into six sections, providing a comprehensive view of the industry.

We begin with an economic round-up, covering construction in the Middle East, country statistics and global construction prospects. Next, our articles section brings together some of our insight and ideas about infrastructure using 'the city' as the conduit for discussion and debate across a variety of topics including urbanization, work, food supply, transportation and global events in cities. The reference article section gives insights about procurement routes, forms of contract in the Middle East and building regulations and compliance. We conclude the Handbook with our reference section, our international and regional cost data.

As with previous years, we continue to seek feedback to support our drive for improvement in everything we do. Please contact the editor, Hamed Madani via BI_MiddleEast@aecom.com for further information and to take part in AECOM's 2017 Middle East Construction Survey.



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02



03



04

01. Siemens Headquarters,
Abu Dhabi, UAE

02. Doha Oasis, Qatar

03. TALEX, Abu Dhabi, UAE

04. Tatweer Schools, KSA

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01



02



03



04



05

01. Qatar Public Realm, UAE

02. King Khalid International Airport,
Riyadh, KSA03. Clemenceau Medical Centre (CMC),
Amman, Jordan

04. Etihad Towers, Abu Dhabi, UAE

05. Al Ahlia University, Bahrain

AECOM Middle East

For nearly 60 years, we have been working in the Middle East to create a better tomorrow. We understand the region's cities — how they work, how they grow, and how they thrive across the built, social, economic and natural environments they inhabit.

Iconic buildings and mega-developments have long been a feature of skylines in many Middle Eastern cities; their silhouettes instantly recognizable and standing as powerful symbols of success. However, with growing populations and fluctuating oil prices, there is a changing emphasis in the approach to urban development which is becoming less about landmarks and more about long-term sustainability.

Our 4,000+ employees in the region are delivering a range of innovative projects and developments that are helping to build strong foundations for the future by contributing to the larger planning and growth of cities, defining their identity and economic positioning, expanding transportation, healthcare and educational opportunities, and forging stronger international connections.

Current AECOM projects include Hamad Port in Qatar and King Abdullah Port in the Kingdom of Saudi Arabia, which are advancing maritime transport and logistics services in the region. Etihad Rail in the UAE is playing a central role in the development of the UAE's industrial infrastructure, while Midfield Terminal (Abu Dhabi's new airport) is expanding the UAE's gateway to the world. In Bahrain, our master planners are ensuring a holistic and integrated approach to urban developments including Al Madina Al Shamaliya and Marina Durrat al Bahrain.

Throughout our work we ensure projects are rooted in local context and respond to environmental conditions.

For nearly 60 years, we have been working in the Middle East to deliver a better world.



Section

ONE

Economic
Round Up

Al Raha Beach Development in Abu Dhabi, UAE

AECOM was engaged as the overall landscape concept designer as well as the detailed designer for several key precincts. In addition AECOM maintained a site-wide design and coordination role for all the public realm consultants engaged on the project.



Middle East construction review

AECOM Middle East Construction Survey

In 2016 we conducted our third Middle East Construction Survey, with the aim to assess the state of the regional construction industry, to examine the drivers and barriers currently at play and to reflect on concerns expressed by our client organizations and other industry stakeholders. The survey findings have informed our review of the Middle East construction industry as outlined in this section.

Overall, concerns over a slowdown in regional construction work expressed last year materialized for the majority of the industry over the past twelve months, with both clients and the supply chain reporting that tougher business conditions are impacting on investment priorities and decision-making. It is no surprise that the prospects of low oil prices for years to come has drastically reduced revenues and reserve cushions in key countries, forcing governments to re-prioritize spending commitments and seek to accelerate economic reforms. In addition, public funds are being diverted to other priority areas such as security in the face of increased geopolitical tensions. These factors are having a direct impact on the construction industry in terms of increased gestation period for project assessment and award, as well as prolongation of project schedules. Nevertheless, the industry is moderately optimistic that whilst business conditions are tougher, work flow will be sustained over the

next years. Given the geopolitical tensions in the region, governments, now more than ever, are under pressure to deliver the promises they have committed to in terms of investments in social and economic infrastructure to provide their populations with adequate housing and job opportunities. Furthermore, the completion dates of key event-driven projects (i.e. 2022 FIFA World Cup Qatar, Expo 2020) are edging closer which should provide impetus to the industry. Against this backdrop, the construction industry will be monitoring the market to judge:

- Whether the regional industry is becoming mature enough to withstand the current uncertain market conditions to avoid another boom-bust cycle;
- Whether long-term infrastructure spending commitments and event driven investments are going ahead as planned;
- Whether the industry will adjust to economic reforms being implemented by governments seeking to diversify their budgets;
- Whether low oil prices will continue to be the overriding concerns for the industry, impacting on government sectors and private investments alike;
- How, with access to capital constraint, client organizations are managing their capital budgets efficiently to ensure projects are aligned with strategic goals and meet time/ budget performance targets.

Industry performance

The flow of industry workload slowed in 2015, as the sharp drop in oil prices and heightened geopolitical tensions, stalled government projects and weighed down on private business confidence.

Project awards totaled USD164.8 billion across the GCC in 2015, 5 percent lower than had been expected, but still a sizable amount. Kuwait, Oman and Qatar performed in line with expectations, while Bahrain outperformed, with project awards totaling USD3.2 billion, compared to USD1.5 billion anticipated for 2015. In contrast, project plans in the UAE and in particular in the Kingdom of Saudi Arabia did not materialize as envisaged last year.

Our findings from the AECOM 2016 Middle East Construction Survey confirm that business conditions have become tougher over the past 12 months to Q2 2016, as apprehension about

budgets amid persistent lower oil prices impacts on the flow of projects. Nine out of ten of those surveyed saw industry workload decrease over the past 12 months, the first time in three years that the vast majority reports a weaker industry performance.

Overwhelmingly, our survey participants noted that with few exceptions, the market has been impacted by governments reviewing budgets and scaling back investments considerably as they are adjusting to new oil price realities and re-evaluating their key projects. In addition, private project owners are faced with more limited access to finance to pursue their investments, as financiers review their exposure to the construction industry. Those companies that are reporting stable or increasing workloads report that the drive to deliver projects such as Expo 2020 and 2022 FIFA World Cup Qatar, as well as significant national infrastructure projects are sustaining the industry's project flow.

Figure 1. GCC project awards (forecast vs. actual)

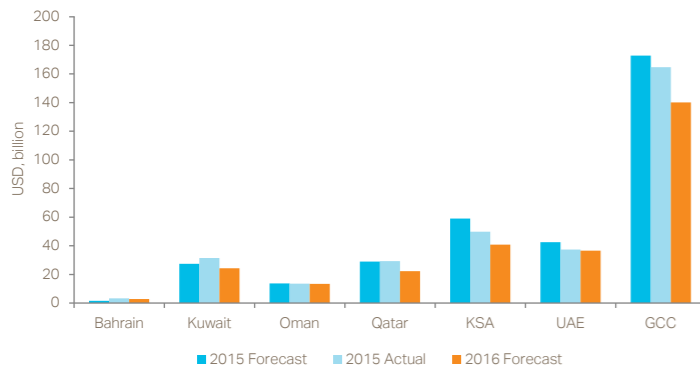
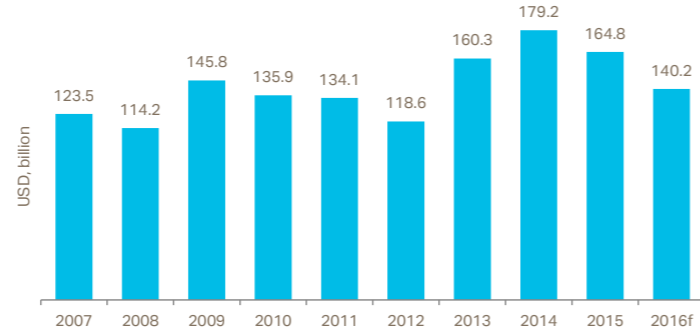


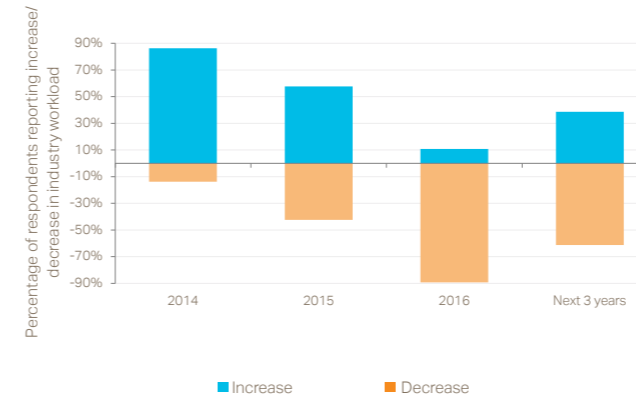
Figure 2. GCC project awards (over time)



Source: MEED

Figure 3. Construction industry growth

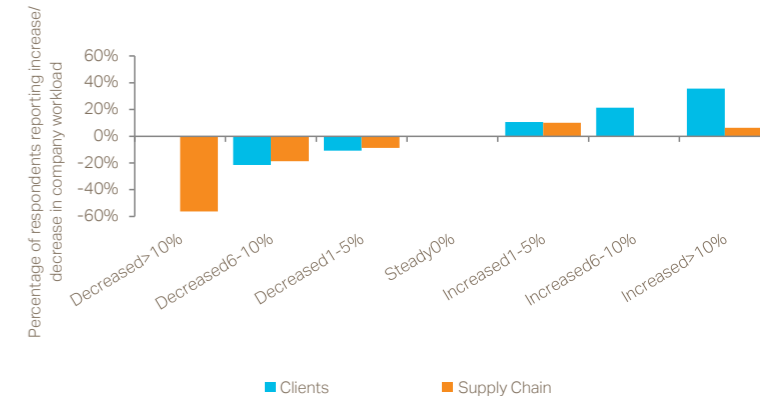
9 out of 10 respondents reported a decrease in construction workload over the past 12 months



Source: 2016 AECOM Middle East Construction Survey

Figure 4. Company workload growth

Clients report a more positive performance than the supply chain over the past 12 months



Source: 2016 AECOM Middle East Construction Survey

Whilst more than two-thirds of client organizations saw their workload increase stronger than the industry's over the past 12 months, just 16 percent of the supply chain (consultants and contractors) reported that they outperformed the wider industry. Client organizations report that the rise in their projects was due to planned growth, ongoing project commitments in infrastructure, tourism and event-driven projects, as well as efficient project execution. Those on the supply-side who saw their workload increase cited previously won projects, client relationships and repeat business, as well as having a diversified portfolio of clients. Forward planning with respect to prioritizing projects that align with government's new spending strategy is key. Companies also indicated that they are able to capture market share and outperform the market due to their ability to pursue large scale opportunities which suit certain contractors and consultants able to deliver an integrated offer. In contrast, many on the supply-side of the industry struggled last year to outperform the industry as increased competition led to aggressive pursuit of work to capture market share.

Client organizations report that the rise in their projects was due to planned growth, ongoing project commitments in infrastructure, tourism and event-driven projects, as well as efficient project execution.

Tempered growth outlook

On the back of a slowdown in workload over the past year and uncertain trading conditions, the majority of survey respondents are cautious about future growth, for the industry as a whole and their companies' prospects.

According to MEED, the value of contracts awarded in the GCC will significantly drop by 15 percent in 2016 to USD140 billion this year, compared with USD 165 billion in 2015. MEED also reports that the construction contracts awarded during the first quarter of 2016 within the region amounted to USD 30 billion – about 21 percent of the forecasted USD40 billion worth of construction contracts for 2016. Bahrain, Oman and the UAE are on track to meet project award expectations, but the Kingdom of Saudi Arabia and in particular Qatar are likely to miss their forecasts. According to MEED, out of the USD 30 billion, UAE accounts for USD 10 billion worth of projects, the Kingdom of Saudi Arabia projects at USD 7.2 billion, Kuwait at USD 4.8 billion, Oman with USD 4 billion, Bahrain with USD 1.7 billion and Qatar with USD 1.6 billion.

Whilst the project pipeline appears solid overall, the expected award data should be interpreted with caution. Based on historic trends, a significant proportion of projects in the pipeline may not be awarded in the time-frame planned, may be put on hold or in the worst case scenario, canceled. Our analysis shows that on average, just 65 percent of projects in the pipeline across the region are being awarded as planned. The share of projects postponed, or canceled, increases significantly in periods of economic uncertainty, for example, in 2012, the low points of expected project awards dropped to 20 percent in the UAE.

There is a significant difference in growth expectations among client organizations and their delivery partners. More than half of respondents to our survey on the client side expect the industry to expand over the next three years, of which more than a quarter expect growth over above six percent. In contrast, just a third of the industry's supply side expects an increase in workload over the next three years, with the majority anticipating industry workload to decline.

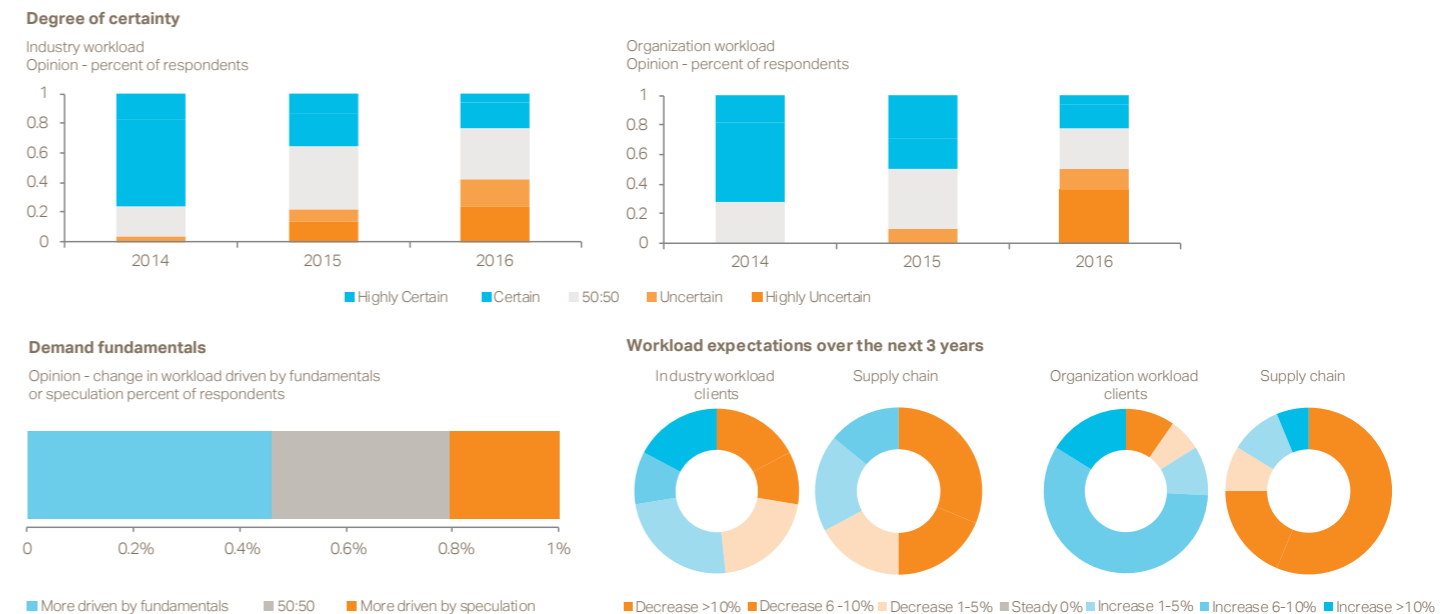
Those that expect the regional industry to expand over the next three years cite the continued need for social and transport infrastructure investments, the drive to complete projects for upcoming global events, Saudi Arabia's Vision 2030, and a rebound in oil prices to act as catalyst for private investment as key drivers. Locations such as Dubai and Bahrain are expected to outperform other markets in the regions such as Abu Dhabi or Kuwait over the next three years.

In contrast, survey respondents that expect the industry to go through a tougher three years, argue that persistent low oil prices will put constraints on revenues and force regional government to re-calibrate public budgets, focusing on current spending (i.e. public services) rather than capital investments.

Uncertain industry and organization prospects have increased significantly compared to the survey findings of the last two years, reflecting the generally weaker sentiment in the market. Indeed, more than two-fifths of respondents indicate that they are 'uncertain' about the industry's prospects, with nearly a quarter saying that they are 'highly uncertain' whether their anticipated growth projection will materialize over the next three years. The main cause of uncertainty is around when and to what extent primary revenue sources (oil) will rebound and the time it will take for national budget to recover and previously planned capital expenditure to be realized. Respondents are even more uncertain about their organization's prospects, with half of those surveyed describing organization workload expectations as 'uncertain', with more than a third appearing 'highly uncertain'.

Notably, client organizations expect their companies to vastly outperform the wider industry, with 84 percent of those surveyed expecting growth over the next three years, with the majority indicating that they expect a six to ten percent expansion. Growth expectations center on planned business expansion and a strategic push in key sectors. In contrast, the vast majority of those surveyed on the delivery side of the industry (consultants and contractors) expect their organization's workload to shrink over the next three years in line with a reduction in industry workload. Those few that expect their organizations to outperform report that it is their large-scale projects, won and underway, that will allow for steady revenue growth in an uncertain business environment over

Figure 5. Workload expectations and risks to outlook



the next few years. Reputation is also cited as a key strength, as clients are increasingly selective in choosing partners for their investments/development. Others cite a push to challenge for an increase in market share as their strategy to outperform the market.

The most positive responses continue to come from businesses in the UAE, Bahrain and to a lesser extent Oman, as they continue to meet or exceed workload expectations. Those in other regions are more doubtful about industry prospects. Such findings are largely consistent with the trading conditions in these countries. In the UAE, activity is led by Dubai where consensus remains around workload expectations surrounding Expo 2020 and associated transport, aviation and metro links, as well as tourism related projects. In contrast, uncertainty has increased in the real estate sectors over the past year, where buoyant demand especially in the residential sector, has waned this year amid more subdued demand levels and expectations of a price correction.

In Qatar workload expectations continue to center around preparations associated with the 2022 FIFA World Cup Qatar and associated infrastructure investments, a review of project viability, efficient project management and delivery and targets to achieve lower capital cost for projects continues.

MEED expects project awards this year to experience the sharpest drop in the Kingdom of Saudi Arabia, currently predicting that only USD40.7 billion worth of contracts will be awarded this year. Over the next few years, the industry will be monitoring development and initiatives associated with the Saudi Vision 2030 and the National Transformation Program 2020 launched in the first half of 2016 which are expected to open up new opportunities for the industry over the next decade.

Saudi Vision 2030 and the National Transformation Program 2020 (NTP)

Saudi Vision 2030 is a wide-ranging economic reform and privatization program that aims to reposition the Kingdom's economy away from its dependence on oil revenues and government spending.

The program entails strategic objectives, targets, outcome-oriented indicators and commitments that are to be achieved by the public, private and non-profit sectors in the Kingdom. Some of the initiatives included in the Saudi Vision 2030 include privatization targets such as a partial privatization of Saudi Aramco and the development of the Public Investment Fund (PIF), intended to become a sovereign wealth fund with a value up to USD3 trillion.

The National Transformation Program 2020 has been developed to help fulfill Saudi Vision 2030 by establishing strategic objectives and identifying the initiatives necessary for achieving specific interim targets in 2020. The National Transformation Program 2020 has been launched across 24 different Government bodies to help build the institutional capacity and capability required to fulfill the Saudi Vision 2030.

The following section provides a summary of the key initiatives and targets per Ministry to:

- Decrease subsidies
- Increase non-oil exports (focusing on manufacturing and light industry)
- Increase private sector investment and foreign direct investment
- Increase percentage of social and public infrastructure available to the population



Ministry for Energy, Mineral Resources and Industry targets includes:

- Decrease water and electricity subsidies by SAR 200 billion.
- Boost annual non-oil commodity exports to SAR 330 billion from SAR 185 billion.
- Increase the volume of private sector investments in high-potential regions from zero to SAR 28 billion.
- Spend more than SAR 2.5 billion on new initiatives over the next five fiscal years, including coordinating with relevant authorities to build production centers for manufacturing and light industries in Raas Abu-Gamis, Bani-Tamim and Debaa

Ministry for Transport targets includes:

- Increase private sector contribution to developing and operating railways projects (from 5 percent to 50 percent) and ports projects from 30 percent to 70 percent.
- Spend over SAR 5.5 billion on new initiatives over the next five fiscal years, including the establishment of private sector operation and maintenance concession contracts and development of an integrated program to increase the efficiency of ports.

Ministry of Health targets include:

- Increase private healthcare expenditure (from 25 percent to 35 percent) and total revenue generated by the private sector (from SAR 300 million to SAR 4 billion).
- Spend over SAR 23 billion on new initiatives over the next five fiscal years, including reform and restructuring of primary health care, the establishment of private public partnerships, the privatization of one of the medical cities and the localization of the pharmaceutical industry.

Saudi Arabian General Investment Authority targets include:

- Raise direct foreign investment from SAR 30 billion to SAR 70 billion.
- Developing a unified national investment vision to promote and direct investments supporting the national economy, resulting in SAR 2.3 trillion in new investment opportunities.
- Spend SAR 1 billion on new initiatives over the next five fiscal years, including the development and execution of plans for localizing construction material and equipment industries and the transportation and logistical services sector, establishment of a government agency to manage and execute mega projects, launching the unified permits for foreign investors and the execution of the “National Investment Plan.”

Haj, Umrah and Tourism targets include:

- Increase total new tourism investment from SAR 145 billion to SAR 171.5 billion.
- The Saudi Commission for Tourism & National Heritage to spend over SAR 10 billion on new initiatives over the next five fiscal years, including the development of Ola City, Uqair, Farasan Islands and Okaz City.

Royal Commission for Jubail and Yanbu targets include

- Increase the number of value-added basic manufacturing and transformation products from 432 to 516.
- Increase the size of the private sector’s new investments from SAR 681 billion to SAR 1.065 trillion.
- Spend SAR 41.5 billion on new initiatives over the next five fiscal years, including the development of new infrastructure in Yanbu Industrial City (including the localization of the renewable energy industry and rubber industry and establishment of industrial gases and steam networks), Jubail Industrial City, Ras Al-Khair Industrial City and Jazan Economic City.

King Abdullah City for Atomic and Renewable Energy targets includes:

- Increasing the local content in the industrial and service value chains and localization of expertise in the renewable energy sector (from 25 percent to 35 percent) and the atomic energy sector (from 25 percent to 30 percent).
- Spend SAR 5 billion on new initiatives over the next five fiscal years, including the atomic energy sector (identification and preparation of the construction locations of the first nuclear power plant sites and provision of necessary infrastructure), the renewable energy sector.

Ministry of Water targets includes:

- Increase percentage of desalinated water production through strategic partners from 16 percent to 52 percent.
- Increase percentage of treated water production through strategic partners from zero to 20 percent.
- Increase percentage of cities covered with water and sewage services through The National Water Company (42 percent to 70 percent).
- Spend SAR 12.9 billion on new initiatives over the next five fiscal years, including the expansion of the number of the cities covered by the services of The National Water Company in collaboration with the private sector.

Ministry of Housing targets includes:

- Increase contribution of real estate sector to GDP from 5 percent to 10 percent.
- Increase percentage of available housing units (new and unoccupied) to total number of eligible citizens (10 percent to 50 percent).
- Spend SAR 59 billion on new initiatives over the next five fiscal years, including encouraging private sector real estate developers to invest in housing projects and establishing partnerships with private sector developers to develop government lands into large-scale housing projects.

Ministry of Education targets include:

- Spend SAR 24 billion on new initiatives over the next five fiscal years, including encouraging private sector investment in public education in the Kingdom.

Growth areas and investment priorities

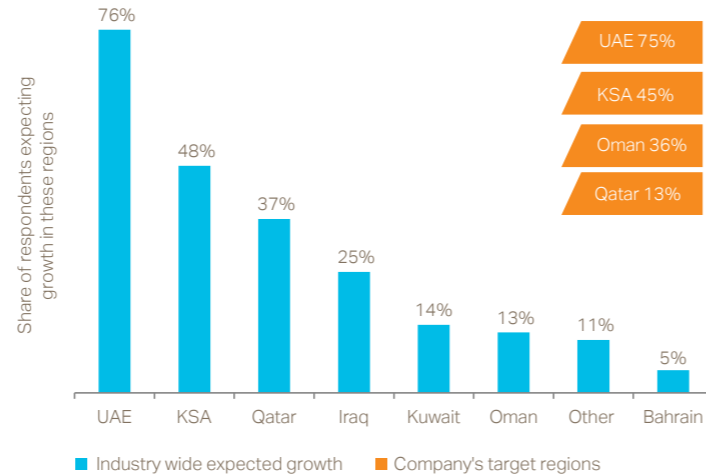
The region's construction industry is going through a renewed cycle of consolidation, witnessing the historic trend of lower oil prices translating into slower project implementation as well as suspensions.

At the same time, these efforts to rationalize public spending come at a time when economic diversification is a central policy priority across the region and governments are envisaging a multitude of infrastructure investments to strengthen the competitiveness of their economies. In addition, the long-term fundamental drivers for construction demand across the region still remain in place, which, together with global events-driven projects, should support the projects market in the region. Fiscal reserves, urbanization and population increases will continue to place pressure on housing, water, electricity, transport and social infrastructure, and the region's governments will seek to meet these demands to ensure social cohesion in the face of heightened geo-political risks.

Despite headwinds, the industry believes that there are opportunities across the region and across sectors. In particular, project award data up to Q2 2016 period shows that the market is now split into two streams: meeting or exceeding expectations in Dubai, Bahrain and Oman; and not meeting expectations in Qatar, Abu Dhabi and the Kingdom of Saudi Arabia. Dubai appears to be decisively tacking the oil price issue by announcing a number of new projects and pushing ahead with its vision. On the other hand, Qatar and KSA in particular are struggling as the government is unable to find or release funds to pay for projects.

In line with this, the UAE, and more specifically Dubai is now seen as the most attractive country to invest in in the region, with three-quarters of those surveyed viewing the UAE as the priority market both for the industry as a whole and their organizations. Apart from high-profile projects such as Expo 2020, Dubai is pushing ahead with other mega-projects. Dwarfing all infrastructure projects is the Al Maktoum International Airport expansion, currently budgeted at USD32 billion according to MEED, which when completed, is planned to accommodate more than 200 million passengers a year. There are also large-scale mixed-use developments in the pipeline, the most prominent of

Figure 6. Growth regions

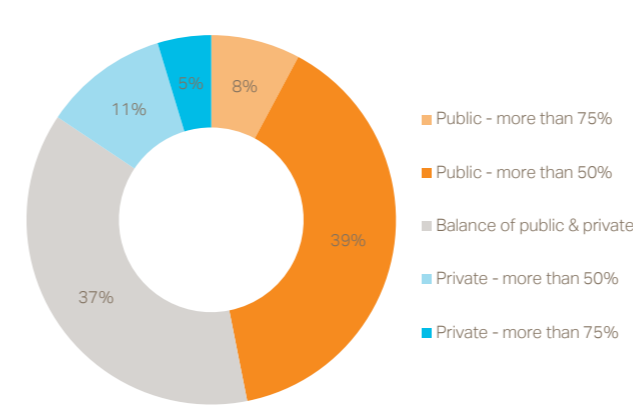


which is Dubai Holding/Emaar Properties Dubai Creek Harbour currently budgeted at USD17.7 billion and planned to be developed over a 30-year horizon. In this regard, Dubai may be 'ahead of the curve' within the GCC with regards to its ability to push ahead with economic growth in times of lower oil prices and greater uncertainty. Having not had the luxury of oil as its main source of revenue, the need to push through with economic diversification is 'business-as-usual'.

Despite project award data showing a significant slowdown in the Kingdom of Saudi Arabia and Qatar, our survey shows that both remain important targets for the industry in the region. In addition, our survey shows that the industry expects the re-emergence of two large regional markets – Egypt and Iran providing project opportunities for the sector in particular for first movers.

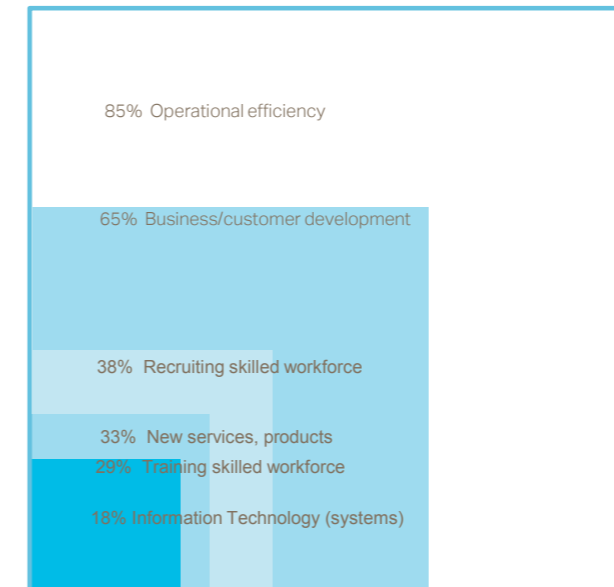
This year our survey participants are expecting balanced growth across the industry sectors moving forward. This is in contrast to previous years, where transportation dominated growth expectations. Possibly reflecting the regions renewed emphasis on 'economic reform and diversification', survey participants are anticipating progress with real estate and hospitality sector projects that support the economic reform being targeted.

Figure 7. Workload expectations by type of client



Source: AECOM 2016 Middle East Construction Survey

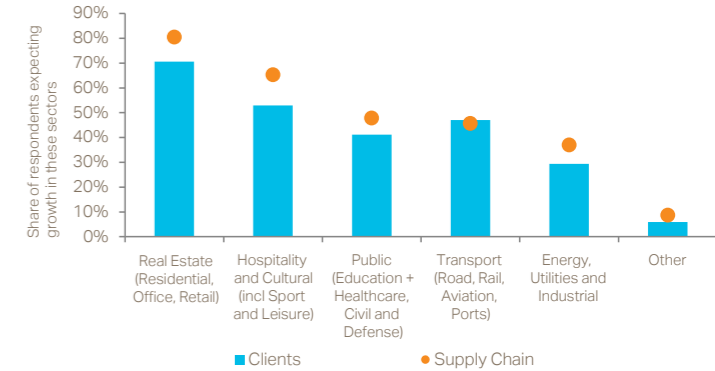
Figure 8. Company investment priorities to achieve growth



Source: AECOM 2016 Middle East Construction Survey

Figure 9. Growth sectors

Industry perception of growth sectors and company target sectors



Despite the call on the private sector to offset some of the slack in the public sector, our survey participants expect construction firms to still be heavily dependent upon public sector plans for future workload. More than 60 percent of respondents believe currently the main source for project financing is the government. 47 percent of respondents expect public works to make up more than 50 percent of the workload over the next three years. However, a proportion (37 percent) anticipate a successful transition to a balanced 50:50 public and private workload over the next three years. The importance of government workload, in terms of the tangible capital investment and the intangible market sentiment, cannot be underestimated.

Such reliance amid potential public belt tightening could mean diminishing work from a vital source of new projects. Hospitality and cultural related work is a priority growth sector for nearly half those surveyed, driven mainly by works related to the 2020 Expo in Dubai, which has spurred interest not only in directly related works, but also in retail, hospitality, theme parks and other attractions related projects.

Reflecting increased business uncertainty, expected slower industry growth and tighter cash flows, the industry is focusing on operational efficiency to achieve their business growth targets. In addition, business and customer development remains a key investment area for businesses, with many survey respondents suggesting a focus on winning repeat work from established clients. Compared to our 2015 survey, recruitment of workforce is still important but no longer the main priority.

Market pricing

Across the region, tender prices remained relatively unchanged compared to last year, but there are considerable variations in the market, with some regions reporting a softening in prices while others experience some capacity constraints. Overall, the current pricing environment is very competitive and client organizations continue to press for the best possible prices.

The majority of regions, and in particular the Kingdom of Saudi Arabia, Qatar and the UAE report that lower global commodity prices and increased competitiveness for fewer private and government financed projects have begun to filter through to increasingly competitive pricing. Whilst the total project pipeline reported by MEED indicates that there is still enough work to potentially fill order books, contractors' and consultants' prospects are vulnerable to tender periods taking much longer to conclude, if at all.

Experienced contractors able to deliver large-scale, complex projects still benefit from priority infrastructure projects being awarded to established contractors with a delivery track record. These have been able to pick and choose projects and the pricing of tender components such as overheads and profits has remained relatively stable. For the mainstream construction market, competition, little capacity constraints, as well as low commodity prices mean that clients are pressing for lower project costs.

Our 2016 survey shows the industry currently has sufficient capacity when it comes to labor, plant and equipment and materials, and this trend is expected to continue to persist over the next three years. Consequently, no significant pressure on tender prices is expected in the near term. Regional variations do persist both between and within countries, and large-scale projects, in particular those in remote locations, may face higher construction costs mainly as they require experienced contractors able to deal with the scale of the projects. In addition, in smaller markets such as Bahrain survey respondents report an increase in capacity utilization on the back of stronger project awards. In the majority of locations across the region however, survey respondents report that competitive pricing prevails as contractors and consultants alike to secure workload.

Despite the drop in oil prices, survey respondents report that energy and fuel costs exerted significant pressure on input costs over the past year, due in parts to cuts in government subsidies. Looking ahead, the industry expects energy and fuel costs to continue to rise over the next years due to an expected rebound in oil prices and further energy market reforms across the region as government seek further cut fuel and electricity subsidies to make their budgets less dependent on oil. In line with these market reforms, the industry is bracing itself for a potential rise in taxes, such as VAT, with the majority of survey respondents expecting the introduction of taxes and quasi-taxes, levies to increase their business costs.

More than half of survey respondents report a fall in tender price inflation over the year to June 2016, the majority of which report a decrease of one to five percent. A third of those surveyed reported stagnant prices. This is generally in line with AECOM's analysis of tender prices, which saw a general softening in prices since the latter half of last year. However, the survey and our data shows that tender price trends have varied considerably over the past half year, with downward and upwards movements being reported. Well established contractors with a delivery track record and able to choose clients and projects are still commanding an

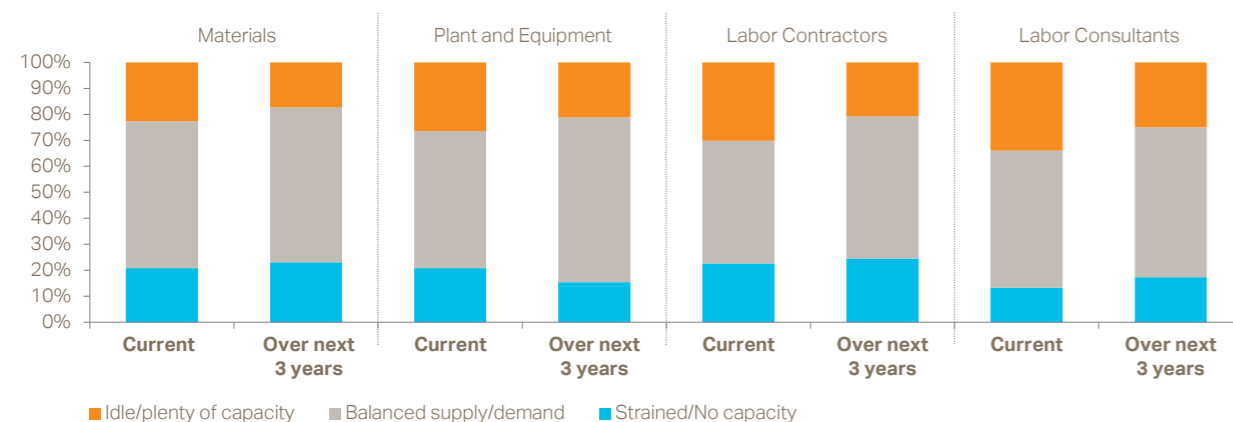
uplift on tender prices. In contrast, feedback from the market suggests that contractors eager to secure a continuous flow of workload at a fixed price over a longer time period may have to price a lot more competitively.

This discrepancy is also visible in reported profit margins, with two-fifth of survey respondents reporting a decrease in their margins over the past year, while nearly half saw their profit margins unchanged.

Looking ahead, nearly half of survey participants expect construction tender prices to decrease over the next three years, the first time the industry anticipates a fall in the history of our survey. The drop in pricing confidence reflects the uncertainty around project awards, as expectations are that clients will remain cautious in the current business climate and are likely to pressure the construction supply chain to accepting reduced capital costs. However, whilst the industry is bracing itself for softer prices, the majority of those surveyed expect the decrease to be moderate over the next three years, in the range of one to five percent, as the supply will seek to pass on input cost increases, mainly from fuel and raw materials costs.

Regional variations will persist and more active locations, such as Dubai and Bahrain may see firmer tender prices over the next three years. Bahrain has seen a general uptick in construction activity recently, which may lead to some capacity constraints in this small market. Dubai is still expected to award a number of large high-profile schemes over the next years, such as Expo 2020 related projects, Al Maktoum airport expansion, or Dubai Creek Harbor, which will impact the market dynamics for the more established contractors and consultants. Other locations will continue to feel the impact of less government spending and fiercer competition from fewer projects, coupled with an expected increase in the cost of doing business in the region resulting from economic reforms.

Figure 10. Capacity in the building industry
Share of Respondents



Source: AECOM 2016 Middle East Construction Survey

Figure 11. Expected change in costs over the next 3 years
% of Respondents

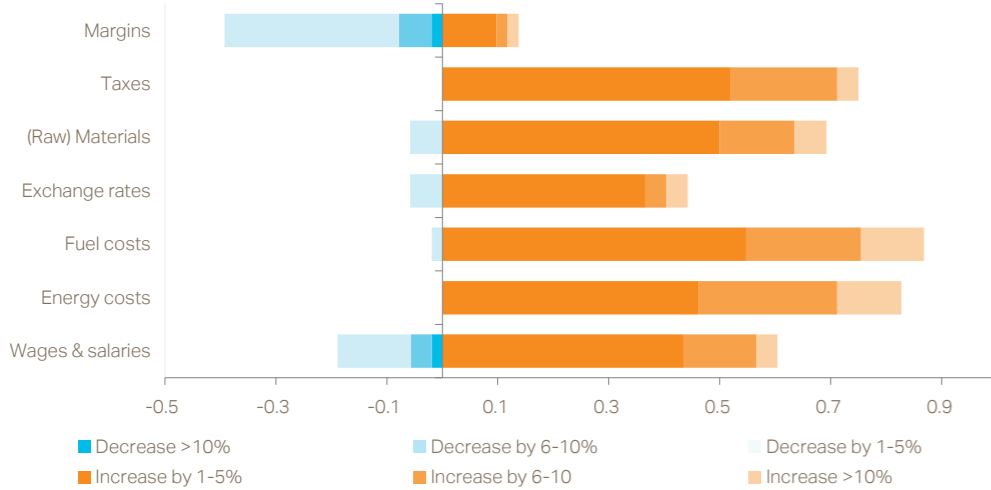
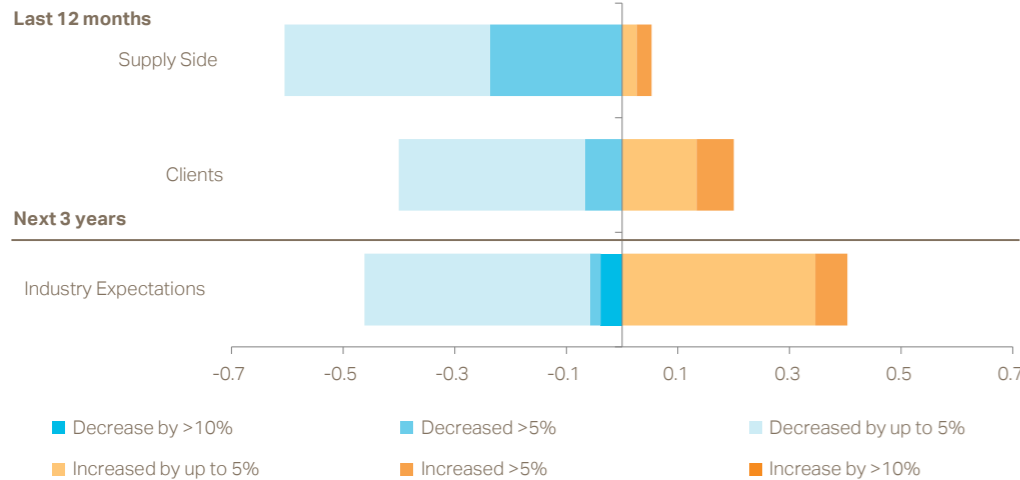


Figure 12. Tender prices
% of Respondents



Source: AECOM 2016 Middle East Construction Survey

Challenges and risks

The regional construction industry is experiencing a tough market, with the industry facing restructuring, downsizing and increasing contract disputes.

Of all the potential barriers to progress, the biggest risk to the projects markets is currently lower government revenues, access to finance and the resulting impact on investor sentiment over the last few years. A prolonged period of low oil prices has not only led to public sector budget reviews and a slowdown in the flow of public sector projects, but also hit private sector sentiment. Political continuity in the context of geopolitical risks, efficient project delivery and bureaucracy and regulation are also continuing to be challenges to the regional industry.

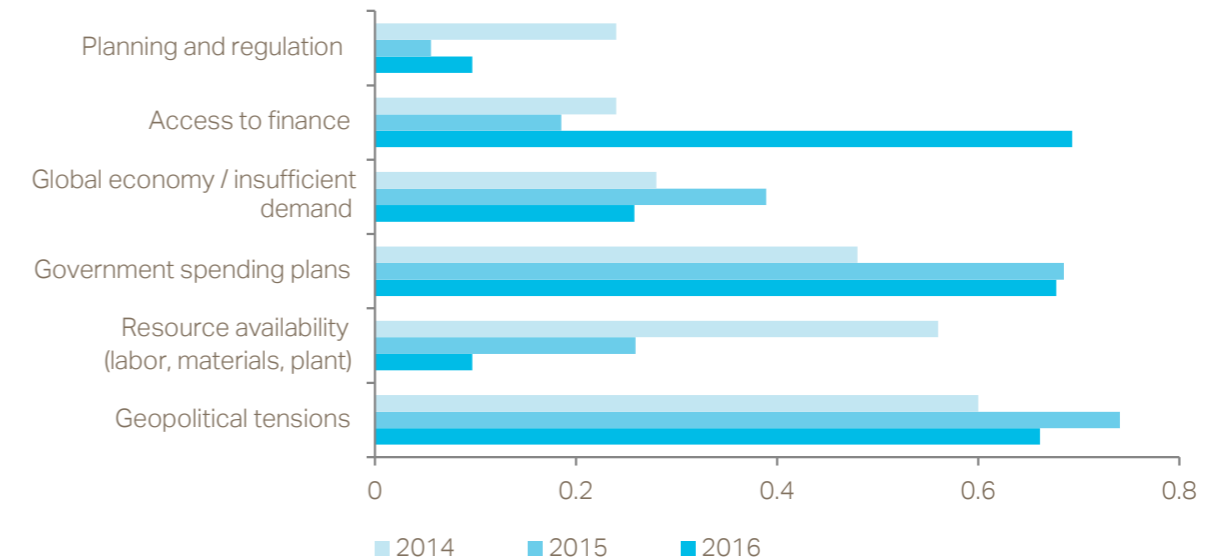
New oil price realities and project funding

Government sponsored projects and public funding continues to dominate the region's project market. The real concern of the past year was that the collapse in oil revenues would have a sharp impact on flow of projects in the region with regards to:

- Direct government projects
- Projects sponsored by state or executed by semi-government entities with finance made available due to guarantees it is perceived to offer
- A drop in private sector confidence, investment and access to project finance

Figure 13. Key risks to industry growth

The majority of respondents view financial constraints, limited government budgets and geopolitical issues as the key risks to industry growth over the next three years.



Source: AECOM 2016 Middle East Construction Survey

However, while the pipeline has certainly slowed, the market has not seen the dramatic collapse in the projects market that some may have feared. Countries are likely to be impacted differently by lower public funding availability, depending on the depth of their reserves, willingness to run a budget deficit and the share of the public sector in the market. Also, governments appear cognizant of the fact that they have to maintain project spending, particularly in social and transport infrastructure, to maintain social cohesion and prepare their economies for new oil price realities.

Public-financed projects continue to dominate the region's project market, as the region largely remains in early stage of evolution in terms of financing large projects. Whilst more than 30 percent of survey respondents indicate that projects are being financed by local and international banks as well as private funds, access to these sources of funding are seen as currently being restricted. The major factor for more limited access to finances are cited as the risk profile of the sector, with lenders demanding significant risk premiums, making funding – despite the generally low interest rate environment - considerably more expensive than in previous years.

The new economic environment is driving the GCC governments to identify alternative funding sources. In particular, there is a desire to involve private capital more effectively in meeting some of the financing requirements. Diversification of project funding has been long on the cards within the region, an issue that is becoming more pressing given lower public budgets. Alternative financing options are being explored to increase private finance participation, including various public-private partnership models, export credit agency guarantees, Islamic Finance structures, government guarantees, multilateral financing, and raising funds at capital markets via construction financing, bridging loans, bonds, etc. This will not be the first time the region has looked to alternative sources of financing. The key issue will be the robustness and speed of legislative reforms and the commitment to an alternative planning and delivery mechanism.

Uncertainty over future revenue streams from oil has rekindled interest in Public-Private Partnerships (PPP) as a way of ensuring project continuity and restructuring public sector spending commitments. Apart from the fiscal advantages, PPP promise benefits from more explicit risk sharing between the government and the private sector, and if properly designed, could increase the efficiency of procurement and project management. However, whilst the concept of PPP is not new across the region, the actual use of these financing and delivery structures has been relatively limited in most sectors and to date is mainly confined to water and power projects.

The main reasons cited for the limited use of PPP models are:

- complexity of PPP structures and
- insufficient institutional and regulatory framework.

The region's experience highlights the need to clearly articulate government objectives and to properly identify the risks associated with projects that tend to have long life-spans and long-term funding commitments. Indeed, whilst ambitions to increase private finance participation have been voiced for some years and the market is starting to develop solutions for long-term funding solutions, evidence of alternatively financed deals remains patchy and more needs to be done to convince the investor community of project owners' ability to proceed with these projects. Apart from general market conditions, risk-averse private and institutional funders require a high level of confidence in a project and its owners, as well as firm contractual arrangements, a condition not always met in the region.

The new economic environment is driving the GCC governments to identify alternative funding sources.

Figure 15. Project finance
Current source of project finance

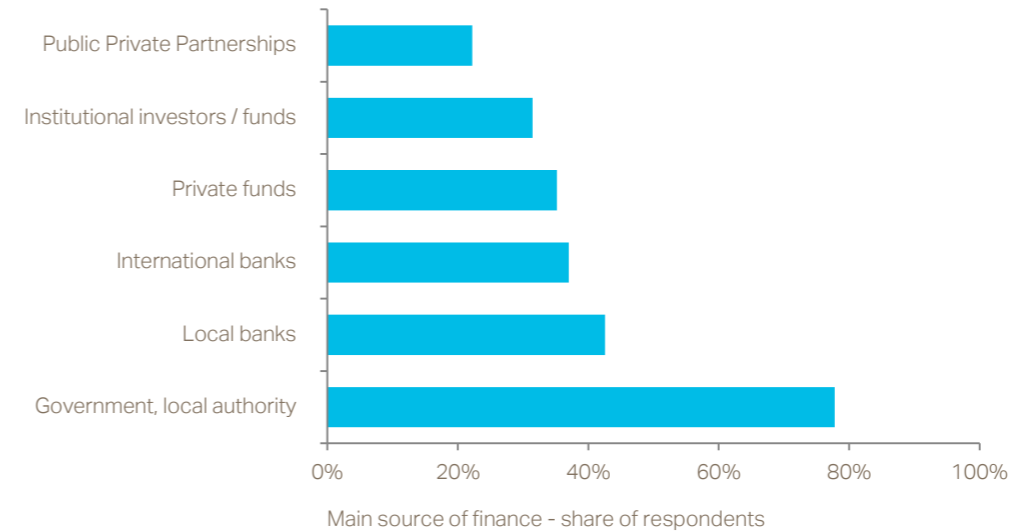
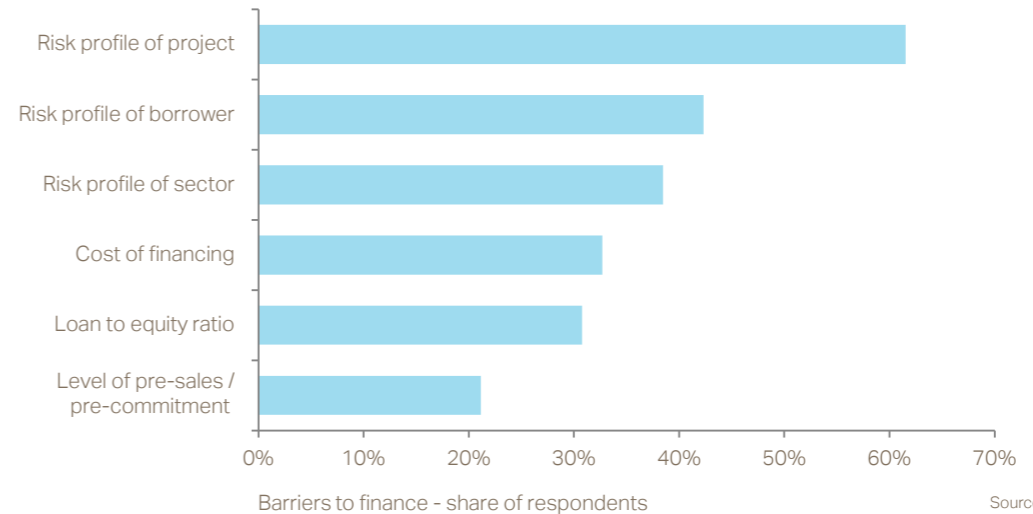


Figure 14. Barriers to project finance
The risk profile of the project and the borrower are the greatest barrier to project finance



Source: AECOM 2016 Middle East Construction Survey

Project performance and risk mitigation

Of all the factors necessary to achieve expected growth, efficient project execution ranks high on the agenda of the industry, yet as our 2016 industry survey shows, the Middle East construction industry still has some way to go before it can have real confidence in its ability to deliver projects.

Despite significant investment in project controls, delivering projects on time and on budget remains a major challenge. The vast majority of survey respondents report underperforming projects, saying that less than one out of four of projects is delivered on time and on budget.

The main reasons cited on the project delivery side of the industry are changes in project scope, delays and unrealistic timeframes, and unclear project objectives and business case.

In turn, clients are faced with the challenge of project teams not delivering projects within budgets and schedule. Quality of work has also been cited by clients as a major concern, which has partly been explained by poor project management in some parts of the industry. This finding in of itself is not new. For decades studies have demonstrated the degree of uncertainty around time and cost in project delivery. The real question is why this trend continues in our industry.

Optimism bias relating to setting project targets, assumptions and forecasts around cost and time estimation is a common phenomenon in the industry. The inherent uncertainties around these factors can be better understood and accepted by decision makers, specifically at the initial planning phase of the project via high level risk assessment. To deal with these uncertainties, the industry is planning for delays and cost overruns in form of contingencies. Contingencies typically assess downside risk

to time and budgets throughout the lifecycle of the project. Our survey shows that nearly half of organizations incorporate contingencies for all of their projects. The two most popular approaches are determining contingency by quantitative risk assessment and by internal benchmarking for reference projects. Despite the weak track record of delivering projects on time and budget, organizations have a relatively optimistic attitude towards contingency levels. More than three quarters of survey respondents indicate that the typical range of project level contingency is 10 percent or less. In addition, the majority of survey respondents indicate a relatively small allocation towards management reserves, which are used to recognize risks that are outside the project team's control.

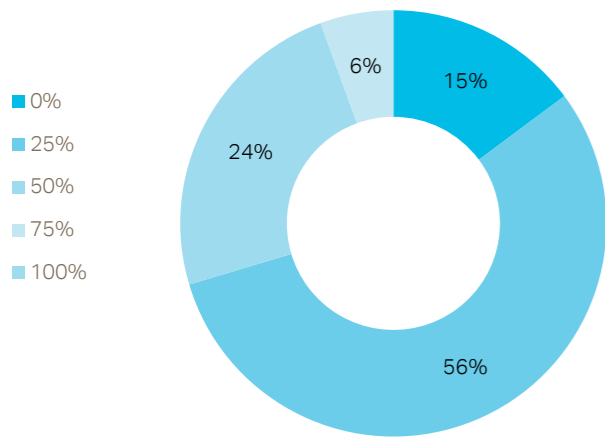
Given the track record of project performance, the Middle East construction industry still has some way to go before it can have real confidence in its ability to manage risk.

Whilst most industry players in the region have a conceptual understand of the risk management framework, process and basic tools, and acknowledge its importance for successful project / program delivery. Generally, the industry is still heavily focused on the risk identification step of the process.

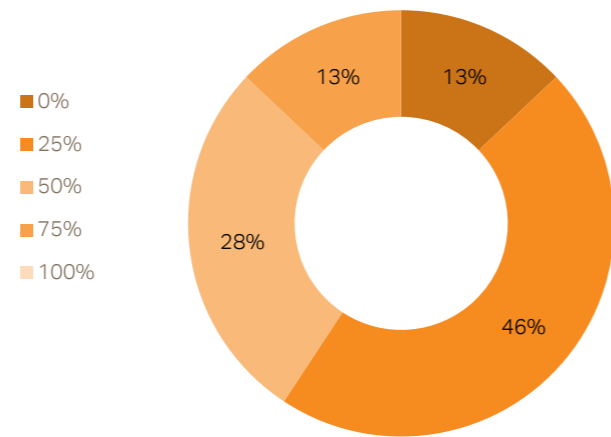
An increase in performance is seen when risk management is implemented as an integral part of the project planning and decision making process as opposed to a process that follows after the plan is developed and decisions are made. That is, the industry should seek to appropriately dedicate resources to analyse the underlying cause of the risks and the actions, investments and accountability required to mitigate the risks. Senior managers buy-in is key to help build a culture of risk management that acknowledges risk as an inherent part of projects and the management of risk as an integral part of the 'way we work' as opposed to one of compliance.

Figure 16. Project performance

Percentage of projects delivered on time



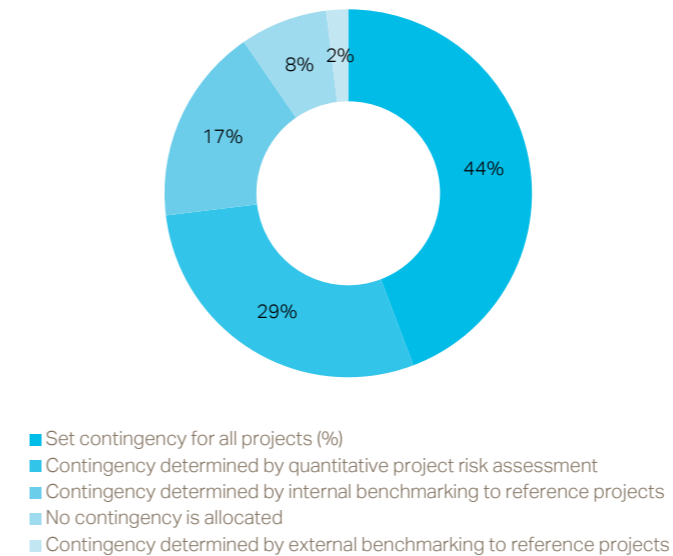
Percentage of projects delivered on budget



Source: AECOM 2016 Middle East Construction Survey

Figure 17. Project risk management

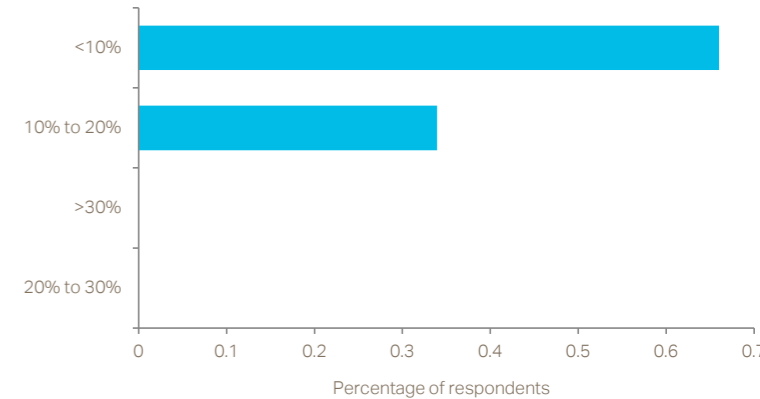
Organizations' project contingency management
Percentage of respondents



Source: AECOM 2016 Middle East Construction Survey

Figure 18. Project risk management

Typical range of project contingency as percentage of estimated project costs



Source: AECOM 2016 Middle East Construction Survey

Project pricing and industry relationships

With the slowdown in activity across the region, changing dynamics mean old challenges for successful project or program delivery. Uncertain market conditions mean that the mood of contractors and consultants alike is changing.

Whilst organizations will continue to manage challenges ranging from working capital, organizational restructuring, skills retention and operational efficiency to win work, they will have to maintain capacity and employees level to remain competitive and able to deliver projects. Securing new work at an appropriate margin is the focus for the industry supply chain, but given the current climate, this commercial target may become increasingly difficult to meet, in particular as competition increases for fewer numbers of projects.

Whilst there is a consensus that applying a client focus will pay off through repeat business and contract extensions, the terms of engagement may quickly shifting as the market moves to its next phase. Contractors will still seek to manage their market interaction and workload in order to achieve consistency and stability, but the assessment and pricing of risks and project uncertainties is an area where views are changing with industry performance. As a result of a slower flow of projects in the pipeline, pricing of risk within tenders is a typical competitive element, and genuine risk exposure on a project may not always be reflected in submitted tenders. The potential exists therefore that a project's cost decreases beyond the market rates where a greater number or larger risks are assessed. Typically, more uncertain market conditions means changing perception and intent towards contractual claims. According to anecdotal evidence, the likelihood of claims has increased considerably

over the past year and may increase further, particularly where tender and commercial offers have been aggressively priced in the first place. This approach, typically seen in difficult market conditions is risky for the whole supply chain, as contractors are running the risk of project losses if unforeseen or un-priced for project risks are not covered by sufficient margins. This in turn increases adversarial relationships across the supply chain and claims culture, impacting on the successful delivery of projects

Procurement and tendering opportunities are still carefully scrutinized by contractors to ensure there is an alignment between workload, cost structures, sector orientation and avoiding the overly aggressive pricing of rivals. Payment issues are lingering throughout the supply chain and despite an increase in competition to win work, client organizations will continue to face scrutiny as contractors attempt to determine the client's reputation and means to pay in accordance with the contract terms and conditions.

Additionally, willingness to contract equitably is a key requirement in any commercial decision by main contractors. Our survey shows procurement in the region remains dominated by traditional design-bid-build and design-build projects, which has garnered a certain amount of historical popularity because of local market conditions. Lump-sum single-stage procurement is still held out perhaps as a litmus test to see just how low prices can go. Yet some client organizations guard against the use of single-stage for this very reason – it adds risks to the project in the event that pricing is below that which is required to successfully complete the project, as well as project delays resulting from a misalignment between time, cost and design intent.

Whilst tendering activity is expected to decrease on the back of fewer projects, mega projects in the pipeline means that procurement complexity is likely to challenge existing ways of delivery, particularly where sectors are disproportionately affected by supply-chain pressures. Client organizations and consultant teams must then invest greater effort into ensuring that their scheme attracts the best possible interest. Successful delivery in a transitioning market requires clear thought and good planning to foster industry collaboration and to avoid adversarial relationships during project execution. Some key factors include:

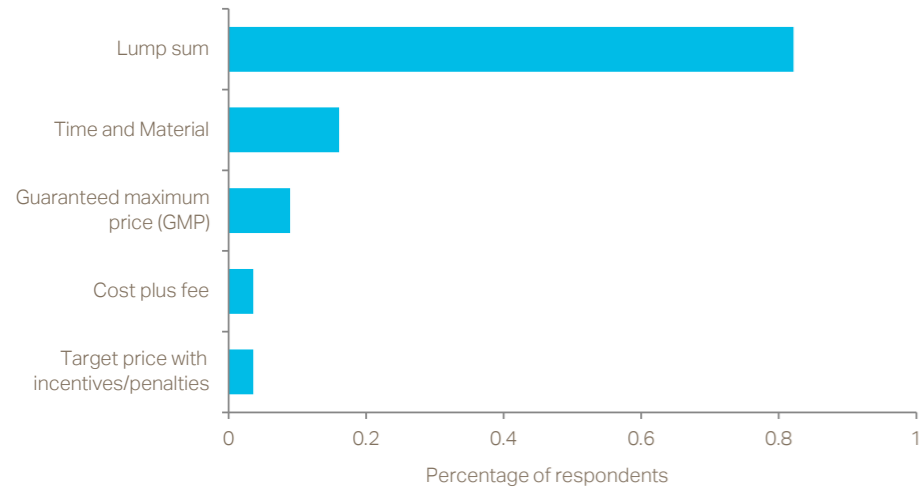
- Allocating a sensible timeframe for pre-qualifications and the tender period, and ensuring contractors are notified in advance to enable allocation of bid resources;
- Providing clear tender information – quality documentation is emphasized, with precisely defined specifications and interfaces;

- Offering equitable contract conditions, along with contract mechanisms that have positive impacts on tender price and the overall commercial offer;
- Appropriate use of single-sourcing or two-stage tendering according to project specifics with incentives and risk sharing and
- Including early trades to secure some element of fixed price in the first stage.

Tender prices are now expected to remain stagnant, but there are still prospects of a number of mega projects being procured in the near future which could still put parts of the supply chain under capacity constraints, pushing up prices. Uncertainty in the business environment will make the industry reluctant to invest in capacity before any major project commitments have been firmly made and contracts are in place, an issue that is magnified in smaller markets where the availability of skills and key materials might be smaller or more limited.

Figure 19. Middle East project contracts

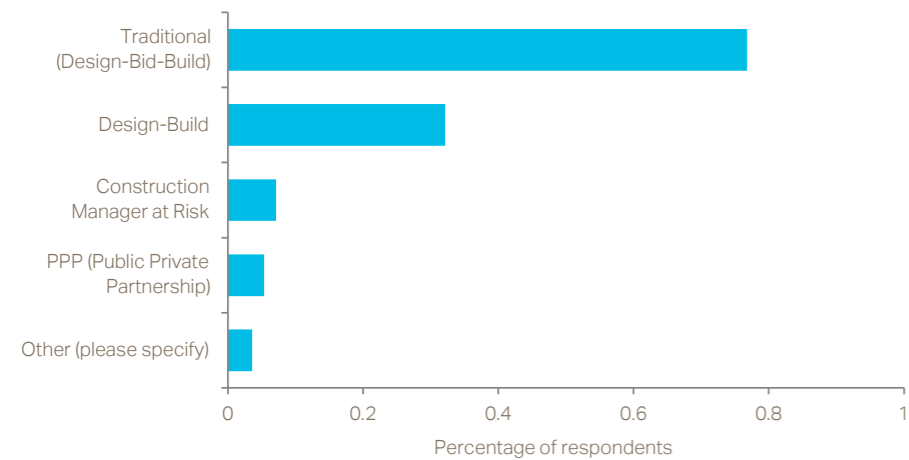
Lump sum contracts by far dominate the Middle East construction market.



Source: AECOM 2016 Middle East Construction Survey

Figure 20. Middle East project delivery strategies

Traditional (Design-Bid-Build) delivery strategy is preferred by Middle East clients, followed by design and build.



Source: AECOM 2016 Middle East Construction Survey

Country statistics

The table and figures below provide a summary of key macroeconomic statistics

Statistics 2015										
	Bahrain	Egypt	Iraq	Jordan	Kuwait	Lebanon	Oman	Qatar	KSA	UAE
Land Area, km ² (1)	0.8	995.5	437.1	88.8	17.8	10.2	309.5	11.6	2,149.7	83.6
Capital City	Manama	Cairo	Baghdad	Amman	Kuwait	Beirut	Muscat	Doha	Riyadh	Abu Dhabi
Population, million (2)	1.4	88.4	35.2	6.8	4.1	5.9	4.4	2.4	31.4	9.6
Population growth, CAGR 2016-21 (CAGR, %) (2)	2.0	2.2	2.6	2.2	2.3	1.0	3.1	2.3	2.0	3.0
GDP, USD, billion, current (2)	32.2	330.8	169.5	37.6	120.7	51.2	71.8	168	646.0	399.5
Real GDP growth, % (2)	2.9	4.2	2.4	2.5	0.9	1.0	4.1	3.3	3.4	3.9
Real GDP growth, 2016-2021 pa forecast (2)	2.1	4.5	4.7	3.8	2.7	2.4	1.6	2.7	2.0	3.1
GDP/Capita (PPP), USD(2)	50,095	11,850	15,474	12,123	70,166	18,240	19,490	132,099	53,624	67,617
Construction Output, Share in GDP (%) (4)	7.2	4.9	7.0	4.4	2.1	5.5	8.3	8.8	6.7	9.0
Value of Construction Output, USD, billion	2.3	16.1	11.9	1.6	3.4	2.8	5.9	14.6	43.5	36.0
Project awards, USDbillion (3)	3.2	N/A	N/A	N/A	31.5	N/A	13.6	29.3	49.8	37.4
Consumer Price Inflation, %	2.4	11.0	1.4	-0.9	3.2	-3.7	0.2	1.7	2.2	4.1

All data are 2015 data unless otherwise stated

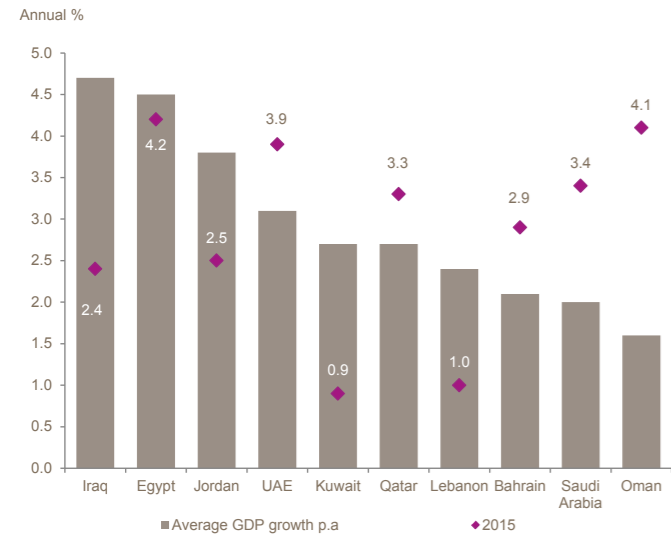
(1) Source: World Bank

(2) Source: IMF, UN Estimate (Lebanon)

(3) Source: MEED, Budget value of construction contract awards

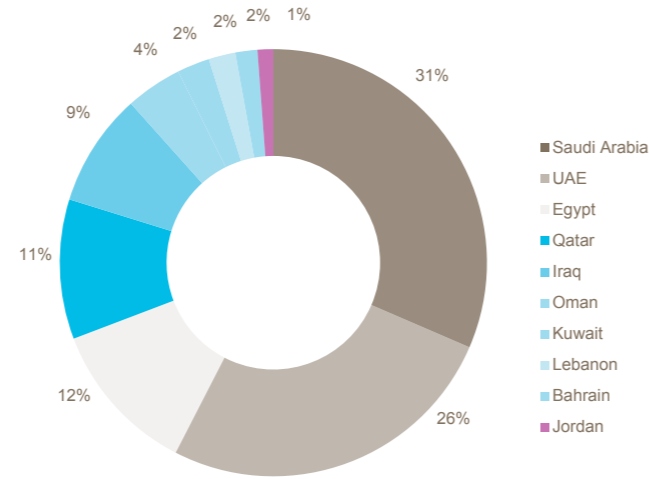
(4) Value of Construction Output based on National Accounts

Figure 21. Middle East economic growth forecast



Source: IMF, National Statistics

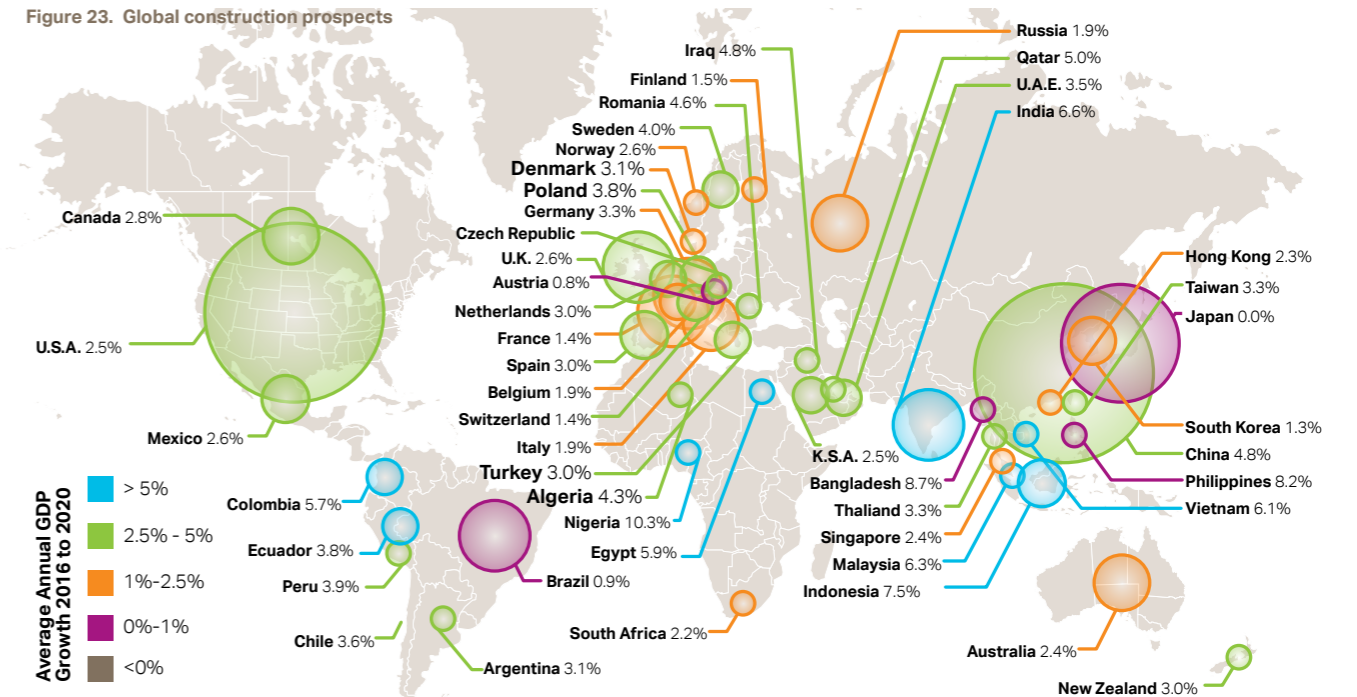
Figure 22. Share in regional construction market
Based on 2015 construction output



Global construction prospects

The outlook for the global construction industry is complex, characterized by uncertainty over the wider global economic outlook, restrained public finances coupled with infrastructure gaps due to demographic expansion in many places, as well as strong cyclicity and cross-country differences.

Figure 23. Global construction prospects



Source: Global Construction Perspectives 2030, National Accounts, IMF, BMI, AECOM

According to Global Construction 2030, the global construction industry will grow from USD 9.5 trillion to USD 15.5 trillion by 2030 at an average annual growth rate of 3.9 percent, outpacing global economic growth, as developed countries make up for years of underinvestment and emerging economies continue to industrialize. Growth in the global construction industry is expected to be evenly distributed among transport, energy and utilities, residential and non-residential buildings.

Notably, the latest forecasts expect the US construction industry to outpace China over the next 15 years, a reversal in the trend seen over the past decade. At the same time India is forecast to become the third largest construction market, pushing Japan into fourth place. Dampening the outlook for global construction is the underperformance of other key emerging markets (apart from China), such as Brazil, Russia and Turkey,

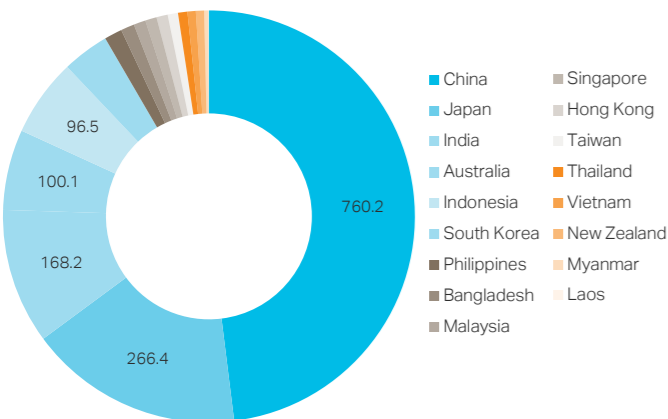
Asia

Asia as a whole is set to continue to be one of the largest and fastest growing construction markets globally. Large and more developed markets such as China, Hong Kong, Singapore, Japan, Australia and South Korea are expected grow more slowly going forward.

Chinese construction growth is expected to slow considerably over the next years as the country transitions to a consumer and services driven economy. This means that industrial and housing related construction is expected to expand much slower, making way for new investment opportunities in healthcare, education and social infrastructure demand. At the same time, the effective implementation of the 13th Five Year Plan, which has among other things a focus on investment in railways, roads, airports and water infrastructure, could bolster continued infrastructure growth.

The Philippines, Indonesia and Vietnam are the markets in Asia seen to become increasingly attractive for investors over the coming years, supported by positive economic growth, a large

Figure 24. Asian construction sector
Estimated Industry Size
Total industry Value: USD1,582.4 billion



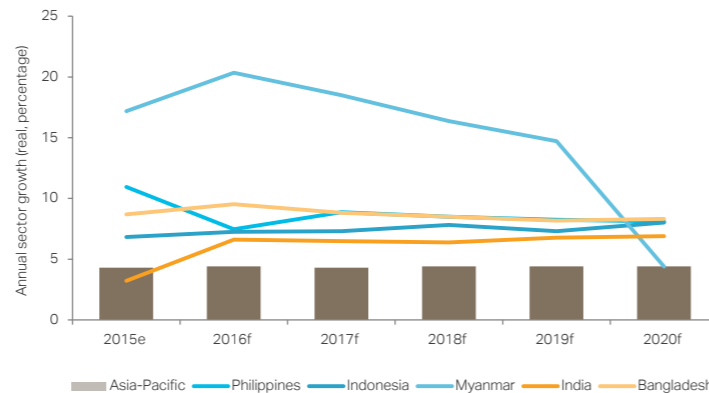
Source: BMI, National Accounts, IMF, AECOM calculations

infrastructure deficit, and an improving regulatory outlook. Growth and investment in Asia's construction sector is being supported by the low interest rate environment which continues to support capital intensive projects, as well as the establishment of various multilateral financial institutions such as the Asian Development Bank (ADB) and the Asia Infrastructure Investment Bank (AIIB), which seeks to finance transport and other infrastructure projects.

India is expected to outperform many markets in the region and grow to be the third largest construction market globally over the next decade. However, India has been touted as the next big construction growth engine for many years and so far the country has not met expectations, which has been blamed on bureaucracy, red tape and legal issues over land acquisition. Whilst the Indian government continues to seek policy reforms in an effort to attract private investment, more needs to be done to increase investor confidence in the market in order to realize growth rates.

Largest five Asian markets account for nearly 90 percent of the region's construction sector.

Figure 25. Asian construction sector
Top 5 regional growth markets



Source: IMF, BMI, National Accounts

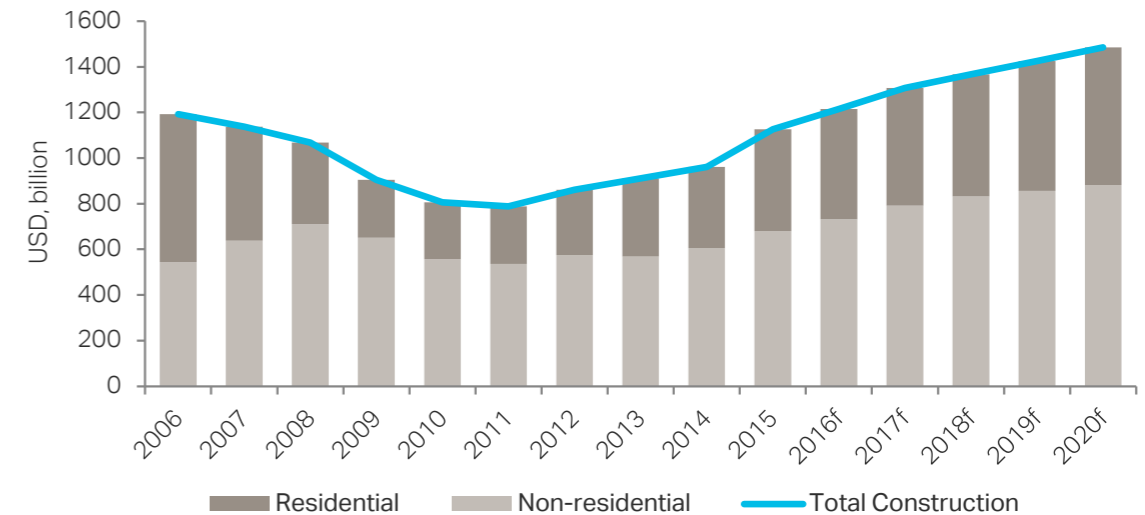
North America

The construction industry in the US has seen a busy couple of years and next to China remains the biggest market globally. This trend is expected to continue despite some uncertainty associated with the upcoming presidential elections.

Investment in transport infrastructure, in particular roads and highways on the back of a new five-year highway bill, is seen as a key industry growth driver over the next few years. The new highway bill - FAST Act - set outs USD 305 billion for highway, transit and railway programs. Of that, USD 233 billion is for highways, USD 49 billion for transit, and USD 10 billion is dedicated to federal passenger rail. Furthermore, residential and leisure related works are expected to be seen as key growth drivers over the next few years.

Figure 26. US construction activity

Growth expectations for the US construction industry have been moderated, but the industry is still expected to see a moderate expansion. Slower residential growth over the next two years is expected to be partially offset by stronger infrastructure investment



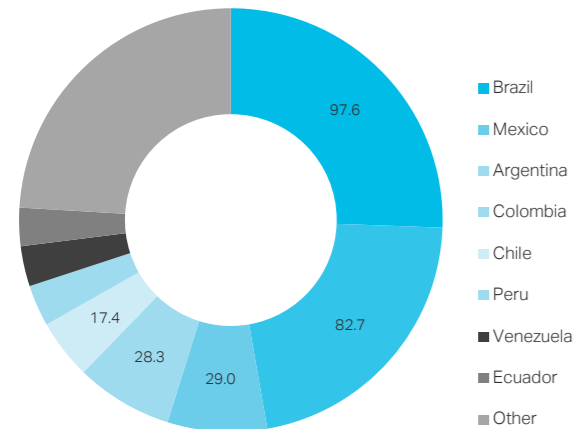
Source: US Census, AIA Consensus Forecast, FMI

Latin America

Latin American construction growth is anticipated to rebound over the next years, though the pace of growth is expected to lag behind other emerging markets. In particular Brazil, the region's largest market and its former power house, is likely to act as a brake on regional performance.

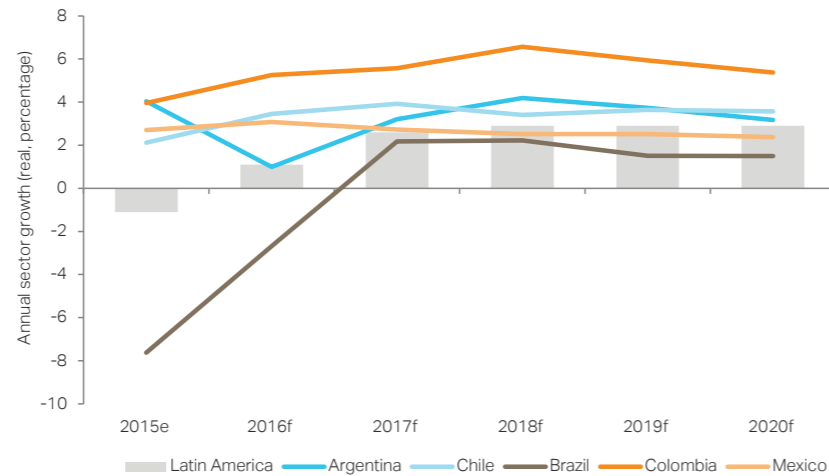
Brazil in particular has been hit by the drop in commodity prices and its subsequent impact on public budgets, a rise in credit costs and high levels of corruption. The latter in particular is having a significant impact on investor sentiment and confidence within the market. More positively, other markets including Colombia – the outperformer in the region, as well as Chile and Mexico are seeing stronger construction growth in the back of increased levels of private sector – both domestic and foreign – investments.

Figure 27. Latin American + mexican construction sector
Estimated Industry Size in 2015
Total industry Value: USD382 billion



Source: BMI, National Accounts, IMF, AECOM calculations

Figure 28. Latin American construction sector
Top 5 regional growth markets



Source: IMF, BMI, National Accounts

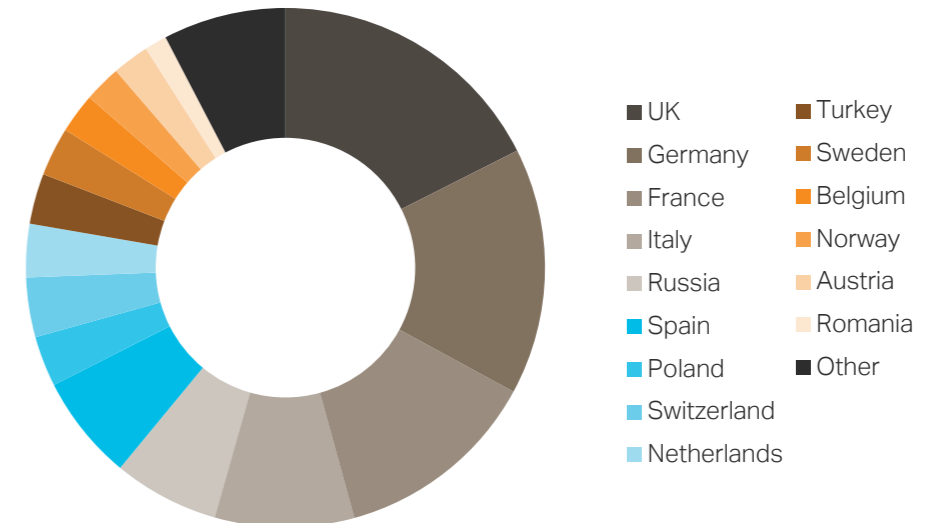
Europe

The European construction sector is one of the largest but most saturated markets globally. European construction forecasters point to stronger growth in the European market in the next few years. Euroconstruct estimate European construction output total €1,412 billion in 2016, rising to €1,478 billion in 2018. This compares to a peak of €1,532 billion just before the 2008 financial crises.

The drivers of European construction demand include more positive economic developments, favorable financing conditions, as well as a greater scope for expenditure on the part of several member states. In addition, demographic aspects, such as pronounced immigration and internal migration, and the investment gap seen in several European regions in recent years due to austerity measures, also play an important role.

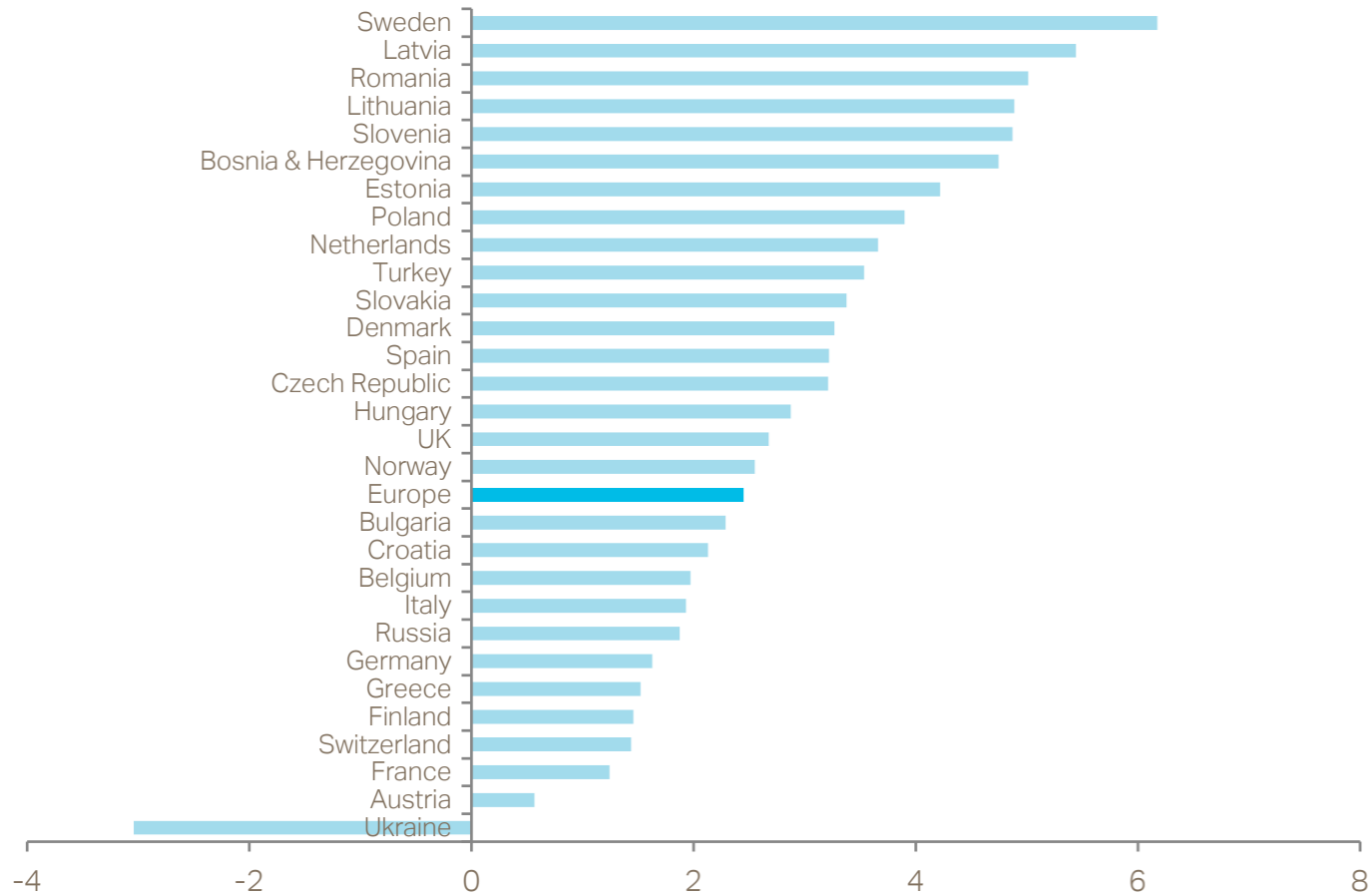
Euroconstruct forecast that the construction sectors of all countries will grow between 2016 and 2018, with the exception of Greece, Russia and the Ukraine. Construction growth in Western Europe has outperformed that of Eastern and Southern Europe in recent years, led by a strong rebound in the UK market. However going forward, a new wave of EU funding is expected to boost the Emerging Europe's construction sector. Growth is expected to be strong in Ireland, Slovakia, the Czech Republic, and the Netherlands, although growth comes from a relatively low base after years of construction sector gloom. The five largest construction markets in Europe - Germany, UK, France, Italy, and Spain - are also expected to grow more strongly over the next couple of years as reflected in the Euroconstruct forecast. It remains to be seen how the uncertainties surrounding the EU (as exemplified by Brexit) will impact investor sentiment and the construction market in these countries.

Figure 29. European construction sector
Largest 15 construction sectors in 2015
Based on GVA
Total (Europe 28 countries + Turkey + Russia): EUR 834 billion



Source: Eurostat
Other countries: FIN, DK, CZR, POR, HUN, GRE, LUX, LIT, CRO, BUL, SLV, LAT, EST, CYP, MAL

Figure 30. Europe
Average annual construction growth (2016-2019)
Percentage change



Source: Eurostat, National Accounts, BMI

Africa and the Middle East

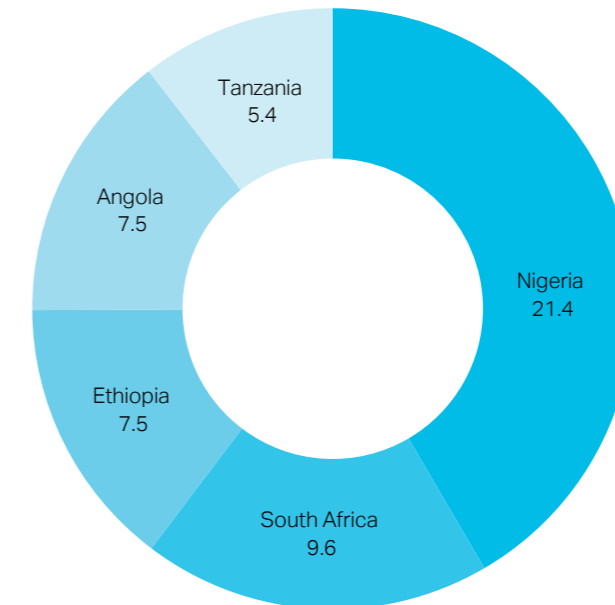
Africa continues to be a high-risk and reward market, characterized by large infrastructure gaps, with some countries attracting more investment than others. Generally, Nigeria and Ethiopia are seen as outperformers, with Business Monitor International expecting these markets to post the strongest growth in Sub-Saharan Africa over the next few years.

Nigeria is by far the largest market in Sub-Saharan Africa. Growth is partly driven by public funding towards improving transport and energy infrastructure as well as foreign direct investments from China. Positive performance is also expected from Kenya and Cameroon, with the freight logistics, energy infrastructure and real estate sectors key target investments. Other opportunity markets are Tanzania, Uganda, Namibia and Cote d'Ivoire are also

expected to outperform the regional average. In contrast, South Africa's construction sector is set for a period of sub-standard performance as business sentiment has been heavily impacted by political uncertainty curbing investor confidence.

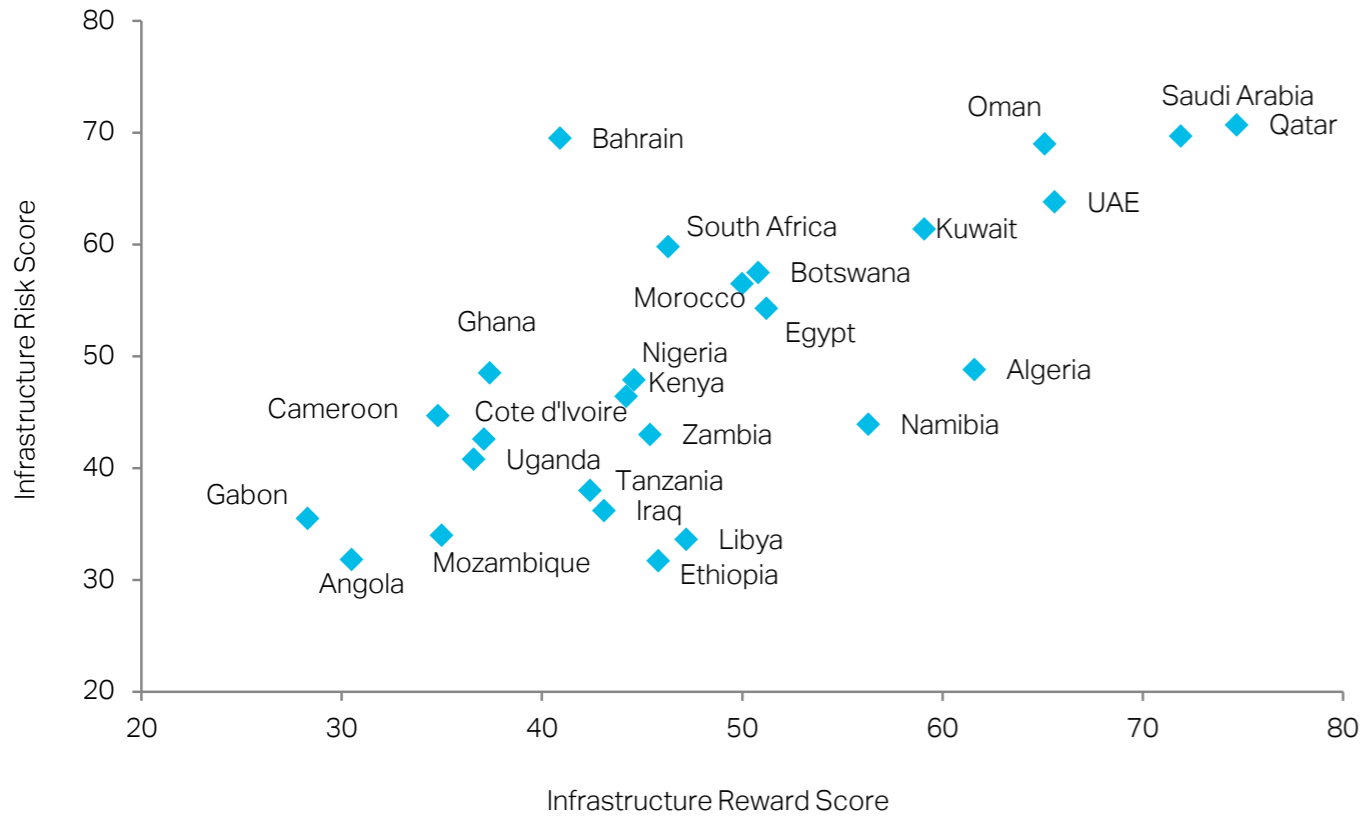
Falling oil prices had a major impact on the Middle East and North African (MENA) construction markets, which in addition to heightened geopolitical risks had hit public spending and private investments alike. Providing the growing populations with residential, social, and transport infrastructure, will remain a key priority area for regional governments in order to maintain social cohesion. This in addition to continued efforts by governments to diversify their economies by expanding domestic production and/ or services (i.e. tourism) industries should attract spending in corresponding build assets.

Figure 31. African construction sector
5 Largest Construction Markets
Forecast 2016 Construction Value in USD



Source: BMI, National Accounts, IMF, AECOM calculations

Figure 32. Africa and MENA infrastructure risk- reward index
Scores out of 100, higher risk score indicates lower risk



Source: BMI, Q2 2016



Yas Mall, Abu Dhabi, UAE



Section

TWO

Articles

There is also the additional dimension of the 'Global City'. Numerous studies have defined such places on a variety of scales — 'livability', population, economic transactions, points of intersection in a globalizing society, centers that influence global culture, and many other characteristics. However, a global city is not only a very large city with an aggregation of attributes somewhere in the world. A global city also transcends its characteristics — its physical and financial artifacts — to become a key node in the network of global humanity. For a city to truly be global, there must be psychological and emotional attachments that cause individuals to be concerned for the city's success even if they are not residents. In this sense, every city's boundaries are artificial. Our perception of a city's boundaries has to change if we are to engage our global cities in driving more sustainable outcomes for humanity.

A range of forces, from new technologies, to environmental change, to demographic shifts, is changing the urban infrastructure equation. Private-sector innovators are offering new options for how we move around the city and to where we need to transport ourselves—new places and types of places to live, work, and play. In the context of climate change and diminishing natural resources, our approach to food, water and energy generation and distribution and the need to prepare for erratic weather and rising sea levels are also changing. As the global population grows and shifts into cities, increased social inequality worldwide and within any given city further drives a mandate for change.

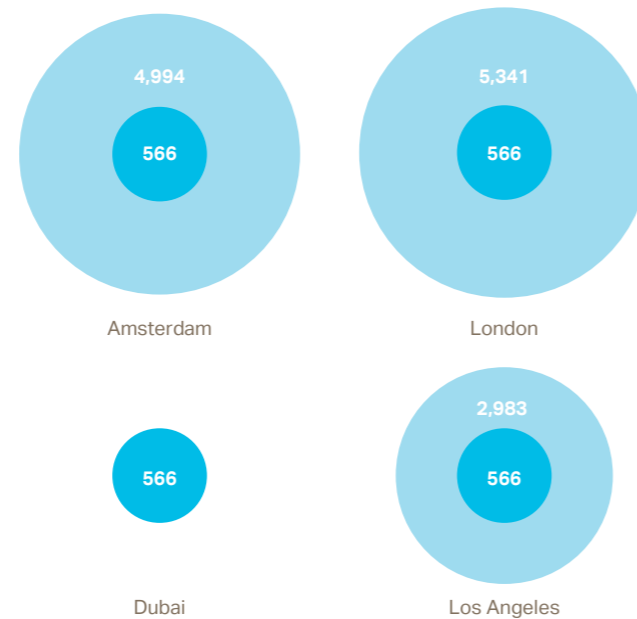
We are still planning, funding, delivering and governing for the traditional urban infrastructure equation, but technology, the environment, and society are changing very rapidly and thus demanding more infrastructure to be developed quicker while offering a better quality and greater inclusiveness. Looked at with the existing set of tools, this may seem insurmountable: how can we possibly fund and deliver all of the infrastructure that the new global urban population will need in time? What about a different question: how can we change our infrastructure delivery approach to align with the new equation, and what opportunities could this unlock?

In the following sections, we look at the opportunities for the city equation, covering a range of topics including growth, work, food supply, transportation and events.

To help illustrate some of the points raised in this introduction and the following articles, information from the World Council on City Data is used. Data from Amsterdam, Dubai, London and Los Angeles is used to illustrate the wide spectrum of city characteristics prevalent in today's global cities. Data on Dubai provides an opportunity to compare a city in the Middle East with the other global cities.

'The World Council on City Data (the "WCCD") hosts the WCCD Global Cities Registry™ for ISO 37120 and a network of cities committed to improving city services and quality of life with open data. The WCCD developed the WCCD Open City Data Portal to provide cities with a platform for standardized urban metrics.' Please refer to the Open City Data Portal for the source data.

Figure 33. Population density (people/km2)

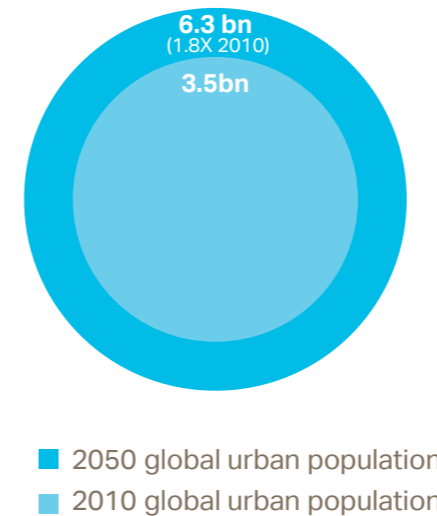


Source: Open City Data Portal

Growing the city core

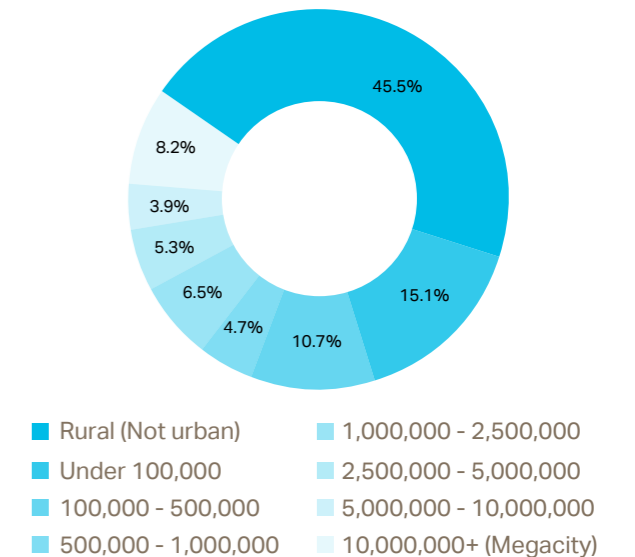
City population is growing, and fast. With more and more people expected to live and work in urban areas, how can we successfully accommodate this growth while striking a balance between productivity and retaining our great quality of life?

Figure 34. Global Urban Population - Growth (billion)



Source: tbc U.N.

Figure 35. World population distribution 2016 – urban and rural



Source: Demographia World Urban Areas 12th Annual Edition: 2016:04

When we think of city growth, we tend to think about expanding the edges – a centrifugal force pushing out new development frontiers to create more buildings to meet demand. However, a successful city also needs to ‘expand’ its metropolitan core to sustain the urban centres as a key driver for growth. Expanding the center and moving to a denser way of living does not mean abandoning what we cherish. Central to our quality of life is the need for open space – whether it is a backyard, a football field, or an unstructured playground. In a denser urban centre, this may simply take a new form, as we rely less on large expanses of green space and create smart ways to integrate community spaces into our urban fabric. Elevated public spaces – on rooftops and above transit areas could become activity areas such as playgrounds, gardens, basketball courts and soccer pitches, integrated into central areas.

The city would be explored more and more on a vertical plane, with surprising green spaces and hangouts high above ground level. Slowly, we are starting to see examples cropping up – the unused car park on the rooftop of Melbourne’s Federation Square has been transformed into a community gardening paradise, where veggie crates can be rented by the city’s residents, restaurants and businesses. Creating smart ways to integrate community spaces into cities may involve green spaces high above ground level.

Also to effectively ‘expand’ an urban center, the key is to effectively organise new developments around a similarly beefed up transport network. The movement of residents and workers is far smoother and desirable if they have more choice and flexibility in moving around this intensified urban centre. The creation of an effective multi-modal transit system will become much easier in this intensified centre. A better connected train, tram, bus and taxi system can provide greater choice and flexibility for visitors, residents and workers and will become much more desirable than the trusty private vehicle. As such, the edge of the growing urban centre may become a boundary at which we need to get out of our cars and use public transport. This could perhaps be further encouraged by applying a congestion zone charging mechanism, which would make public transport provision even more important.

It is easy to oversimplify the challenges of ‘expanding’ our central metropolitan cities. True global cities such as London, have concentrated metropolitan populations. Yet, they have had true metro transit systems for several decades; in London’s case for almost a century. They invested in developing methods of moving people and goods around in a more sophisticated manner. If we can better plan for the growth of our cities, it will enable us to effectively move large numbers of people – connecting them to jobs, homes and open space, all within a denser city landscape.

As our cities become denser and environmental challenges more pressing, the success of future real estate development will in significant part reside in how creatively we can develop the city core and repurpose existing structures. Central to this challenge is efficiently designing and engineering spaces that engage robust human activity with minimal resource impact.

Figure 36. Greenhouse gas emissions measured in tonnes per capital



Source: Open City Data Portal

Parametric design data and future cities

The city’s shifting dynamic implores designers to rethink the way buildings and cities are planned and designed. AECOM has been part of the process to develop a software application that can quickly and accurately evaluate varying urban design and engineering scenarios early in the planning process to improve overall performance of systems, reduce cost, and allow architects, planners, city officials, and residents to make informed decisions about our future cities.

Para-Form combines the existing technologies of 3D Modeling Software (Rhino), Parametric Modeling Platform (Grasshopper), and Microsoft Excel to evaluate building and community performance in real-time. The application links specific design parameters directly to 3D models, allowing users to effectively manage data and consider various design options along with their greater implications at the building and city scales. Beginning with a set of design parameters, the application uses advanced built-in calculation tools to evaluate performance criteria such as floor area ratios, gross floor area, building heights, population, number of dwelling units and parking. The performance evaluation happens in real time as the design team makes changes to the 3D model, which allows for quick and informed choices about the project’s design. Unlike traditional geospatial tools, this application has the ability to assign land use functionality to the 3D modeling environment. By keeping track of land use information we can optimize distribution and achieve ideal urban design.

By developing a software application based on existing technologies, this tool allows for multiple iterations of a new building or city design to be explored, evaluated and modified during the early stages of the urban planning and design process. The city-form application is used alongside other sustainable modeling tools to generate multiple development alternatives each rated across a range of sustainability key performance indicators. This helps to determine the most cost-effective sustainability measures, bridging the gap between our design and evaluation tools. Used in conjunction with an integrated design and planning approach, this application helps to reduce costs, elevate performance and clarify the environmental, social and aesthetic complexities inherent in each project.



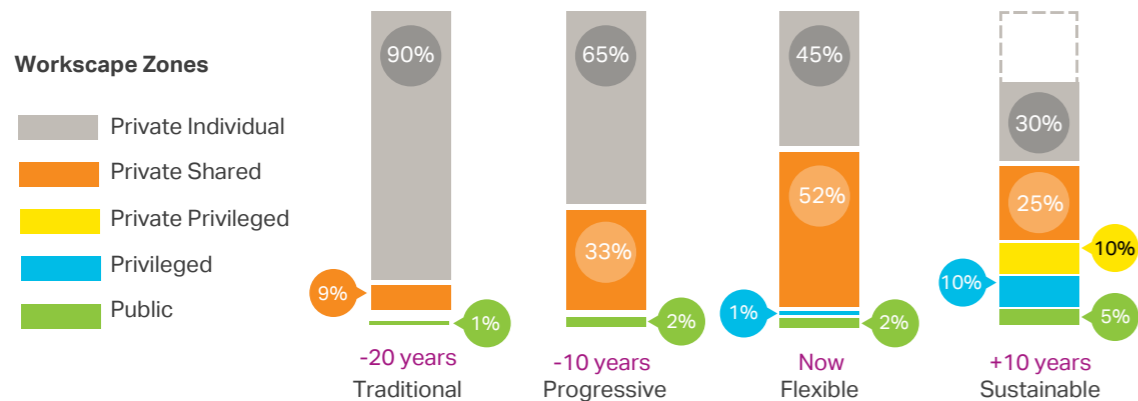
Work and the city

In 2016, most employees really can work anywhere, at anytime. Technology is shifting both the means of work and the relationships that manage it.

People have multiple options beyond the traditional office space to work, including cafes, business hubs and at home. In addition, the nature of our work is changing. According to research by Frey and Osborne, 47 percent of all jobs are likely to be replaced by a computer in 20 years – not just factory work, but any process governed by an algorithm of rules where best practices can be identified. The 'work' left for us humans is arguably the more interesting stuff that relies on higher-order thinking, collaboration, innovation and relationships. Qualities found in the companies that we most admire.

As a result, the innovative organizations are rethinking the traditional working environment, with its conventions of the work commute, the relentlessly efficient single-use office tower, the long commercial lease, the privately owned work point. They are fundamentally questioning the purpose the formal working space serves, how much space they need, how it should be organized and what skills are needed to help it thrive. Companies such as Google are looking to create working environments where employees and other partners want to 'hang out' with likeminded people for as long as possible. The purpose is to learn, to engage and collaborate, to intersect disciplines, industries and ultimately to create new profitable ideas.

The evolving program for the office building

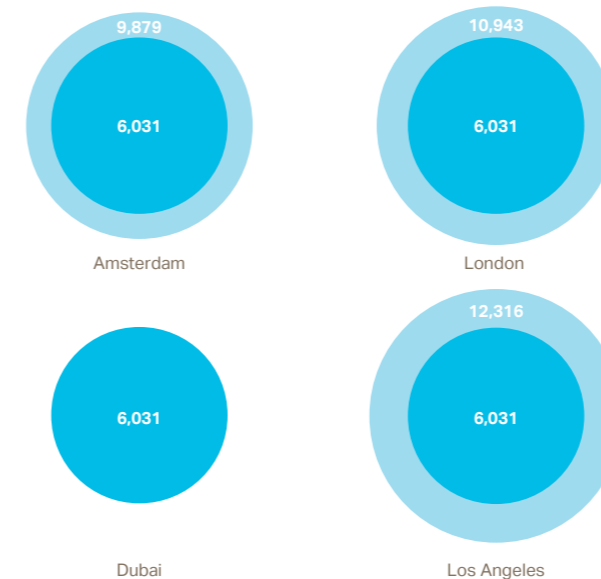


The innovative companies are looking to design working environments that not only attract and retain the world's best talent, increase general productivity, but also increasingly act as a center for innovation. This attracts talented and passionate employees who are looking for working environments that facilitate what Hagel and Brown call 'scalable learning': learning driven by passionate people who are committed and connected to their industry, and who actively seek out challenges to rapidly improve their performance. People that draw energy from environments that allow them to learn. Working environments, which simply support increased productivity, may not be enough to sustain performance in uncertain times, where the half-life of a business model is constantly contracting.

So what can cities, who are similarly competing for global talent, investment dollars and a competitive edge, learn from next generation of corporate working environments. How can we create similar city environments where people want to live, work, learn and play as we transition from a basic economy to a high-value, people-orientated knowledge economy? In the context of the city being 'one company,' how do we enable and encourage innovation everywhere?

The concept of business clustering within cities has become a prominent way of looking at the city working environment in recent years. Essentially, clusters are supposed to do what it sounds like they do: attract a range of mutually beneficial industries. These specialized hubs in turn attract more talent and innovation, which in turn catalyzes the local urban economy and creates long-term resilience. In the UK, 30 economically

Figure 37. Number of businesses (No. per 100K pop.)



Source: Open City Data Portal

Figure 38. Jobs/housing ratio



significant clusters contain eight percent of the country's businesses, but generate 20 percent of the economic output (GVA). London integrates some of the largest ones, specializing in creative and digital industries, business and financial services and, more recently, web and technology in the form of 'Silicon Roundabout'.

However, we have also come to realize that business clusters in a city can be challenging to create by design and successfully execute. The most successful business clusters continue to form in cities, which are themselves already hubs for human interactions – places that have strong identities to begin with, places that are dense, mixed use, mixed industry and well supported by social and capital infrastructure. Most of their origins are largely organic, filling market niches that are difficult for governments to anticipate. Ironically, governments' increasing interest in the formation (and ultimately regulation) of clusters in order to grow a city, may well diminish what makes the clusters work in the first place – the time and space for human interaction – places to 'hang out' with likeminded people for as long as possible, to learn, to engage and collaborate. It seems that in the last decade, every second-tier city has tried to create a technology cluster, with mixed results, and some feeling completely disconnected from the city.

As technology shifts both the nature and means of work, some common themes emerge for both the individual corporate office and the city business cluster. The working space for innovative companies and cities is being recast as an open interactive proposition in the city core for 'scalable learning', rather than a closed private arrangement dislocated from the city for the purpose of efficient productivity.

Common themes in city and corporate environments:

- Use less space (or put another way), do more with the same space
- Share the space you have across multiple uses
- Design permeable spaces
- Celebrate spaces with events and experiences
- Have multiple means of connecting spaces and people (virtual and physical infrastructure)

Figure 39. Economic output of 30 clusters in the UK



A truly brilliant city needs to make it possible for the thinkers, makers, consumers and financiers to hang out, kick back and interact—everywhere.

Farms and the city

Agriculture has made cities a reality. Without a reliable food supply, it is simply not possible for large numbers of humans to settle together in the same location, and agriculture has allowed us to do this on a staggering scale.

For the first time in our history, more people live in cities than rural areas. More than 1,000 cities worldwide have a population of one million or more. So with all of this success, why change the status quo?

In a rapidly urbanizing world, we are faced with a very real challenge — supporting a larger population with fewer resources. The United Nations predicts that by 2050, the global population will reach nine billion, with over six billion people living in urban areas. This is uncharted territory for our civilization, and could require an increase in food production by as much as 70 percent.

Our current food system is already showing the strain. Disconnecting the farm from the city has enabled food production at an industrial scale but is reliant on significant infrastructure to process food and transport it to the city's hungry mouths. It is here that many issues and questions arise.

Figure 40. Global Annual Food Production (Kcal Trillion)



Source: World Resources Institute Report 2013–14: Interim Findings

Figure 41. Global Annual Food Production (Kcal trillion)



Source: World Resources Institute Report 2013–14: Interim Findings

Health: Food items are often produced for maximum shelf-life and transportability, not nutrition. Worldwide, 1.6 billion people are now overweight, with significant medical and financial implications. Could short food chains with more localized food production make people healthier?

Waste: Globally over one-third of all produce is spoiled before reaching the consumer. What would it mean to future food requirements if this number could be reduced significantly? What if the food that did still spoil could be fed directly into a city's nutrient cycle?

Fossil Fuel: Industrial food production is reliant on fossil fuels at all stages of the process, from fertilizer and pesticide, to farm machinery operations, to transportation. What happens when fossil fuel costs increase to a level that makes this unsustainable?

Figure 42. Total collected municipal solid waste tonnes per capital



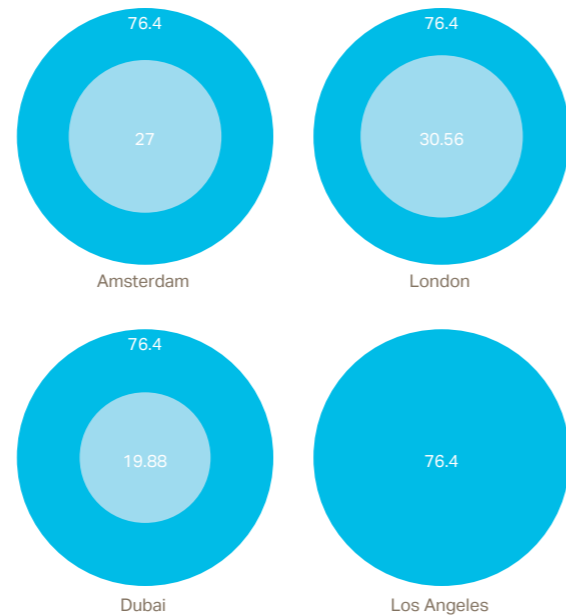
Source: Open City Data Portal

Energy: As energy costs increase, how will this affect what we eat and how we grow it? Could urban farms harness waste energy from surrounding buildings?

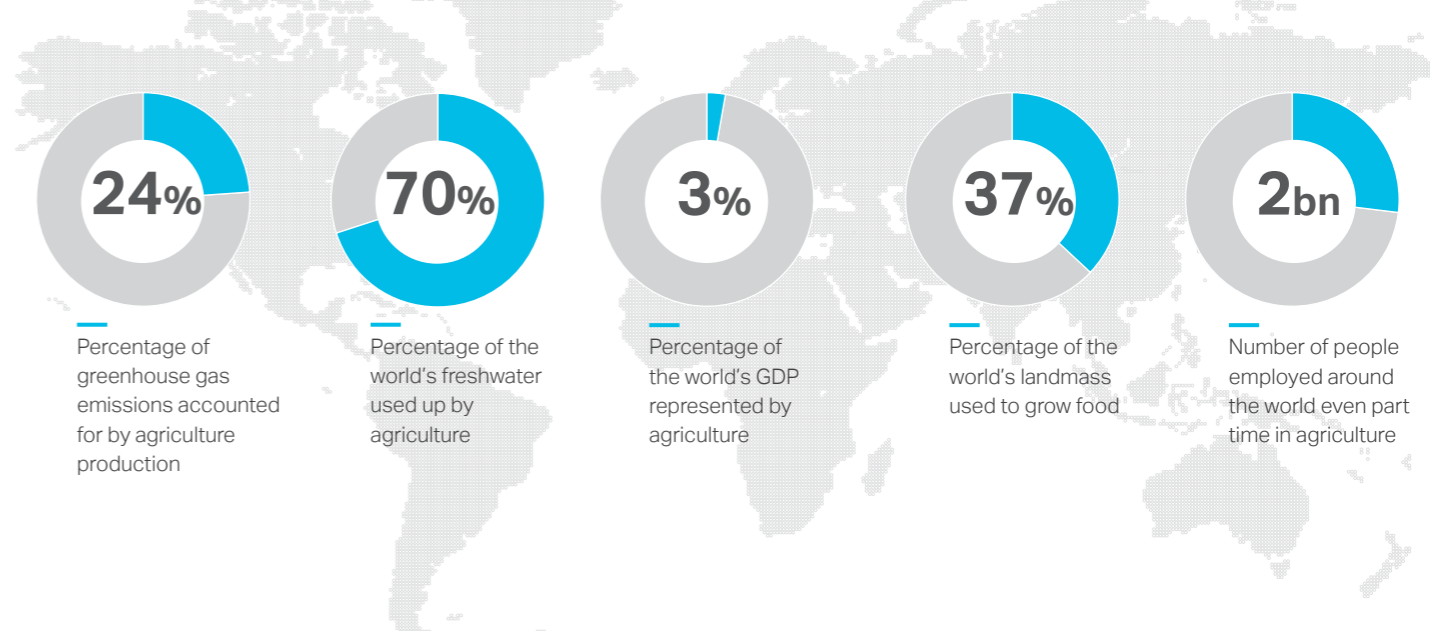
Water: Both water shortages and flooding are symptoms of climate change that threaten food security. Population growth will exacerbate this threat. What if food production used 90 percent less water and was shielded from climatic extremes by the urban fabric, using techniques like aquaponics?

Community: Many urbanites have become so divorced from the food system that a child may grow up on a diet of French fries but have no idea what a potato looks like. What if the process was once more made visible, becoming a focus for education and community building?

Figure 43. Percent of the city's solid waste that is recycled



Agriculture in figures



Source: World Resources Institute Report 2013-14: Interim Findings

Just at the point when we become a civilization of urbanites, the food foundation on which cities rely on is faltering. This can be seen as a time of great opportunity. While it is easy to view the city as a thing in stasis, the reality is quite different — adapting to market demands and external pressures. The way that cars changed cities in the middle of the twentieth century illustrates a way in which innovative food production can change the city in the twenty first century.

In addition to the food imported from rural farms, how can we integrate the production of food into the city to reduce the burden on farmland? Examples exist of urban farms in lots dotted around cities and on rooftops of buildings and carparks. The cities of New York and Detroit are two examples of some of the largest urban farms. Farming the city is no longer a hobby but a 'buy local' industry movement that can be the answer to some very real global challenges when designed into the fabric of the city.

Nevertheless, how do we introduce 'urban farming' into dense vertical city centres in harsh climates in an environmentally sustainable way? What about agriculture integrated into the fabric of the buildings themselves? There has been a lot of hype surrounding the use of plants to create verdant building facades or interior atriums 'the living wall'. Increasingly, blank walls and building are being transformed into vertical landscapes, turning dense urban areas from grey to green. This has helped developers create a dramatic visual backdrop for a development, encouraging visitors and shoppers to stay in the development longer, have a positive effect on physical and mental wellbeing, supported by epidemiological studies 'which find that individuals living in the greenest urban areas tend to have better mental health than those in the least green areas.' The evapo-transpiration of living walls also cool the surrounding micro-climate — a kind of biological air conditioning system. So, can we expand the concept of the 'living wall' to the 'living agricultural wall'?

Like all new technologies, however, there have also been spectacular failures, with some unfortunate buildings turning from green to brown as their plants fail and die in tough, arid environments for plants to grow. There is also skepticism on the use of expensive custom systems. These challenges may be overcome through the careful selection of the correct species and advancement of affordable technology.

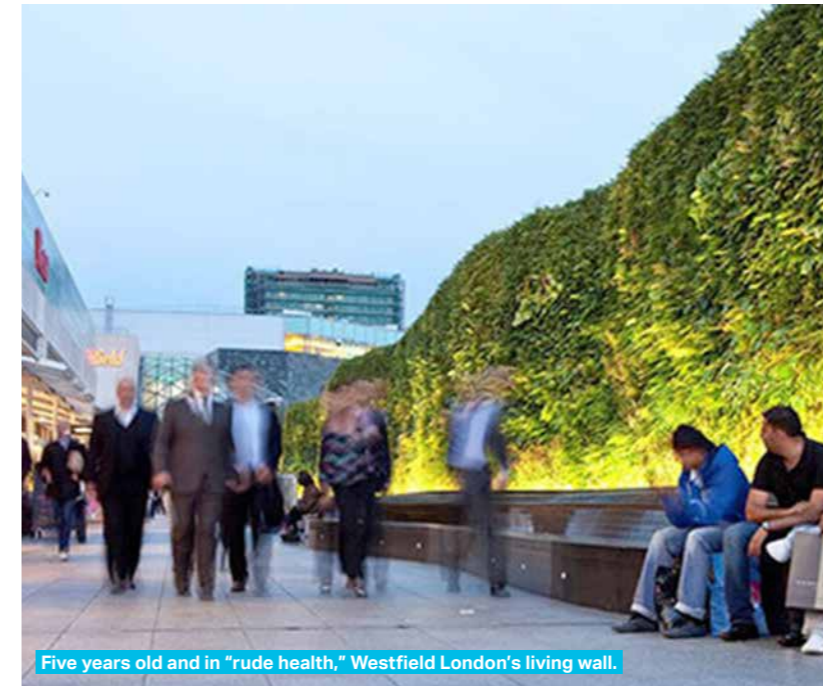
A 'moon-shot' step is to take full advantage of the potential symbiotic relationships between nature, agriculture, architecture, and its occupants. Not only learning from nature as is the case with biomimicry but directly using plants to perform some of the services typically undertaken by mechanical systems and acting as a source of food. Air quality is an example, with NASA research demonstrating the filtration abilities of plants in removing toxins from our built environments. This has the potential to dramatically reduce the energy demands arising from conventional air filtration

systems in climates where buildings have either high air heating or cooling loads. With the integration of plants comes the choice of what species to grow, with there being no reason why fruit and vegetable varieties could not be used – air filtration that's good enough to eat.

Data on urban farming is not readily available, even in developed countries such as the U.S. However, anecdotal information does suggest 'business is booming'. For example, New York City-based Gotham Greens produces more than 300 tons per year of herbs and greens in two hydroponic facilities.

How much food can be grown in cities and will this have a material impact? No one knows yet, but urban farming is clearly worth exploring as a possible solution to meet the gap in our future food needs.

Agriculture options for the city



Five years old and in "rude health," Westfield London's living wall.



This theoretical environment makes urban food production (and consumption) the source of wonder and delight.



Eagle Street Rooftop Farm, Brooklyn. Image courtesy of <http://www.garden.harvard.edu/?p=977>

A 'moon-shot' step is to take full advantage of the potential symbiotic relationships between nature, agriculture, architecture, and its occupants.

Cities on the move

A city's economy moves at the pace of its transportation network. Efficient transportation speeds the flow of people, ideas and commerce.

Airports and seaports are global gateways. Roads and rail establish regional connections. Bike and walking routes make mobility healthy, inexpensive, fun and come at the heart of why people come to cities to be near other people. In a great city, access is built into the fabric.

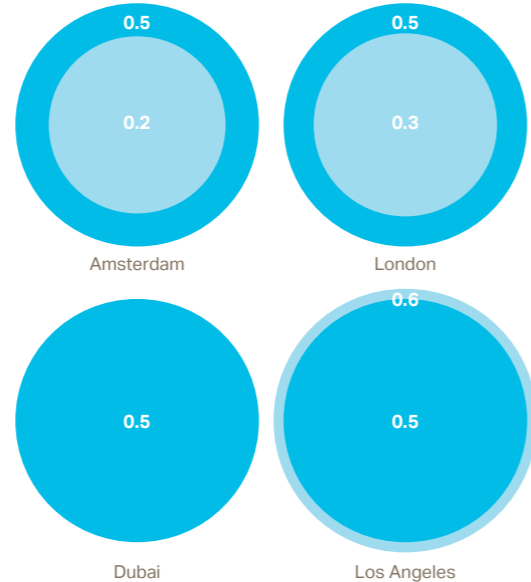
Over past decades, city design has been guided by the need to drive. This functional view of the city as a mechanism geared to efficient transit has kept private car use in sharp focus. This form of transit has implications for social connectedness (isolation within the car and separation brought about by roads), for climate (urban heat island), for the use of limited space within cities (opportunity cost) and the health of drivers and their passengers who are physically inactive on their daily journeys.

Figure 44. Annual number of public transport trips per capita



Source: Open City Data Portal

Figure 45. Number of personal automobiles per capita



Transportation is one of the slowest changing industries, and is not often disrupted. So the last major disrupter arguably was the automobile, which by displacing walking, the bicycle and the horse, not only had a profound impact on how we travel, but also changed our spatial economy through its influence on land use patterns. The advent of big data and new technology, along with shifting social and environmental priorities is fundamentally changing how we prefer to travel, what a car is, how we use it, and what supporting infrastructure is necessary to support it. We have the potential to create a more equitable platform that provides greater opportunities to all sectors of the population. Big data is enabling us to more accurately predict demand and understand travel patterns, enabling more efficient infrastructure choices and uses, potentially reducing costs, and enabling the concurrent reprogramming of scarce funds to meet more pressing needs. Real time pathfinding based on traffic conditions provided by internet companies is optimizing the use of the entire street network to accommodate peak period travel.

The new mobility includes such diverse modalities as: peer-to-peer car sharing, shared-use mobility, integrated way-finding, electric vehicle (EV) charging infrastructure, and new investment in mass transit systems. Many components of "smart" cities are already ubiquitous, such as smart phones; others are in rapid ascent, like bicycle lanes, electric vehicles, mixed-use development and redevelopment around multi-modal transit hubs. From electric vehicles, to car sharing, to smart parking, to Intelligent Transportation Systems, building / vehicle interaction (V2B), smart charging, grid storage and Wi-Fi lampposts, new technologies and designs are being applied to optimize infrastructure, reduce congestion and address the challenges of climate change.

With the sharing economy, you no longer have to be able to afford the whole vehicle, and can pay as you go, purchasing only the part that you need to use, perhaps enabling access to employment that was not previously accessible. If we do not need our own cars all the time, do we need all that parking? What else could that land be used for? With fewer, more efficient autonomous vehicles on the road, can we realize truly shared right-of-ways where

technology enables greater equality between modes of transport?

Shifting cultural preferences to both the sharing economy and the increasing interest in active transportation are driving the pursuit of "complete streets" – using the public right of way not just for automobiles, but rethinking design standards to incorporate all users including transit riders, cyclists and pedestrians in a safe environment.

Next generation mobility planning has the power to "warp space" and realize significant benefits, including value creation and value capture. Historically, infrastructure development has had a major impact on real estate values - the corner store next to the bus stop fares better (artificial value increase) than the one a few blocks away. How can classically underfunded transit systems realize a portion of the real estate value increase they enable?

The published "Value Capture Road-map" (AECOM/Consult Australia) argues that a well-conceived and managed value capture program could contribute between 10 percent and 30 percent of infrastructure costs from a defined improvement area. The Value Capture Roadmap report positions value capture as an alternative infrastructure funding method and a decision-making tool to help fill the infrastructure defining gap in cities. Value capture mechanisms capitalise on the increased commercial and residential densities created by virtue of significantly increasing access to metropolitan centers. London's Crossrail project, a USD29.6 billion extension to the commuter rail network, for example, is being partially funded by a two percent Business Rate Supplement on non-residential properties. The supplement (which is locked in for 25-30 years until the project costs are fully repaid) is contributing USD7.6 billion (26 percent) of the project's cost.

By making the development of high quality transportation infrastructure a priority, the city stakeholders are investing in the future of their city. By taking a somewhat more modest and patient approach to funding and delivering these essential connections, the city can realise the largest of projects.

Over the last few years discussions surrounding driverless cars has been getting louder. What are the implications of driverless cars for cities and real estate?

The biggest promise is that there will be more space for people. Currently in Europe, up to 30 percent of urban land is devoted to roadways and parking. In the U.S., the number goes up to 50 percent. Potentially, 90 percent of that available road space could be turned over to development and public realm.

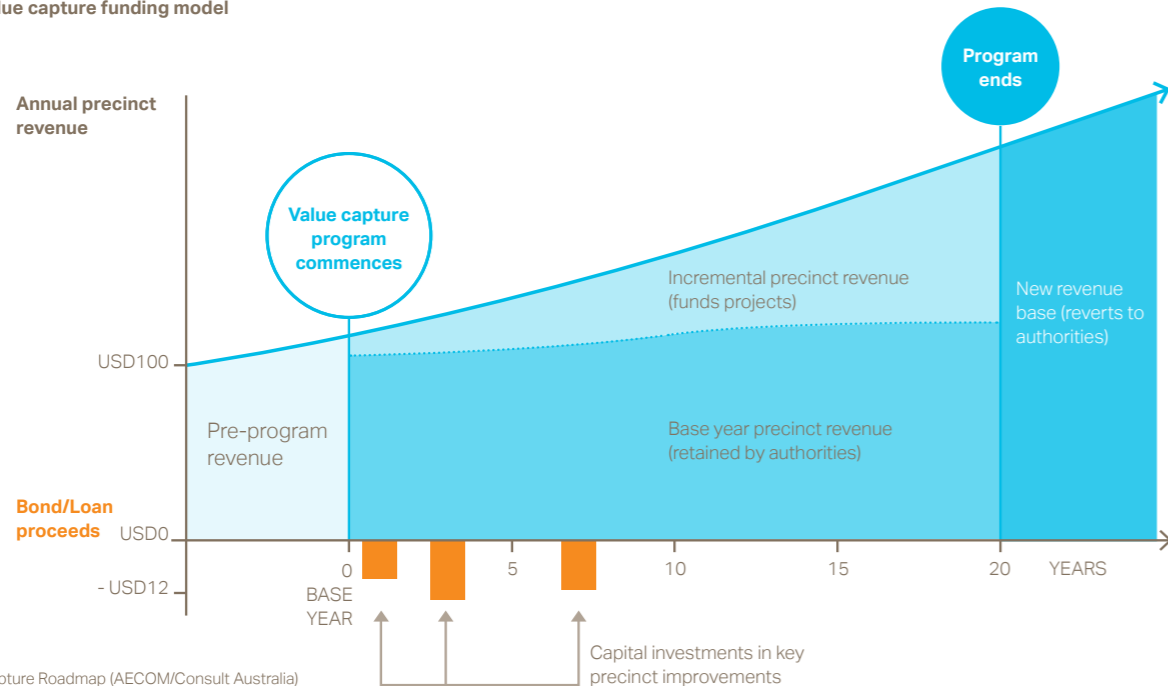
These areas are in prime, central-city locations. Parking infrastructure like garages and lots could be repurposed as commercial, mixed-use, or residential projects. Expressways and access ramps could become new brownfield developments. And there could be great improvements in open spaces because there will simply be more room for pedestrian- and cycling-oriented infrastructure—covered crosswalks, elimination of curbs,

more bike stands, more landscape and playgrounds instead of car parking.

Autonomous vehicles will greatly reduce the number of cars overall—perhaps by a factor of ten. They also will reduce overall travel times for users, as sensors and software allow cars to merge and cross seamlessly, using up to eight times less travel area in the process. An MIT study estimates that Singapore could reduce its taxi fleet by 70 percent if all were computer destination directed.

There are major implications for emergency services: response times for fire and ambulance vehicles will be more rapid because they won't be competing with as many cars on the road. Also, autonomous movement means freeing up capacity on tunnels, bridges, and other public infrastructure that are under stress. That means these major assets might not have to be expanded—or built in the first place.

Figure 46. Value capture funding model



Source: Value Capture Roadmap (AECOM/Consult Australia)

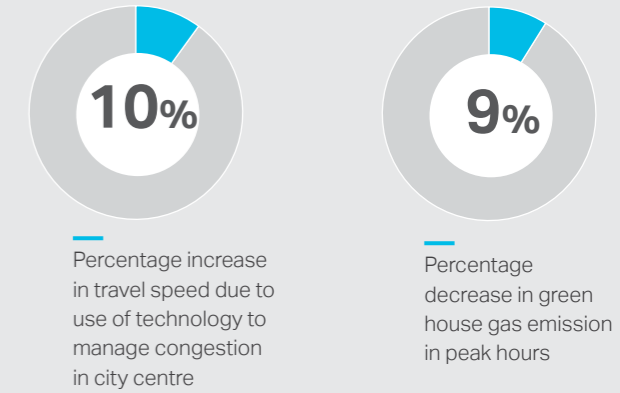
Perhaps most importantly, though, are implications for public safety. Ninety-three percent of vehicular deaths are caused by human error, with 1.2 million vehicular deaths worldwide every year. The public health and safety benefits of driverless cars can't be overstated. Insurance premiums will also go down, with liability shifted from the driver to the vehicle manufacturer.

Figure 47. Transportation fatalities per 100 000 population



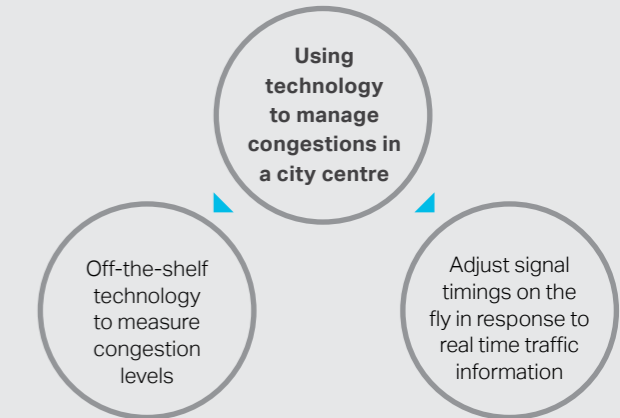
Source: Open City Data Portal

A 21st century economy requires a city to have a transportation network that is convenient, dependable, accessible, and connected. This growth will pose challenges for urban mobility – the networks of transportation facilities and services that move the flow of people and commerce into, out of and within the world's cities. The ease, safety, and reliability of transportation influence our capacity to do business, obtain health care, and participate in social and recreational activities. Advances in technology facilitate integrated and smart mobility solutions, while leveraging the existing infrastructure with new concepts and business models.



Percentage increase in travel speed due to use of technology to manage congestion in city centre

Percentage decrease in green house gas emission in peak hours



Source: ITE Journal, 2013

London 2012 Olympic and Paralympic Games, UK



Cities and international events - reasons to bid (even if you lose)

As lessons have been learned and passed on from one event to another, there are now a number of examples of cities that have won the right to host a major event and then gone on to plan for and deliver long-term benefits. Barcelona, Vancouver and London to name a few are all examples where positive legacies prevail.

Cities such as these have all strategically set objectives and used their event to 'fast-track' development projects to varying degrees to achieve physical legacies.

The concept of bidding, losing and then still achieving physical and other legacies, in other words, aiming to strategically gain legacies just by bidding, is relatively new but gaining recognition. The Mayor of Boston, recently said in relation to the city's 2024 Olympic bid: "Whether you oppose or support the Games, whether you are a business leader or a community activist, whether you live in Boston or work here, we can all agree that having a two-year, public conversation about the future of our great city is a good thing."

The introduction of the recent IOC Olympic Agenda 2020 reforms, including specific measures to help reduce the costs of bidding, is a recognition that if bidding becomes unattractive due to sunk costs being too high, it might reasonably be assumed that fewer cities will be prepared to bid in the future, leaving only a relatively small number of the world's major cities with the capacity to stage the spectacle that is the Olympic Games.

In the meantime, however, the cost of bidding has continued to escalate. Tokyo reportedly spent USD150 million on its 2020 Olympic bid and Boston 2024 has a stated budget of approximately USD75 million. The almost unprecedented drop-out of Stockholm, Munich, Krakow and Oslo from the

2022 Winter Olympic Games bid process was largely attributed to the perceived cost of bidding and hosting relative to the likely legacies, which in turn led to a lack of public confidence and support. Edmonton withdrew its bid to host the 2022 Commonwealth Games, citing financial reasons and leaving Durban as the only remaining bidder.

Bidding and not winning is both a short and long-term risk for bidding cities. A bidding city that does not win loses its investment in making the bid and may only see that as a longer-term investment if a future and ultimately successful bid is made, as in the case of Pyeongchang, which bid three times for the Winter Olympics before it finally won the right to host the event in 2018.

It is possible, however, to identify a number of distinct benefits enjoyed by a candidate city whatever the outcome, and therefore maximise the potential for a return on investment if and when the bid is lost. Researchers in the Economic Analysis and Policy Group at the University of California have found that unsuccessful bids to host the Olympics have an impact on trade every bit as significant as the effect of actually hosting the Games. This suggests that the Olympic effect on trade, as an example, is attributable to the signal a country sends when bidding to host the games, rather than the act of actually hosting such an event.

Aside from the so-called 'mega' or flagship events such as the Olympic and Paralympic Games, there are thousands, if not hundreds of thousands of events which occur across the globe every year.

As well as sport, the event sector also includes cultural, political and trade events, large and small, and all have the potential to generate a wide range of well-documented economic benefits for the host city or community. Events also create media



“ Whether you oppose or support the Games, whether you are a business leader or a community activist, whether you live in Boston or work here, we can all agree that having a two-year, public conversation about the future of our great city is a good thing. ”

— Mayor of Boston, Martin J. Walsh

attention, increase the quality of life in our communities and can dramatically increase the global profile of emerging destinations.

The benefits directly attributable to the bid process include:

- International city branding: bidding for any global event immediately raises the international profile of the city and puts it on the map. This is especially significant for emerging destinations.
- Identifying aims, objectives and goals: formulating a bid forces candidate cities to identify their own metrics for success.
- A long-term plan: bidding for but not winning an event can yield constructive criticism of a city's proposals that allow and encourage it to successfully bid another time, such as in the case of Pyeongchang.
- City development: bidding for a global event encourages the adoption of new benchmarks for city development, changing the rules of engagement and prompting real progress in city development. The imposition of multiple external deadlines actually helps the city to achieve disciplined and rapid progress and yields valuable lessons in time management.
- Working together: bidding for a global event means that city, regional and national authorities have to work together to plan the full range of logistics.

– Physical legacy: bidding for a global event requires that venue development plans be drawn up well in advance, setting out budget projections and long-term usage, and often that sites and land must be assembled and prepared before the final bid outcome is known.

– Urban transformation catalytic effect: most importantly, the 'catalytic' effect on urban transformation that is derived from hosting a global event is, to a large degree, experienced from the earliest moments of bid formation, as indicated by the research on trade impact.

Against the backdrop of a global economy that is still struggling to gain momentum, the escalating costs of bidding for major events and the challenge of building public support, cities can still benefit from the bid process. Bidding to fail is unlikely to be a supportable policy but there is evidence to suggest that with the right approach, the bid process can be a catalyst for significant long-term legacies, regardless of the outcome.

SMART city infrastructure

As the drive toward increased digitization continues, many industries have started linking machinery, equipment and other physical assets with networked sensors and actuators to capture data and manage performance, enabling machines to collaborate and even act on new information independently.

Networked sensors and actuators are proliferating and affecting companies, systems and individuals in multiple ways. While many companies, especially equipment manufacturers, already employ the Internet of Things (IoT) in pioneering ways, this trend is just starting to take off in the construction industry.

SMART, which stands for Self-Monitoring Analysis and Reporting Technology solutions, is a term that can be applied to any asset. For example, a SMART bridge or building has the ability to alert us of its changing condition by using standard technologies. This is becoming possible because the physical and digital worlds are converging, bringing greater efficiency and new opportunities.

A key component of SMART is remote monitoring of infrastructure like buildings, transportation assets and water and environment resources. The use of SMART solutions on existing infrastructure has huge potential benefits from improving operational efficiencies, reducing total cost of ownership, extending the life of assets, reducing the risk of catastrophic failures, managing regulatory compliance and improving sustainability.

One example of a SMART solution is remote monitoring of energy consumption and performance of building systems and equipment, from heating, ventilation, and air conditioning (HVAC) to air compressors, to ensure that all systems operate at peak efficiency and in combination with one another. Real-time remote

monitoring enables the identification of anomalies in building systems that might otherwise go unnoticed until they become significant expenses and provides opportunities for continuous commissioning by constantly monitoring all systems to ensure they are within parameters for optimal operating conditions.

Another example of a SMART solution would be placing sensors like accelerometers, tilt meters, temperature sensors and acoustic sensors on buildings and other structures to continuously monitor structural health. These sensors would allow us to receive an early warning of changing conditions, potentially extending the need for periodic inspections by human inspectors. This real-time remote monitoring approach is also able to capture changes in between inspections, which would otherwise go unnoticed. In addition, this helps reduce the risk of catastrophic failures and can reduce maintenance costs by supporting the move to preventative and predictive maintenance models.

Providing digital instrumentation to infrastructure assets is the first critical step in making new and existing assets SMART assets. Several forces are at work to make infrastructure SMART and more intelligent:

- **Costs of deployment:** Instrumentation costs have declined dramatically, making it possible to equip and monitor infrastructure assets in a more economical manner than in the past.
- **Communications:** The cost of network connectivity has fallen; at the same time coverage from cellular networks, wired or wireless networks or point-to-point networks, has steadily widened. Meanwhile, the introduction of new, high-speed networks such as fourth generation (4G) mobile networks will start to allow new kinds of high bandwidth applications.

- **Computing power and the rise of the cloud:** Continued improvements in microprocessor chips and the advent and proliferation of cloud computing are providing flexible and scalable technology platforms to support SMART applications.
- **Advanced analytics:** Advances in “big data” software tools and analytics combined with industry knowledge provides a means to understand the massive quantities of data generated by these intelligent assets, which enables better decisions to be made resulting in better outcomes on client projects.

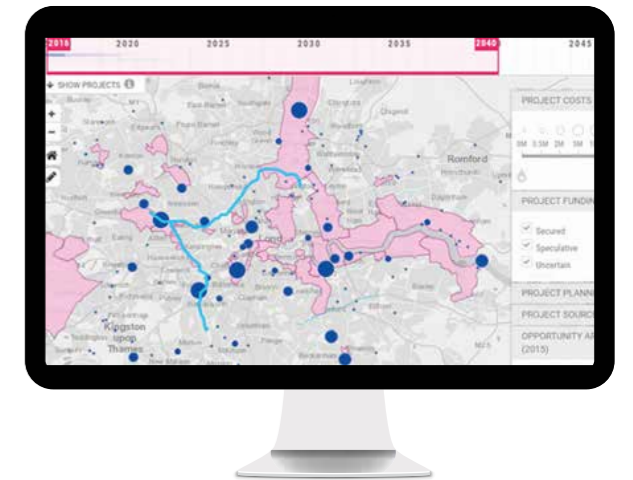
The explosion of IoT applications provides many opportunities for companies to improve performance. While there are many drivers accelerating the adoption of SMART solutions in infrastructure, some steps worth considering include developing a return on investment for each project, identifying the various data sources and formats since data normalization and integration is not easy, as well as developing an information security plan.

Visualizing the city infrastructure with GIS

The Infrastructure Group at the Greater London Authority (GLA) has developed a new map, which is currently in beta-testing. This is no ordinary map.

Like many GIS applications, this database integrates an extraordinary amount of infrastructure information in an interactive format and currently incorporates over 40 major urban opportunity areas (some several times larger than the 2012 Olympic Site) and over 12,000 ongoing and planned projects.

What makes this particular digital map so powerful is that for the first time, virtually all of the city’s infrastructure providers (transport, power, water, sewerage, broadband, etc.) as well as major developers in the city are updating the digital database every week. And unlike conventional GIS databases, which layer assets and links to related information, this particular platform integrates project data, spatial organization, and powerful analytics via an interactive dashboard.



Screen shot from the GLA's Infrastructure Mapping Application for London

Users can identify conflicts (e.g. project overlaps with other utilities, interference with view corridors), parallel efforts by other infrastructure providers, and projects occurring in similar timescales. The dashboard allows users to measure consequences of development (e.g. impacts to traffic movements of individual and overlapping projects), identify land ownership and tax base, and even to anticipate employment sectors and vocational training requirements related to particular major initiatives.

Although full access to granular information is restricted to members of the London Infrastructure Delivery Board because of commercially sensitive information, the regulated utilities that have contributed to the vast majority of the database and higher-level information is now publicly accessible.

The Infrastructure Group at the GLA recognizes advances of machine learning and is managing the introduction of mega-data into the public sector. This particular new tool creates a powerful platform that encourages innovation, suggests cross-sector opportunities across the urban realm, and encourages collaboration between London's boroughs.

AECOM is developing its own Smart Cities/London 'M-App', and it's not hard to imagine how powerful a tool we can develop when we start to eventually merge the databases. This GIS map is a great model for what city authorities can do for their own territories, anywhere in the world.

Article contributions from James Kirpatrick, Chris Choa, Adam Williams, James Haig Streeter, Sue Wittenoom, Geoff Lynch, German Aparicio





Section

THREE

Reference
Articles

Procurement routes

All clients expect buildings to be on time and budget with an agreed level of quality, 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 buildings 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 maximise the value from their time, cost and quality mix, whilst adhering to a process that increases the likelihood of their building being successfully procured by their team involved.

Studies conducted with our key clients who regularly undertake development work, have shown that buildings can be delivered for 12-15 percent less cost when procured correctly with no impact on quality or time. Buildings are more likely to be on time and meet clients' expectations when procured correctly. So what is the right procurement approach for your building? Which funding strategy, funding partner, team behaviours, attitudes, communication channels, budget and program delivers the best approach and how can we best combine these to lead our clients to ultimate success?

AECOM Project Management

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 maximises the value we can offer. Some of the procurement strategies followed in the industry are listed below, but the real challenge is mixing 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 above, 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 the way in which 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. They design and procure the project on behalf 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 design team to complete the design or use his own team. 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 his 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, 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.

Private Finance: 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 private finance 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 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 a 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 Organizing 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 re-measured 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 re-measured 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 re-measurement and lump sum contract dependent on choice of clauses, 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.

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 utilize 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."

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.





Kuwait

Construction contracts in Kuwait are generally based upon the FIDIC forms of contract. The public and private sector, have promoted the development and use of bespoke forms of contract, tailored to each 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.

As cited by a FIDIC article (FIDIC in the Middle East) the Ministry of Public Works in Kuwait, for example, has historically issued its own set of contractual conditions based on FIDIC conditions. But where such conditions have been heavily amended to reflect a lump sum fixed price requirement primarily driven by local public tender laws.



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 onerous and slanted towards the client, but are usually 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, although these are usually for smaller scale fitting out or highly specialist works.

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.



UAE

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 contract 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 re-measurable 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 re-measurable element, reflecting those parts of the design which are incomplete at tender stage.

Building regulations and compliance

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

The AECOM Project Management team are experienced in the procedures for obtaining Building Permits across the region and are 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 Defense 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 master plan 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 copy 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 Defense, 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/ master plan stage application

The applicant submits a Concept Design/Master Plan 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 Defense, 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 Defense, Food and Hygiene, etc, prior to presenting these to the municipality or statutory authority for final approval.

Kuwait

The below extract sourced from the World Bank's Doing Business, provides an overview of the building permit process.

Step 1: Submit drawings and receive certificate from the relevant sector Public Authority

Step 2: Obtain lot plan with site map from the Municipal Authority

Step 3: Obtain zoning approval from the Municipal Authority

Pursuant to Law 5 of 2005, the Municipality is mandated with the authority to plan the use of land in Kuwait. This involves designating permitted uses of land based on mapped zones which separate one set of land uses from another (e.g. residential, industrial, recreational, etc).

Step 4: Request electricity and water plans approval from Ministry of Electricity and Water

According to No. 30/2012 issued by Kuwait Municipality on August 2012, the building permit will not be granted unless the Ministry of Electricity and Water (MEW) gives its approval on the electric supply. A site inspection must be conducted before the approval can be issued.

Step 5: Receive electricity and water inspection from Ministry of Electricity and Water

Step 6: Obtain electricity and water plans approval from Ministry of Electricity and Water

Step 7: Obtain approval of plans from Kuwait Fire Services Directorate

Step 8: Request sewage plans approval (sanitary certificate) from Ministry of Public Works

Step 9: Receive sewage inspection from Ministry of Public Works

Step 10: Obtain sewage plans approval from Ministry of Public Works

Step 11: Conduct soil test with private laboratory

Step 12: Request and obtain building permit

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

Step 13: Obtain site take-over letter (supervision commitment license)

Step 14: Submit final report and the file of cadastral measure of the structure to the Municipality for approval

Step 15: Receive final inspection from the Municipality

Step 16: The municipality inspects the buildings to ensure compliance with the drawings.

Step 17: Receive final approval certificate from Municipality

Step 18: Obtain commercial license from Ministry of Commerce

Step 19: Obtain water connection

Step 20: Obtain sewage connection

Step 21: Receive inspection from the Kuwait Fire Services Directorate

Step 22: Obtain certificate of fire and panic safety from the Kuwait Fire Services Directorate

Step 23: Register building with the Real Estate Registry

Source: World Bank Doing Business

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 master plan 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 companies 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.

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 Defense 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.

Stage 3: Building Permit

Once 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, depending upon the quality of the submission, although

in practice it 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.

All fit-out projects are being brought under the control of the regulatory departments, in particular Civil Defense, and all such works are now required to be submitted for approval prior to commencement. This submission must be made by a registered local consultant and failure to do this can significantly delay the approval and permitting process.

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.

Etihad Towers, Abu Dhabi, UAE



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 Defense, 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

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 and quasi-government departments, including Civil Defense, Food and Hygiene, CID etc, prior to presenting these to the Municipality or statutory authority for final approval.



Section

FOUR

Reference
Data

International building cost comparison

The international cost data shown is a comparison of local construction costs converted to US Dollars. The building costs for the respective asset types are averages based on local specifications and the actual cost of a building will depend on among other things, unique site conditions, design attributes and applicable tariffs. 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:

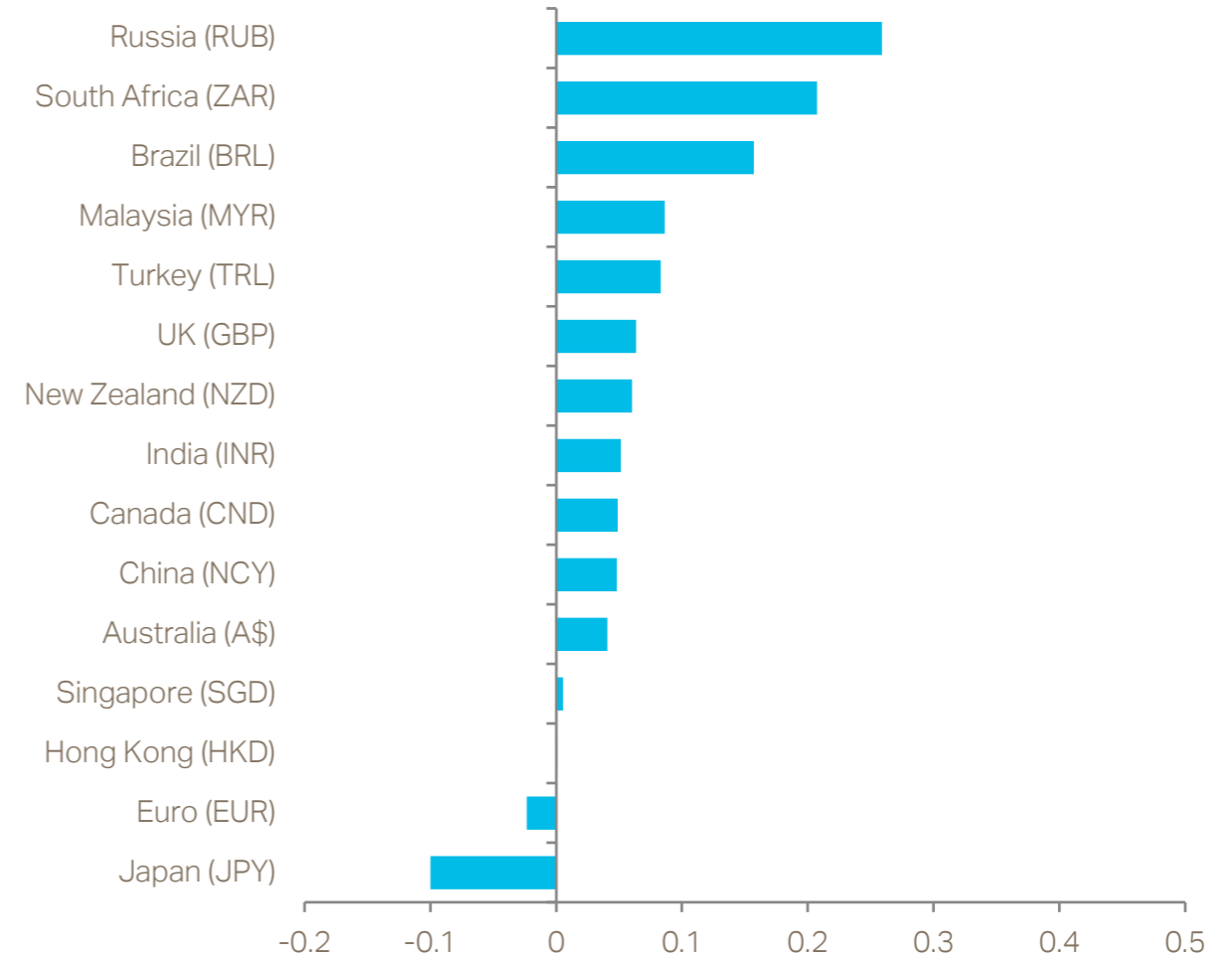
- Local market conditions
- Complexity of project
- Commodity price movements
- Building specifications
- Exchange rates

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:

- A renewed strength in the US dollar
- US Federal Reserve monetary policy shifts
- Political developments in both the US (presidential elections) and the UK (EU referendum)
- Corporate debt issues in China
- Global commodity price recovery dynamic

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

Figure 48. Currency movements of the US Dollar against major currencies Q2 2016 compared to Q2 2015



Source: Bank of England, www.xe.com

How are global markets comparing

United States

The US construction industry has performed solidly over the past year and this trend is expected to continue on the back of strong residential construction. The positive outlook for construction is being driven by improving consumer confidence and a growing population demanding new technologies and housing. In non-residential construction, growth is led by the highways and roads construction partly due to a new highway bill being pushed through. The hospitality sector is another growth area for the US construction industry, as well as communication-related construction, offices, as well as amusement and recreation-related work. Construction price inflation has ticked up slightly over the past year reflecting the impact of increasing amount of construction activity, but remains contained overall.

Asia

Despite a slowdown in the growth rate from historic highs, Asia is set to continue to be one of the fastest growing construction sectors globally. However performance within the region is forecast to vary considerably. China, the growth powerhouse over the past decade is forecast to slow, while more developed construction markets such as Hong Kong, Singapore, South Korea and Japan will also weigh on regional growth. In line with slower industry growth and lower material prices, construction cost inflation in these regions has slowed markedly, and in places turned negative, a trend that is likely to continue. In contrast India, the Philippines, Indonesia and Vietnam are seen as market becoming increasingly attractive for private and foreign investment over the coming years, supported by positive economic growth, a large infrastructure deficit, and an improving regulatory outlook.

Middle East

The impact of lower oil revenues is keenly felt in the oil-exporting Middle East countries, and public sector spending plans appear to be re-assessed in light of a potentially longer than expected period of low oil prices. In the UAE, increased competitiveness for fewer private and in particular government financed project

appears to have begun to put filter through to increasingly competitive pricing. Whilst the total project pipeline reported by MEED indicates that there is still enough work to potentially fill order books, contractors' and consultants' prospects are vulnerable to schemes taking much longer than expected to come through. Anecdotal evidence suggests that contractors increasingly resolve to hard pursuit of workload, which has resulted in lower levels of overheads and profit. This, together with lower preliminaries levels is expected to act as a downward push for overall price levels.

United Kingdom

On the back of strong workload growth, momentum in UK tender price inflation built up in 2015 and carried through into 2016. Whilst current activity indicators, contractor selectivity and capacity constraints generally support firm tender price inflation in the near term, uncertainty has certainly increased in the local construction industry. Businesses and investors alike will await the impact of the EU referendum, although the implications on the UK construction and property industries of are ambiguous at best.

Europe

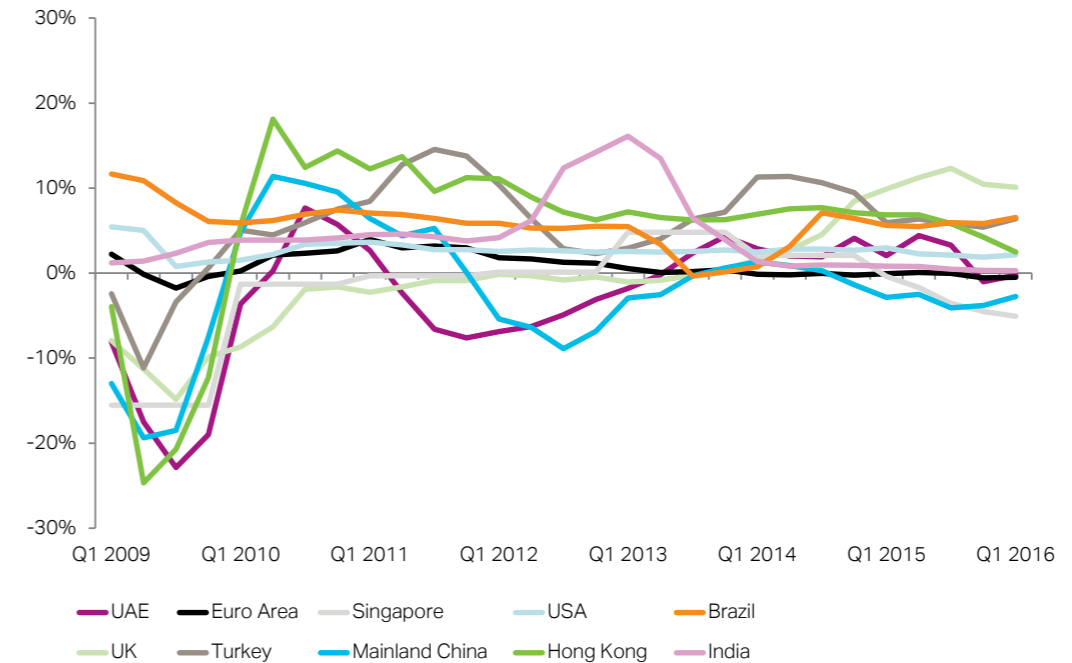
Construction demand in Europe is continuing to recover, according to Euroconstruct, the network of European construction forecasters. The drivers of European construction demand include more positive economic developments, very favorable financing conditions, as well as a greater scope for expenditure on the part of several member states. Growth will be uneven across the region. Western Europe is expected to perform better than Central and Eastern Europe, with the former region remaining one of the most attractive infrastructure markets globally owing to its low risk, inelastic infrastructure demand and mature regulatory markets. Out-performers include Ireland, the Netherlands, Norway, Poland, and Portugal, as growth rebounds following multi-year recessions. The larger markets such as Germany, France, Italy, and Spain are also expected to grow more strongly than in recent years. Eastern and Central Europe could benefit from a new phase of EU funding in the next few years. The weakest growth is forecast for the crisis-countries including Greece, Russia and Ukraine.

Australia

Australia's construction industry should start to recover from its post-commodity gloom, with government sponsored infrastructure spending the main catalyst for growth in the near term. In particular transport infrastructure is expected to benefit from the initiatives, with a number of high-value road and other transport projects in the pipeline. The government is also promoting private sector investment through a shift to a user-pays system for transport infrastructure. On the downside, continued cuts in capital expenditure in the mining and extractive sector will continue to weigh on industrial and overall construction growth. The outlook for construction cost escalation is modest at best in most cities, with the exception of Sydney where a combination of significant size projects and strengthening demand is keeping many contractors busy.

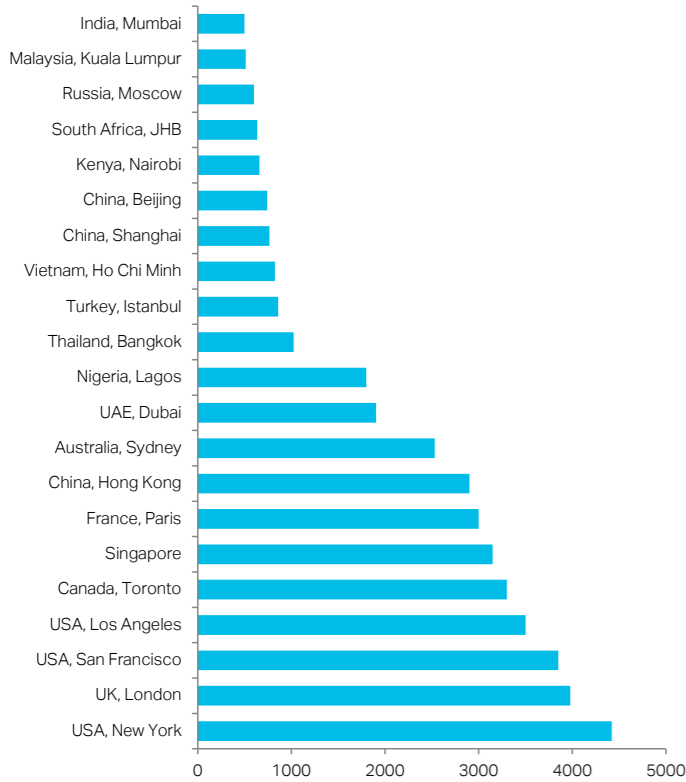
Figure 49. International construction cost inflation

Annual percentage change



Source: Based on AECOM Indices for UK, UAE; ENR USA Construction Cost Index; Brazil IGBE Building Cost Index, NBS Mainland China Construction + Installation Price Index, Singapore Building Construction Authority, Hong Kong Building Works Tender Price Inde

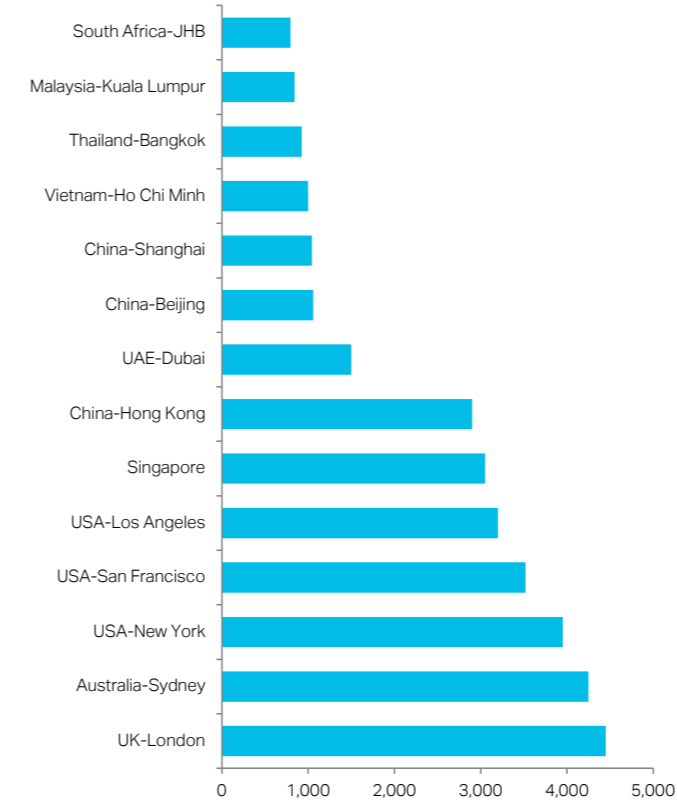
Figure 50. Residential
Average standard high rise (USD/sqm)



Average Building Costs (USD/ sqm)														
Residential	USA New York	USA San Francisco	USA Los Angeles	United Kingdom London	Singapore	China Hong Kong	Australia Sydney	UAE Dubai	China Shanghai	China Beijing	Thailand Bangkok	South Africa JHB	Malaysia Kuala Lumpur	Vietnam Ho Chi Minh
Luxury Unit High Rise	5,790	4,950	4,500	5,578	4,550	4,050	3,987	2,310	1,702	1,659	1,525	1,104	841	1,000
Individual Prestige Houses	4,480	4,400	4,000	5,535	5,200	5,850	4,641	N/A	929	810	1,600	1,064	720	675
(As at 1 April 2016)	AUD	HKD	CNY	CNY	MYR	SGD	ZAR	THB	AED	USD	USD	USD	GBP	VND
USD1 =	1.30	7.78	6.48	6.48	3.90	1.35	14.76	35.21	3.67	1.00	1.00	1.00	0.70	22425.00

Note: Prices exclude land, site works, professional fees, tenant fitout and equipment. Rates exclude GST/VAT. Hotel rates include FF&E
COSTS BASED ON 1 JULY 2016
EXCHANGE RATES TO USD AS AT 1 APRIL 2016

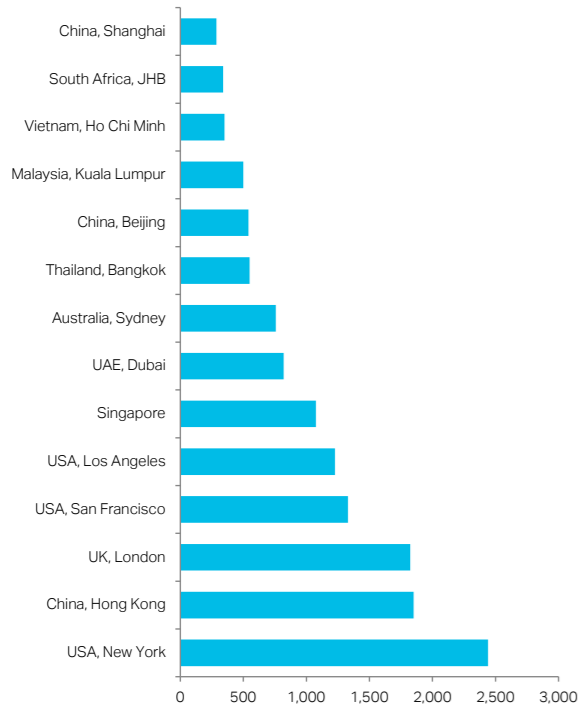
Figure 51. Commercial - offices
Average standard offices high rise (USD/sqm)



Average Building Costs (USD/ sqm)														
USDper sqm	Australia Sydney	China Hong Kong	China Beijing	China Shanghai	Malaysia Kuala Lumpur	Singapore	South Africa JHB	Thailand Bangkok	UAE Dubai	USA Los Angeles	USA San Francisco	USA New York	United Kingdom London	Vietnam Ho Chi Minh
Prestige Offices High Rise	4,967	3,650	1,482	1,625	1,245	4,050	1,023	1,100	1,940	4,200	4,620	5,117	5,500	1,200
Major Shopping Centre (CBD)	3,569	4,200	1,428	1,518	1,310	3,900	678	800	1,635	3,228	3,712	3,874	4,850	700
(As at 1 April 2016)	AUD	HKD	CNY	CNY	MYR	SGD	ZAR	THB	AED	USD	USD	USD	GBP	VND
USD1 =	1.30	7.78	6.48	6.48	3.90	1.35	14.76	35.21	3.67	1.00	1.00	1.00	0.70	22425.00

Note: Prices exclude land, site works, professional fees, tenant fitout and equipment. Rates exclude GST/VAT. Hotel rates include FF&E
COSTS BASED ON 1 JULY 2016
EXCHANGE RATES TO USD AS AT 1 APRIL 2016

Figure 52. Industrial
Light duty factory (USD/sqm)

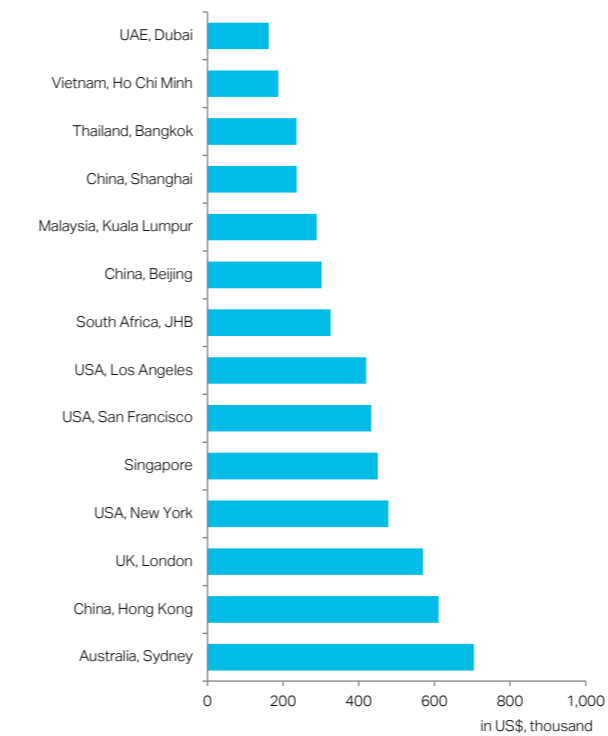


Average Building Costs (USD/ sqm)														
USDper sqm	Australia Sydney	China Hong Kong	China Beijing	China Shanghai	Malaysia Kuala Lumpur	Singapore	South Africa JHB	Thailand Bangkok	UAE Dubai	USA Los Angeles	USA San Francisco	USA New York	United Kingdom London	Vietnam Ho Chi Minh
Light Duty Factory	758	1,850	540	286	501	1,075	339	550	820	1,227	1,329	2,440	1,824	350
Heavy Duty Factory	954	2,050	N/A	N/A	539	1,325	386	875	955	1,743	1,888	3,461	3,130	450
Multi Storey Car Park	980	1,500	N/A	N/A	334	900	241	575	585	1479.5	1546.75	1494	894	350
District Hospital	6,111	5,750	N/A	1,431	988	4,350	1,575	N/A	2860	6,000	6,600	8,100	4,495	N/A
Primary and Secondary Schools	2,510	2,650	N/A	N/A	353	1,325	437	N/A	1470	3,800	3,900	4,397	2,279	N/A
(As at 1 April 2016)	AUD	HKD	CNY	CNY	MYR	SGD	ZAR	THB	AED	USD	USD	USD	GBP	VND
USD1 =	1.30	7.78	6.48	6.48	3.90	1.35	14.76	35.21	3.67	1.00	1.00	1.00	0.70	22425.00

Source: AECOM

Note: Prices exclude land, site works, professional fees, tenant fitout and equipment. Rates exclude GST/VAT. Hotel rates include FF&E
COSTS BASED ON 1 JULY 2016
EXCHANGE RATES TO USD AS AT 1 APRIL 2016

Figure 53. Tourism
Five star luxury hotel (USD/key)



Average Building Costs (USD/ key)														
USDper key	Australia Sydney	China Hong Kong	China Beijing	China Shanghai	Malaysia Kuala Lumpur	Singapore	South Africa JHB	Thailand Bangkok	UAE Dubai	USA Los Angeles	USA San Francisco	USA New York	United Kingdom London	Vietnam Ho Chi Minh
3 Star Budget	346,405	353,500	135,800	100,980	160,600	100,000	185,000	60,000	50,916	73,449	76,397	81,000	94,000	N/A
5 Star Luxury	704,575	611,000	301,500	236,050	288,850	450,000	325,100	235,000	162,004	419,203	433,166	478,260	570,000	187,500
Resort Style	N/A	N/A	393,000	279,348	256,600	450,000	N/A	262,500	190,865	263,402	273,875	210,000	350,000	225,000
(As at 1 April 2016)	AUD	HKD	CNY	CNY	MYR	SGD	ZAR	THB	AED	USD	USD	USD	GBP	VND
USD1 =	1.30	7.78	6.48	6.48	3.90	1.35	14.76	35.21	3.67	1.00	1.00	1.00	0.70	22425.00

Source: AECOM

Note: Prices exclude land, site works, professional fees, tenant fitout and equipment. Rates exclude GST/VAT. Hotel rates include FF&E
COSTS BASED ON 1 JULY 2016
EXCHANGE RATES TO USD AS AT 1 APRIL 2016

Regional building cost comparison

Building cost (USD/sqm)		UAE (Dubai)		KSA (Riyadh)		Qatar (Doha)		Bahrain (Manama)		Oman (Muscat)	
Sectors	Typology	Low	High	Low	High	Low	High	Low	High	Low	High
Residential	Low rise	950	1,500	800	1,330	1,240	1,510	670	1,070	780	910
	Medium rise	1,230	1,500	1,200	1,470	1,380	1,790	1,070	1,470	910	1,170
	High rise	1,500	2,310	1,600	2,000	1,510	1,930	1,340	1,740	N/A	N/A
Commercial	Low rise office (shell and core)	1,090	1,360	670	1,200	1,240	1,510	1,070	1,470	N/A	N/A
	Mid rise office (shell and core)	1,230	1,500	1,200	1,600	1,380	1,790	1,340	1,610	650	910
	High rise office (shell and core)	1,360	2,040	1,600	2,130	1,790	2,200	1,470	2,010	N/A	N/A
	Fit-out - basis	1,090	1,500	670	930	550	690	540	740	N/A	N/A
	Fit-out - medium	1,500	1,910	930	1,200	960	1,240	670	940	N/A	N/A
	Fit-out - high	1,910	2,450	1,200	1,600	1,240	1,790	870	1,340	N/A	N/A
Retail	Community	1,270	1,550	670	930	1,100	1,380	1,070	1,340	1,250	1,510
	Regional mall	1,320	1,620	1,070	1,470	1,240	1,650	1,200	1,470	1,240	1,550
	Super regional mall	1,470	1,800	1,200	1,730	1,240	1,790	1,340	1,740	1,350	1,660
Industrial	Light duty factory	740	900	800	1,070	830	960	800	1,130	700	900
	Heavy duty factory	860	1,050	800	1,070	960	1,240	940	1,300	890	1,150
	Light industrial unit (liu)	610	750	670	800	690	830	670	940	N/A	N/A
	Data centre - tier 3 (*based on aed/kw(it)	19,060	21,780	18,140	20,810	19,820	22,570	N/A	N/A	N/A	N/A
Hotel	Budget	1,770	2,180	1,330	1,600	2,340	2,480	1,470	1,740	N/A	N/A
	Mid-market	2,180	2,720	1,600	2,130	2,480	3,440	1,610	2,140	2,570	3,440
	Up market	3,270	3,680	2,530	2,930	3,440	4,130	2,010	2,540	2,880	3,610
	Resort	3,130	3,810	2,930	3,470	3,850	4,130	2,410	3,210	3,070	3,950
Car parks	Multi storey	520	650	590	720	760	890	400	670	340	520
	Basement	760	930	800	930	830	960	600	940	N/A	N/A
Other	Schools - primary, secondary academy	1,310	1,630	800	1,330	1,510	2,060	1,340	1,740	1,170	1,510
	Healthcare - district hospital	2,590	3,130	1,870	2,670	2,200	2,750	2,410	2,940	2,090	2,680
Exchange rate to 1 USD		AED	3.67	SAR	3.75	QAR	3.63	BHD	0.37	OMR	0.38

Note: All costs are based on Q2 2016

For Typology Definitions, inclusions and exclusions see Appendix 1

Relative cost 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. Relative costs are based on an average across all sectors.

Mechanical and electrical cost comparison

Building cost (USD/sqm)		UAE (Dubai)		KSA (Riyadh)		Qatar (Doha)		Bahrain (Manama)		Oman (Muscat)	
Sectors	Typology	Low	High	Low	High	Low	High	Low	High	Low	High
Residential	Low rise	270	350	280	470	370	450	230	360	700	900
	Medium rise	360	460	420	510	410	540	360	500	340	470
	High rise	570	740	640	800	520	670	540	700	N/A	N/A
Commercial	Low rise office (shell and core)	350	420	200	360	370	450	370	510	N/A	N/A
	Mid rise office (shell and core)	410	490	360	480	410	540	470	560	260	420
	High rise office (shell and core)	460	560	560	850	520	770	660	900	N/A	N/A
	Fit-out - basis	360	490	200	280	60	70	240	330	N/A	N/A
	Fit-out - medium	490	630	280	360	190	250	300	420	N/A	N/A
	Fit-out - high	630	810	420	560	440	630	390	600	N/A	N/A
Retail	Community	350	420	230	330	390	450	360	450	N/A	N/A
	Regional mall	420	540	370	510	440	580	410	500	410	520
	Super regional mall	440	570	480	690	440	720	450	590	N/A	N/A
Industrial	Light duty factory	250	300	240	320	250	290	540	740	290	370
	Heavy duty factory	340	420	240	320	290	370	670	940	390	500
	Light industrial unit (liu)	160	190	200	240	210	250	330	470	N/A	N/A
	Data centre - tier 3 (*based on aed/kw(it)	14,010	16,010	13,340	15,470	15,140	17,340	N/A	N/A	N/A	N/A
Hotel	Budget	440	540	530	640	820	990	470	560	N/A	N/A
	Mid-market	540	680	640	850	990	1,380	510	680	820	1,100
	Up market	820	920	1,010	1,170	1,380	1,510	680	860	1,040	1,310
	Resort	780	950	1,170	1,390	1,380	1,510	750	1,090	1,520	1,960
Car parks	Multi storey	120	150	200	240	230	270	80	130	50	160
	Basement	190	220	240	280	330	390	180	280	N/A	N/A
Other	Schools - primary, secondary academy	520	650	280	470	610	830	370	490	330	420
	Healthcare - district hospital	1,170	1,410	750	1,200	720	1,240	1,160	1,410	N/A	N/A
Exchange rate to 1 USD		AED	3.67	SAR	3.75	QAR	3.63	BHD	0.37	OMR	0.38

Note: All costs are based on Q2 2016

Major measured unit rates

Item (unit rates in USD)	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 m	6.5	12.0	11.0	5.1	5.6
Disposal of excavated material	m ³	Standard / minimum specification disposal away from site	5.9	5.3	6.9	3.9	4.3
Filling	m ³	Imported fill	14.3	8.0	30.3	11.4	11.9
Poured concrete, reinforced	m ³	Standard / minimum specification grade 20 or 30; superstructure, walls or slabs; reinforced	105	147	173	109	89
Reinforcement	tn	Standard / minimum specification 20mm bars	919	1,334	1,101	1,174	1,025
Formwork / shuttering	m ²	Standard / minimum specification superstructure standard; fair face finish to walls	34.8	37.3	41.3	13.1	17.9
Blockwork	m ²	Standard / minimum specification 200mm solid blockwork, usually internal walls	33.5	48.0	52.3	25.1	23.1
Doors	No.	Standard / minimum specification single leaf door, fire rated, timber, basic finish, usually 900mm wide, generally excluding ironmongery	1,035	1,067	963	574	803
Tiling to floors	m ²	Standard / minimum specification 300 x 300mm ceramic tiles	31.6	53.4	68.8	28.3	38.2
Plaster to internal walls and ceilings	m ²	12.5mm thickness	15.0	10.7	12.4	6.9	12.7
Painting to internal walls and ceilings	m ²	Standard / minimum specification emulsion	6.5	5.3	5.5	5.0	5.2
Exchange rate to 1 USD			AED	SAR	QAR	BHD	OMR
			3.67	3.75	3.63	0.37	0.38

Note: All costs are based on Q2 2016

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	76	88	69	96	84
Sand	Sand for concreting	m ³	15	31	14	21	14
Aggregate	19mm aggregate	m ³	14	40	44	40	12
RMC	Grade 50 (OPC)	m ³	76	79	111	94	90
	Grade 40 (OPC)	m ³	71	73	107	86	73
	Grade 20 (OPC)	m ³	65	63	96	83	58
Reinforcing steel	High tensile	Tonne	504	774	812	682	625
	Mild steel	Tonne	490	774	674	682	764
Hollow concrete blockwork	100mm thick	m ²	41	9	10	9	6
	200mm thick	m ²	49	12	11	10	7
Structural steelwork	Mild steel grade 50 to BS 4360	Tonne	1,035	1,601	2,477	963	1,172
Timber	Hardwood	m ³	792	800	1,197	931	957
	Softwood	m ³	303	467	798	300	632
Fuel	Diesel	Liter	0.48	0.07	0.41	0.27	0.43
	Petrol premium 95	Liter	0.48	0.16	0.36	0.27	0.41
Exchange rate to 1 USD			AED	SAR	QAR	BHD	OMR
			3.67	3.75	3.63	0.37	0.38

Note: All costs are based on Q2 2016

Cost rates are indicative and represent supply only costs of the materials listed. Location factors should be applied to address geographic variations in each country. The rates are exclusive of VAT (Value Added Tax) or similar, where applicable.

Labour costs

Description	Unit	UAE (Dubai)	KSA (Riyadh)	Qatar (Doha)	Bahrain (Manama)	Oman (Muscat)
		USD	USD	USD	USD	USD
Skilled operatives						
Concreter	hour	5.7	6.7	3.3	5.7	3.6
Steel fixer	hour	5.7	7.2	3.3	6.3	3.7
Bricklayer	hour	6.3	7.2	3.3	5.7	3.6
Carpenter	hour	6.3	7.2	3.3	5.7	3.9
Mechanical installer	hour	8.2	9.3	5.0	7.0	4.7
Electrician	hour	8.7	8.8	5.0	7.6	4.9
Laborer (skilled)	hour	5.4	5.3	3.0	4.8	3.4
Foreman	hour	10.9	12.0	8.5	7.8	8.4
MEP foreman	hour	12.3	14.7	8.5	7.5	9.3
Site engineer	month	6,808	4,802	4,129	5,300	3,972
Construction manager	month	10,892	13,872	18,716	11,236	7,098

Note: All costs are based on Q2 2016. These rates (USD) 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. These rates should not be misinterpreted as contractors' daywork rates.

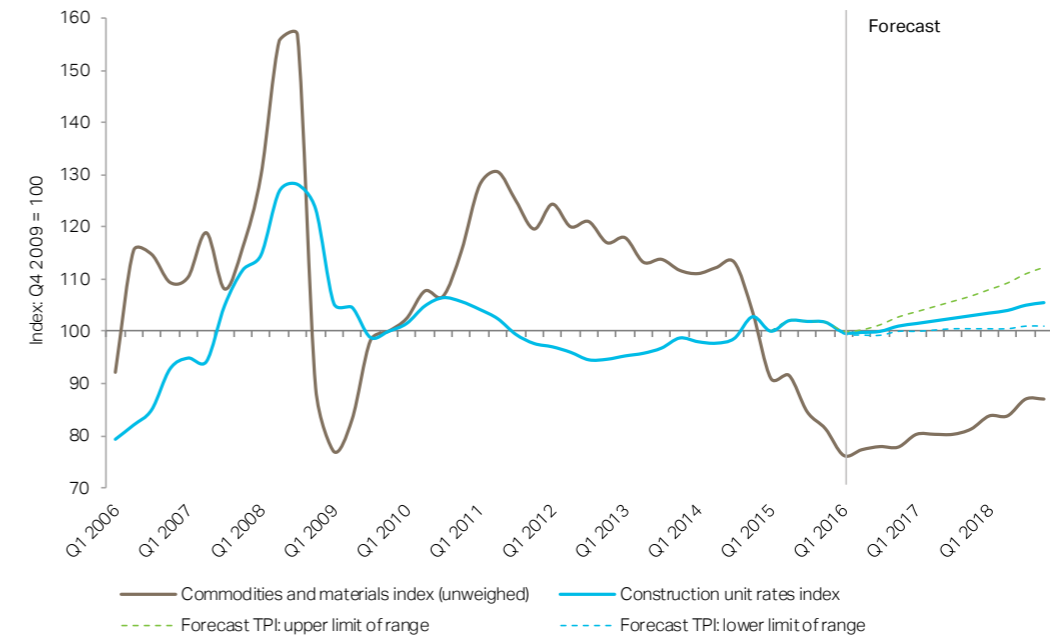
Middle East indices

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).

Figure 54. AECOM UAE tender price inflation index and forecast



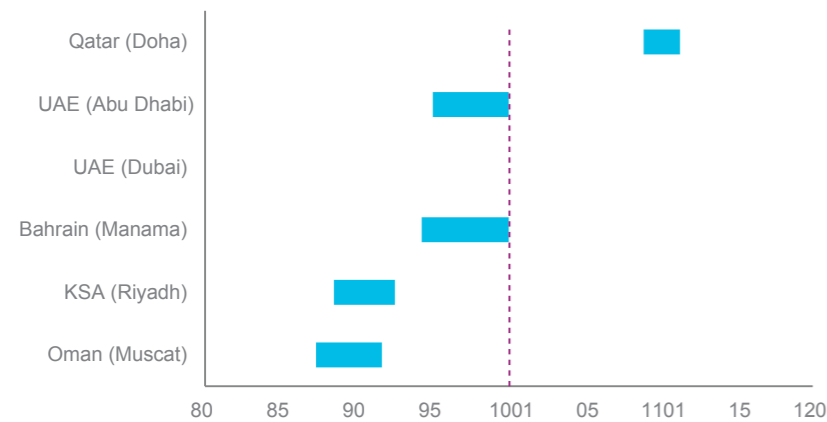
Source: AECOM, IMF

Figure 55. UAE tender price index

Annual Percentage Change										
2008	2009	2010	2011	2012	2013	2014	2015f	2016f	2017f	2018f
21.5	-17.1	2.4	-3.5	-5.3	1.1	2.7	2.1	0 - 2	0 - 3	1 - 4

Source: AECOM

Figure 56. Middle East relative cost of construction



Note: Relative cost 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 2009	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/m ²	1:10 - 1:14/m ²	1:10 - 1:15/m ²	1:10 - 1:14/m ²	1:10 - 1:15/m ²
Occupancy standards — dealer	none stated	1:7 - 1:12/m ²	1:7/m ²	1:7 - 1:12/m ²	1:7/m ²
Occupancy standards — toilets	Single sex one person to 12m ² using 60/60 male/female ratio based on 120% population.	Single sex one person to 12m ² using 70/30 male/female ratio based on 120% population.	Single sex one person to 12m ² using 70/30 male/female ratio based on 120% population.	Single sex one person to 12m ² using 70/30 male/female ratio based on 120% population.	Single sex one person to 12m ² using 70/30 male/female ratio based on 120% population.
Form of air conditioning	Fan Coil Units, VRV/VRF, VAV, Displacement, Chilled Ceiling/Beam, Natural or mixed mode ventilation.	Fan Coil Units, VAV, DX, Constant Volume	Fan Coil Units, VAV, Downflow Units	Fan Coil Units, VAV, VAV with Re-Heat, DX, Constant Volume, plate heat exchangers	Fan Coil Units, VAV, Downflow Units
Heating and air conditioning internal criteria	24°C, +/- 2°C (Summer) 22°C, +/- 2°C (Winter)	22°C, +/- 1°C	22°C, +/- 2°C	22°C, +/- 2°C	22°C, +/- 2°C
Fresh air supplies	12 - 16 liters per second per person	10 liters per second per person	12 - 16 liters per second per person	12 - 16 liters per second per person	12 - 16 liters per second per person
Ventilation — WC's (extract)	none stated	12 air changes per hour	3 - 10 air changes per hour	10 air changes per hour	10 air changes per hour
Internal heat gains — lighting load	12 w/m ²	15 w/m ²	12 W/m ²	12 - 15 W/m ²	12 w/m ²
Internal heat gains — equipment load (typical)	none stated	25 w/m ²	15 W/m ²	15 W/m ²	15 w/m ²
Internal heat gains — equipment load (dealer)	none stated	60 - 215 w/m ²	45 W/m ²	None	none stated
Supplementary cooling allowance (e.o./% area)	25w/m ² , 25%area)	None	25 W/m ² to 25% area	None	none stated
Acoustics — offices	NR 35 - 40	NR 35	NR 30 - 35	NR 30 - 35	NR 30 - 35
Acoustics — common areas	NR 40 - 45	NR 40	NR 40 - 45	NR 40	NR 40

Subject	Bco (UK) specification 2009	Bahrain specification	UAE specification*	Qatar specification	Oman specification
Primary power — lighting	12 w/m ²	15 w/m ²	12 W/m ²	12 - 15 W/m ²	12 - 15 W/m ²
Primary power — typical	15 - 25 w/m ²	35 w/m ²	25 W/m ²	30 - 40 W/m ²	25 - 30 W/m ²
Primary power — dealer	none	400, 800 or 1,500 w per desk	800 or 1,600 W / person	None	none stated
Primary power upgrade (e/o power/% area)	20 - 25w/m ² , 20 - 25% area.	None	25 W/m ² to 25%area	None	none stated
Lighting — office	300 - 500lux, Uniformity Ratio 0.7	400 - 500lux	350 - 500lux, Uniformity Ratio 0.8	500lux	400 - 500lux, Uniformity Ratio 0.8
Lighting — stairs/circulation		200 - 270lux		250lux	200 - 270lux
Lighting — WCs		215lux		200lux	215lux
Lighting — plantrooms		215lux		150lux	215lux
Passenger lifts — capacity and waiting times	80% loading with 25 second waiting interval, handling 15% in five minutes. Population density 1:12	80% loading with 35 second waiting interval, handling capacity of 11% to 17% in five minutes. Population density 1:12	80% loading with 35 second waiting interval, handling 15% in five minutes. Population density 1:14	80% loading with 30 second waiting interval, handling 15% in five minutes. Population density 1:14	80% loading with 30 second waiting interval, handling 15% in five minutes. Population density 1:14

* Specific to the Emirate of Abu Dhabi (differing standards in the seven Emirates). Excludes implications of new building code regulations for the Emirate which came into effect at the beginning of 2011.

Exchange rates

	EUR	GBP	INR	RMB	JPY	AED	SAR	QAR	OMR	BHD	KWD	EGP	LBP	JOD
1 USD=	Eurozone	UK	India	China	Japan	UAE	KSA	Qatar	Oman	Bahrain	Kuwait	Egypt	Lebanon	Jordan
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	0.301	8.3	1,486	0.707

Source: Bank of England www.investing.com

Weights and 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	= 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
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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 (in ²)	= 6.4516 cm ²
1 square foot (ft ²)	= 144 in ² = 0.0929 m ²
1 square yard (yd ²)	= 9 ft ² = 0.8361 m ²
1 acre	= 4840 yd ² = 4046.9 m ²
1 sq mile (mile ²)	= 640 acres = 2.59 km ²

Capacity/volume

1 cubic inch (in ³)	= 16.387 cm ³
1 cubic foot (ft ³)	= 1728 in ³ = 0.0283 m ³
1 fluid ounce (fl oz)	= 28.413 ml
1 pint (pt)	= 20 fl oz = 0.5683 litre
1 gallon (gal)	= 8 pt = 4.5461 litre

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

$$C = 5/9 (F - 32) \quad F = (9/5 C) + 32$$

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.

- 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.
- The standard for each building varies from region to region.
- General and specific cost inclusions and exclusions are listed below.

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 - 450m ²	90 - 200m ²	145 - 165m ²

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 (m ²)	10,000 - 25,000	25,000 - 75,000	100,000 - 250,000
BUA (m ²)	13,000 - 30,000	30,000 - 100,000	130,000 - 280,000
Efficiency (%)	70 - 85%	70 - 80%	70 - 80%
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 (m ²)	Not exceeding 30,000	30,000 - 100,000	> 100,000

Asset type	Industrial			
Typology	Light duty factory	Heavy duty factory	Light industrial unit (LIU)	Data center — Tier 3
Specification	Basic	Basic	Basic	Basic
Key design characteristics				
Building height	8	10	6	4
GIA	10,000	20,000	6,000	G
Wall:Floor ratio	0.33	0.30	0.38	2,000

Asset type	Hotel			
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
Efficiency	70%	75%	75%	55%
Functional units	350	200	350	200

Asset type	Schools	Healthcare
Typology	Primary/secondary academy	District hospital
Specification	Mid range	Mid range
Key design characteristics		
Building height (m)	10	24
GIA (m ²)	21,000 - 22,000	50,000
No of lift core	1	4
No of stair core	9	6

General cost inclusions

Construction works
Main contractor preliminaries and OH&P

General cost exclusions

External works and landscaping
Site infrastructure
Enabling works
Basements and car parks (incl. Podium)
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

Additional inclusions and exclusions by asset typology

Asset class	Cost inclusions	Cost exclusions
Residential	<ul style="list-style-type: none"> – Fit-out works – MEP services Installations – Lift services Installations 	
Commercial offices	<ul style="list-style-type: none"> – 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 	<ul style="list-style-type: none"> – Internal finishes to offices – MEP services installations to offices – Active IT and phone equipment.
Fit out (commercial offices)	<ul style="list-style-type: none"> – Fit-out works — architectural – Fit-out works — MEP services – Specialist installations (AV, IT, security) – FF&E 	<ul style="list-style-type: none"> – Active IT and phone equipment.
Retail	<ul style="list-style-type: none"> – Front of house fit out – Loose furniture and operators equipment – Kitchen and laundry equipment – Active IT equipment 	<ul style="list-style-type: none"> – Tenant fit out
Industrial (light duty factory)	<ul style="list-style-type: none"> – Internal services – FF&E 	<ul style="list-style-type: none"> – 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		<ul style="list-style-type: none"> – Active equipment – FF&E – Utilities outside the building outline – Modular construction (based on one complete data centre)
Hotel	<ul style="list-style-type: none"> – Fit-out – Loose furniture and operators equipment – Kitchen and laundry equipment – Active IT equipment 	
Healthcare, education	<ul style="list-style-type: none"> – Fixed fit-out works only 	<ul style="list-style-type: none"> – All loose fit out and ICT – All medical equipment



Section

FIVE

AECOM's
Middle East
Construction
Survey

About AECOM's Middle East Construction Survey

Now in its second edition, AECOM's Middle East Construction Survey once again asked key decision makers from government, developers, engineering and construction companies operating in the Middle East about their view on the state of the market. All survey responses were gathered through online questionnaires. Company-specific responses to the survey are kept strictly confidential by AECOM and only aggregate data is published.

The Middle East Construction Sentiment Survey assesses the state of construction industry, examines the drivers and barriers currently at play and reflects on concerns expressed by industry stakeholders. Respondents represent a cross-section of organization sizes, locations and markets, including energy, transport, real estate, industrial, healthcare, education and government.

The questions we ask of the industry fall into the following categories:

1. Industry prospects

- Workload trends and expectations
- Growth markets and sectors
- Industry growth drivers and obstacles to growth
- Confidence in market outlook and key risks

2. Organizational prospects

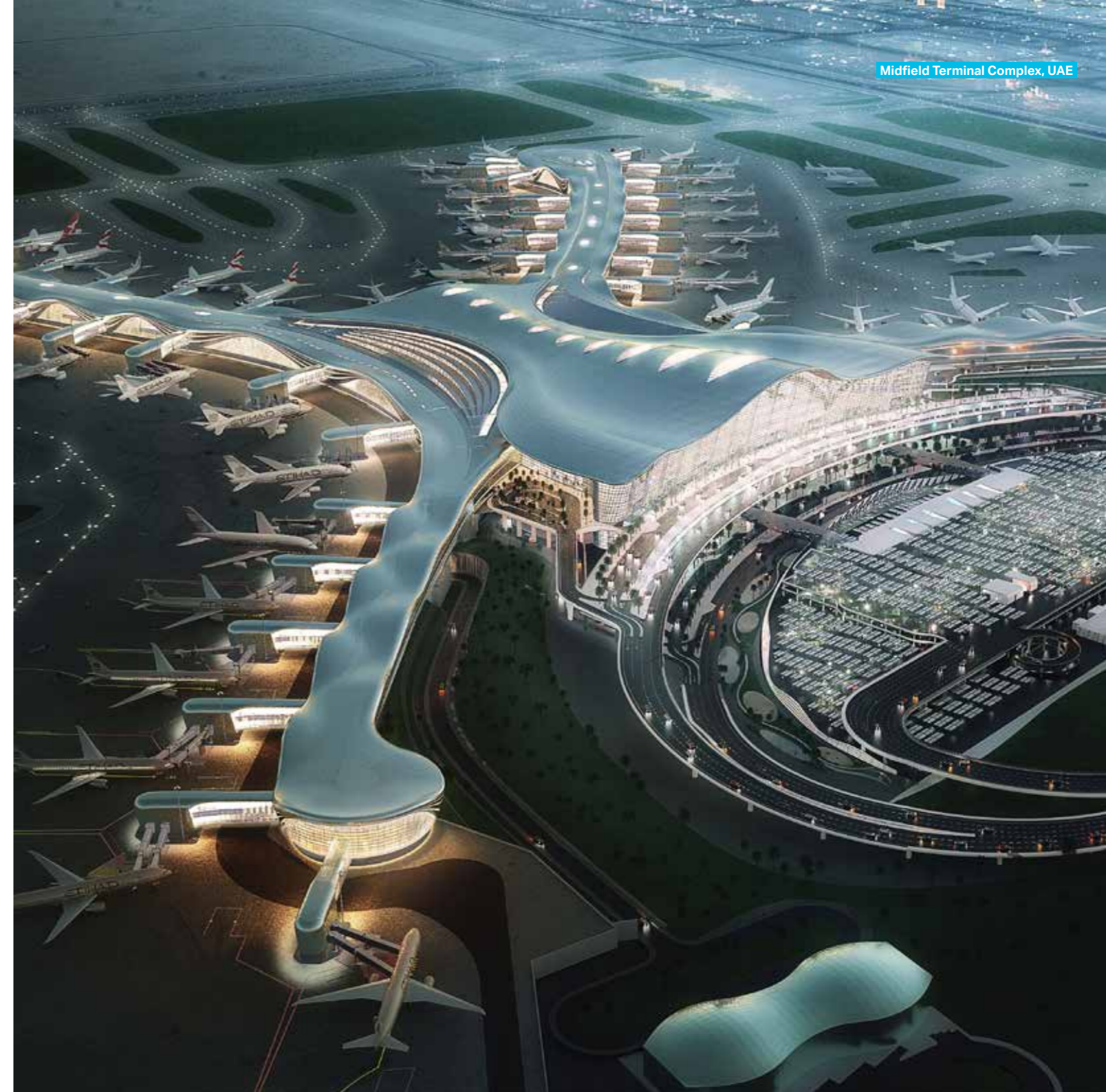
- Workload trends and expectations
- Opportunities for growth
- Investment priorities
- Target markets and sector focus
- Growth strategies and tools for growth

3. Project planning and delivery

- Project Finance
- Project Performance and BIM
- Competition and costs

Once again, we are encouraged by the results of this year's survey and we will continue to engage with our clients to discuss industry trends and prospects and how we can respond to challenges and opportunities posed to us by our clients.

Should you have any suggestions for future content of our research efforts or would like to participate in future surveys, please do not hesitate to get in touch.





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About AECOM

AECOM is built to deliver a better world. We design, build, finance and operate infrastructure assets for governments, businesses and organizations in more than 150 countries. As a fully integrated firm, we connect knowledge and experience across our global network of experts to help clients solve their most complex challenges. From high-performance buildings and infrastructure, to resilient communities and environments, to stable and secure nations, our work is transformative, differentiated and vital. A *Fortune 500* firm, AECOM had revenue of approximately USD18 billion during fiscal year 2015.

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