## Contents

About this research .............................................. 2

Executive summary ............................................. 3

Key success factors in hosting a mega-event .............. 5

- BOX: Healthcare facilities ................................. 8

Mega-events as catalysts for infrastructure innovation ... 9

- BOX: Sustainability to the fore ......................... 10

Conclusion ...................................................... 11
Hosting mega-events: Managing innovation in infrastructure is an Economist Intelligence Unit report which examines the key factors associated with the successful hosting of mega-events, with particular emphasis on innovation in infrastructure. The findings of this briefing paper are based on desk research and interviews with a range of experts conducted by The Economist Intelligence Unit. For the purposes of this report, a “mega-event” is defined as a large-scale, multi-sector, international activity which advances universal values and contributes to the economy of the host city or region.¹

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The Economist Intelligence Unit would like to thank the following experts (listed alphabetically) who participated in the interview programme:

- Sir John Armitt, chairman, Olympic Delivery Authority, UK
- Nick Bitel, chief executive, London Marathon
- Daniel Hajjar, management principal, the Middle East and Africa, HOK
- Tim Hollingsworth, chief executive, British Paralympic Authority
- Ruth Hopgood-Oates, project manager, Buro Four
- Jason Millett, director, major programmes and infrastructure, Mace
- Michael Taylor, senior partner, Hopkins Architects
- Neil Walmsley, Middle East planning leader, Arup

After the celebrations over winning a bid to host a mega-event, planners quickly turn their attention to delivering a memorable and smoothly functioning occasion. Well beyond building stadiums, this task involves mobilising many areas of the economy and ensuring seamless co-ordination among them. In the area of infrastructure alone, hosts must ensure adequate transport, electricity, water, sewage, healthcare and other services for large numbers of visitors. This involves complex tasks ranging from upgrading airports to building or expanding hotels and improving road and/or rail links.

Not surprisingly, infrastructure is a significant part of the cost of preparing for a mega-event. For the Rio 2016 Olympics, for example, energy infrastructure and the environmental management systems (sewage, potable water, waste recycling and disposal) will alone account for 17% of all investments. Considering the costs, hosts must ensure that the infrastructure remains useful long after the mega-event is over.

In this report, The Economist Intelligence Unit focuses on the lessons learnt from hosting mega-events, and in particular how to ensure that infrastructure developed for the occasion remains appropriate in the long term. The report concludes with a discussion of lessons which can be applied to the UAE and Qatar as they prepare to host the 2020 World Expo and the 2022 FIFA World Cup, respectively.

Here are the main conclusions of the report.

- **Broad and stable political support is essential for a successful event.** Planning and implementing infrastructure upgrades requires strong and stable political governance to ensure that financial and political backing will be present over time. Political leaders should form a consensus at the outset concerning the vision for the event and how infrastructure fits into the broader picture, and communicate this to all participants.

- **Collaboration among different infrastructure teams is vital.** For projects with many moving parts, a strong base of co-operation and communication among all participants—including suppliers, planners and government—is needed. The organisational approach for planning and implementation can vary, from “command and control” to looser hierarchies, but close co-operation among teams is essential in all cases.

- **Technology and design teams must have clear and strong briefs.** The sooner event organisers can brief technology partners and the greater the clarity of the briefs they provide, the better the outcomes tend to be. Equally important, however, is leaving some room for innovations
and improvements to the plans, should such improvements become available, and allowing sufficient time and money to complete the projects properly.

- **Planners should set early deadlines for testing all technologies.** Planners should set timetables allowing technology partners to test-run technologies and, in particular, to test new systems and approaches. Technology providers, for their part, should test crowd management, security, ticketing, and all other systems long before construction begins, to avoid delays in building and implementation.

- **Risk should be managed proactively.** All teams involved in planning and implementation should investigate the range of risks facing their activities, including operational, financial, liability, business interruption and reputational risks, and actively mitigate and manage these risks. The risk management activities can range from introducing tighter safety procedures to transferring risk via third-party insurance. Public-private partnerships tend to offset financial risks facing host governments.

- **Harness the potential of mega-events to spur innovation.** A global-scale event provides a platform for cutting-edge design and technology, which can speed up the introduction of similar innovations throughout the economy. Mega-events in recent years provide examples of long-lived innovations extending well beyond the events themselves.

- **Re-use buildings and materials whenever possible.** Modularised stadiums, for example, can be disassembled after a mega-event and used in smaller versions elsewhere. Energy-saving technologies used in event buildings can be adapted for use in other structures later. In general, planners should consider how funds invested in a mega-event can be amortised in future by putting the assets to other uses. At the same time, planners should keep the plans for legacy assets flexible enough to allow for subsequent technological innovations.
When planned and carried out correctly, a mega-event can be a showcase for technological and environmental innovation on a grand scale. The host city or region is in the spotlight as never before. Its successful implementation of the event depends on many factors, not least well-considered, state-of-the-art infrastructure for stadiums, transport links, and housing and healthcare for the multitudes of visitors.

Starting with a political vision and clearly stated aims

Staging a successful event of this magnitude does not happen by accident. The range of detail involved is enormous, but the plans begin with a vision, preferably stated at the highest political levels, of what the event aims to accomplish and how it is intended to bring value to the host region. “We often don’t spend enough time debating the why, before we move on to the what or the how,” says Sir John Armitt, chairman of the Olympic Delivery Authority (ODA), the body charged with building the venues, facilities and infrastructure for the London 2012 Olympics.

As a first step, the vision should reflect a consensus of all levels of government involved—national, regional and local. The vision statement can be very specific about the ways it fits into the hosts’ broader plans. Brazil’s stated aim in hosting the FIFA World Cup 2014 and Olympic Games in 2016, for example, is to upgrade its problem-plagued airports, harbours, highways and urban energy infrastructure.

The vision should also encompass the impact of the event on the host region after the hundreds of thousands of visitors have left—not only during their stay. “If you try to design infrastructure for your worst-case scenario, then by definition you will have a vast majority of the time where it’s dramatically oversized for its legacy functions,” says Neil Walmsley, Middle East planning leader at Arup, a global consulting and engineering firm.

Creating a strong and independent executive agency

Equally important is creating an implementation structure that is independent of a changing political leadership. In London, for example, a private consortium—CLM Delivery Partner Ltd—worked alongside the Olympic Delivery Authority and was empowered to make key decisions on the delivery of infrastructure. An example of what to avoid is provided by the Delhi Commonwealth Games of 2010, which saw contracting irregularities and construction delays that were traced to weak governance of the event.2

An executive agency, tasked with delivering a smooth-running event, is at the centre of a process that relies on co-ordinated teams adhering to inter-related timetables, with the start of one phase often depending on the successful completion of the preceding one. “The lead-up to an Expo is usually two years, to get the pavilions built and to ensure that the power, water and sewage systems are ready to go when the buildings are ready,” says Daniel Hajjar, management principal in charge of the Middle East and Africa for HOK, the architectural and design firm that advised Dubai on its winning bid to host the World Expo 2020.

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1 Key success factors in hosting a mega-event

Smooth integration of the various parts, in turn, requires appropriate resourcing of each phase. “You have to give designers a reasonable budget, but more importantly, if you want quality design, then we need time to think it out,” says Michael Taylor, senior partner at Hopkins Architects. Similarly, central managers must set clear deadlines for all phases, including in particular for early tests of new technologies, such as for crowd management and security. “It doesn’t matter whether it’s a nuclear power station or a sporting event; the sooner the operator is able to communicate its requirements to the designers, the better,” says Sir John Armitt.

Sir John adds that setting proper incentives for contractors helps to ensure successful, on-time completion. In drawing up supply contracts for London 2012 infrastructure, for example, “We said that if [contractors] could deliver faster for less money than budgeted, then they could pocket much of the savings. So, for every pound saved, the contractor would keep 50 pence. If, on the other hand, costs exceeded the budgeted amount, then beyond a certain overrun—3% in this case—the Olympic Delivery Authority would pay the cost.”

**Managing financial and operational risks proactively**

Budget overruns, missed deadlines, malfunctioning equipment, weather disturbances—the list of things that could go wrong with a mega-event is long and daunting. Perhaps the best-known case of a mega-event that caused headaches for decades thereafter is the Montreal Olympic Games in 1976, the cost of which was originally estimated at US$310m, but whose final tab was US$2bn, which took almost 30 years to pay off. After that experience, many cities shied away from hosting the Olympics. In fact, in 1984 Los Angeles was the only bidder for the Olympic Games.

Since then, much has been learnt about managing budget risks, and many other risks besides. In the case of budget risks, cities and regions now routinely seek funding and sponsorship in the private sector to reduce their risks. In 1984, with almost no public financing, the Los Angeles Games relied on private funding—and was the first Olympic Games to pay for itself. The Games turned a profit of US$223m for the Los Angeles Organising Committee and provided an example for others to follow.

Beyond budget risks, using new and untested technologies creates a risk that a mega-event will be remembered as a mega-failure, posing commercial, professional indemnity, liability and reputation risks to all involved. At an extreme, such risks could cause developers to shy away from innovative, untried solutions; their aim, after all, is to deliver buildings, infrastructure and systems that are guaranteed to work flawlessly.

Yet the risks of innovative infrastructure solutions can be managed in such a way that previously untried technologies need not be excluded from consideration. Pro-active risk-management—for example, sharing risks among project managers, designers and building contractors—can change these incentives somewhat. Further risk management measures include early and rigorous testing of new systems, implementing tight safety procedures, and transferring residual risks to third-party insurers.

Above all, risk management requires a sober assessment of the feasibility of systems and of the many ways that facilities and equipment could malfunction. “From an early stage, we reported to the government on a quarterly basis,” recalls Jason Millett, director of major programmes and infrastructure for Mace, an international consultancy and construction company that was one-third of the CLM Consortium delivering the London Olympics. “I had never been a massive fan of assurance [independent opinions which reduce the information risk], but I think assurance done...”

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1 Learning Legacy, Olympic Delivery Authority report, 2011.
well—rather than for the sake of box ticking—can make a real difference.”

Planning to use the legacy assets effectively
Looking beyond the mega-event to the life of the city or region afterwards can be a challenge when the event deadline is looming. Yet failure to do so can result in building expensive facilities that will be under-utilised after the event. The Sydney 2000 Olympics offer a cautionary tale: an ever-shifting view of the long-term use of the site led to poor use of facilities after the event.4 Planners must consider not only the future needs of the city, but also how much additional investment will be needed to ensure that facilities planned for a specific event will remain useful for decades thereafter.

Some host regions have done this legacy planning well. Transport infrastructure built for South Africa’s 2010 World Cup, for example, provided valuable legacy assets in the form of sustainable transport systems for the host cities.5 In addition, investment in sophisticated information and communication technologies for the World Cup led to the introduction of digital television and accelerated Internet penetration in the country. South Africa continues to benefit in other ways as well: the upgrading of emergency response centres continues to help its cities respond to natural disasters and other emergencies.

Other examples of successful legacy planning abound. Ahead of the 1996 Olympic Games in Atlanta, the city built dormitories for athletes, which are now used by 10,000 students at the Georgia Institute of Technology. Similarly, Atlanta’s Aquatic Centre, built for the 1996 Games, is now part of the Georgia Tech Recreation Centre.6

Legacy planning is also part of Qatar’s master plan for the 2022 World Cup: it plans to send stadiums to poor countries after the event is over. Sports stadiums can be modularised, although designers need to know where the parts will go afterwards. “If you were to design a stadium for the Gulf with a view to relocating it to a much colder or wetter region, then you would need to design for both situations at the onset,” says Mr Taylor of Hopkins Architects.

Indeed, modularisation helps to ensure flexible re-use of buildings and facilities. In London, for example, the Aquatic Centre built for the 2012 Games needed to accommodate 18,000 spectators during the event, but only 3,000 at any given time thereafter. The solution was to design a core building with a 3,000-seat capacity, plus two temporary wings that could be removed after the event.

Looking beyond the event to the total visitor experience
Beyond building flexibility into infrastructure, planners advise taking a broad view of visitors’ total experience, not just their experience at the event site. “It may be that the stadium will be air-conditioned, but equally important is the all-round experience: whether the buses are air-conditioned, for example,” notes Nick Bitel, chief executive of the London Marathon, chairman of Sport England and board member of the Olympic Park Legacy Company.

HOK’s Mr Hajjar notes that there are two levels of infrastructure: “The first is the big ‘underground’ stuff that makes everything work, but that nobody really sees, such as sewage networks or communications links; the second is the visible infrastructure, the swimming pools or the museums. These are two very different levels of investment.” While visitors may remember only the visible infrastructure, the smooth functioning of the invisible infrastructure is essential to their positive experience of the event.

Beyond that, planners must find a balance between the reliably functional and the purely spectacular. In designing the visible

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4 http://www.international-seminar.eu/sites/default/files/PwC%20Megaevents%20-%202012%202012.pdf
6 http://www.international-seminar.eu/sites/default/files/PwC%20Megaevents%20-%202012%202012.pdf
infrastructure, there is often some tension between the two. “There is an interesting debate we have with planners and architects,” says Tim Hollingsworth, chief executive of the British Paralympic Association, who was involved organising the London 2012 Games. “Do you go for the sort of jaw-dropping nation-defining, iconic stadiums, or do you go for something that is going to be deliverable and affordable?”

### Healthcare facilities

State-of-the-art healthcare facilities are an essential part of the total visitor experience at a mega-event. Most visitors may not need them, but most would also be reassured to know that they are there. And in some cases—particularly involving sporting events—healthcare facilities are in great demand. The 2004 Summer Olympics in Athens, for example, saw over 10,000 healthcare incidents, most of them near the event sites.

The increased demand for healthcare related to a mega-event presents an opportunity for host cities and regions to build hospitals and clinics that will serve their regions well into the future. South Africa, for example, which is often criticised for its standard of healthcare, leveraged the 2010 FIFA World Cup to improve its healthcare services, according to the country’s health department.

Brazil, too, is using the World Cup and Olympics as an opportunity to build several public and private hospitals throughout the country. Most major cities are building new, or renovating existing, hospitals. For the Olympic Games alone the country will build the Olympic Village Medical Clinic and three new state-of-the-art hospitals in Rio.

But as with all mega-event infrastructure, the legacy uses must be considered carefully. That, in turn, impacts where hospitals and clinics are built. “We might find, for instance, that it doesn’t make any sense to have a prominent hospital facility on the Expo site, but rather across the highway or across the road, because that’s where the majority of the people will live eventually,” says Daniel Hajjar of HOK, a global design, architecture and engineering firm. But for the event itself, building a clinic across the road might not do, he adds: “You’re certainly not going to run a stretcher over 500 meters across paved surfaces.”
Staging a mega-event presents an opportunity to develop cutting-edge design and technology for the event itself. But it does more than that: it provides a spur to introduce new technologies that can have a positive knock-on effect throughout the economy, speeding up innovation and urban transformation.\(^7\)

Indeed, some of the iconic buildings created for mega-events have pushed the boundaries of design. Montreal’s geodesic dome—designed by Richard Buckminster Fuller and now an environmental museum—remains a lasting legacy of the 1967 World Expo, for example. Beijing’s spectacular Olympic Bird’s Nest stadium and London’s Velodrome with its distinctive, double-curved roof are further examples of infrastructure and design innovation inspired by mega-events.

But the innovations extend well beyond the event sites. South Africa’s investments leading up to the World Cup in 2010 included innovations such as efficient street lighting and traffic management systems, energy-efficient stadium floodlights at the Philippi stadium; solar water heaters fitted to roofs in the Western Cape; and hydropower generated from spring water.

Some of the most useful innovations have been prompted by environmental concerns, and by a related focus on reducing energy costs. The organisers of the Rio 2016 Olympics plan to recycle 100% of solid waste generated during the preparations (including construction) as well as during the Games themselves. Planners have also decided to install renewable energy systems in public transport, and to use state-of-the-art hydrogen energy cells and generators in all venues.

Elsewhere, architects have designed buildings to save energy by maximising the use of natural light. Others have focused on using more biodegradable forms of PVC and on designs cutting the use of phthalates (chemical plasticisers) to minimise health risks.

Similarly, recycling of materials and of entire buildings figures prominently and requires innovations in designing the infrastructure. For example, the London Olympics’ 12,000-seat basketball arena—the largest temporary Olympic venue ever built—was designed such that it could be dismantled after the Games, with two-thirds of its components recycled for use elsewhere. Similarly, much of the London Olympics’ Velodrome, now a national cycling centre, was built from pre-fabricated parts, cutting costs and improving quality.

If the 2022 FIFA World Cup in Qatar is held in summer, as currently planned, it is likely to require innovative solutions to problems posed by the heat. Planners are considering innovations in cost-effective air conditioning as well as modularised stadiums which can be re-used in other, cooler climates afterwards.

The flexibility of the infrastructure built for this event “is going to be a really interesting challenge and it will be what the World Cup will be
judged on,” says Mr Bitel, chief executive of the London Marathon. “Will these stadiums become white elephants?” Planners for the Qatar event are also considering innovations in other areas, such as traffic management systems, transport infrastructure and site-access management systems.

Mr Hajjar of HOK says Dubai also aims to discourage traffic jams by providing convenient and comfortable bus and metro links to the site from Dubai’s airport and from other points around the city. Planners are also considering alleviating traffic problems in part by building hotels close to the Expo site.

### Sustainability to the fore

Efficient use of energy and water and minimising carbon emissions are watchwords for designers—and a mainstay of publicity for many large events. Expo 2008, the international exposition held in Zaragoza, Spain, is an example. Adopting the theme “Water and Sustainable Development”, the event showcased green technologies, such as the use of “vegetal walls” fed by river water, harnessing the natural environment to heat and cool buildings, using renewable fuels for all facilities, and promoting hydrogen-powered vehicles.

Zaragoza built on foundations laid at the 2005 World Expo in Aichi, Japan, which was dubbed the first “eco-Expo”. Taking “Nature’s Wisdom” as its theme, the Aichi event emphasised sustainability. An independent local electricity network was set up for the event, fed by alternative power sources, including solar energy and fuel cells. Similarly, the 2000 Summer Olympics in Sydney highlighted green technologies, including low-carbon transport and solar power. And the 1996 Olympics in Atlanta, Georgia transformed a previously derelict industrial area into one of the largest urban green spaces in the US.

The trend to associate mega-events with environmental protection is in full swing. Planners of the Rio 2016 Olympics have developed a sustainability plan that aims to reduce the event’s environmental impact, focusing in particular on ensuring an environmentally sound supply chain. The motto of the 2015 Milan Expo in Italy is “Feeding the Planet, Energy for Life”, while the Expo slated for Kazakhstan’s capital, Astana, in 2017 also has a related theme: “Future energy.”

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8 [http://www.mobility-bovy.ch/resources/35_SHANGHAI.metrochina.04.pdf](http://www.mobility-bovy.ch/resources/35_SHANGHAI.metrochina.04.pdf)

9 [http://www.omeroreactor.unibo.it/web/Furrer%28eng.%29.PDF](http://www.omeroreactor.unibo.it/web/Furrer%28eng.%29.PDF)
Planners of the 2020 Dubai Expo and the Qatar FIFA World Cup 2022 have many examples to draw from to help guide their infrastructure planning. These examples provide valuable lessons in ensuring that infrastructure is fit for purpose, useful for the future, and uses appropriate innovation.

The research for this report shows the broad range of issues to consider in planning infrastructure for a mega-event. First and foremost, there must be a clear and coherent vision for the event’s aims, including its contributions to the host region. The vision statement must be backed up by a solid structure and sound governance system for the executive agency in charge of implementation, and by careful co-ordination of the various committees and work teams responsible for design and implementation.

The entire project would benefit from strong political backing coupled with real authority vested in the executive agency, and by taking a proactive approach to managing the variety of risks—including budgeting risks—facing such a massive project. Finally, planning and implementation benefit from encompassing the entire visitor experience, including the functioning of visible and invisible infrastructure that is not directly related to the event, and from a focus on creating infrastructure that will be useful long after the visitors have left.

Mega-events provide an opportunity for planners to test new technologies and new approaches to design and construction. But innovation for the mere sake of innovation should be avoided. Here are some of the guidelines for infrastructure innovation which are suggested by this research:

- Infrastructure should be developed with an eye on the future needs of the country. That implies considering the country’s broader development goals and how the infrastructure contributes to them. Designing for future use of legacy assets should be included from the start.
- The time lines for contractors to deliver infrastructure projects should allow for rigorous, early testing of new technologies, as well as modifications in case of subsequent innovations.
- In Dubai and Qatar, adequate non-automotive transport and energy-efficient and environmentally friendly power systems are likely to be the focus of infrastructure innovation, as these are the biggest current problem areas. Project planners are already considering ways of optimising traffic flows and bolstering energy efficiency.
- In keeping with the trend in mega-events, a focus on environmental friendliness in the planning and staging of the 2020 Dubai Expo and the 2022 Qatar FIFA World Cup is likely to lend a favourable image to these events.
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