

PLANNING FOR LEGACY - A COST EFFECTIVE AND SUSTAINABLE APPROACH. CASE STUDY: DUBAI EXPO 2020

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Commission IV, WG IV/9

KEY WORDS: Legacy, Mega Event, Sustainability, Governance, Planning, City Growth

ABSTRACT:

The planning and development of a site for hosting a mega event such as world exhibitions, summer and winter Olympic Games and World Cup, that attracts numerous numbers of visitors and global attention, is a challenging mission and requires a massive and resource intensive effort of coordination and cooperation between different authorities to ensure the timely delivery of the required facilities and infrastructure, on budget and without unanticipated cost overruns. Usually, these mega events last for a relatively short period, which presents a significant financial risk that requires addressing, in order to avoid building surplus assets and infrastructure that will be only used for the limited duration of the event which is fraction of its potential asset life, potentially resulting in it being left unutilized after the event. This risk can be controlled by forming a governance body to ensure appropriate coordination between different authorities to ensure that the plan for hosting a mega event is embedded in and integrated with the plan for the hosting city's growth and with the objective of ultimately deliver a lasting legacy that efficiently capitalizes on the potential asset life of all of the mega event's buildings and infrastructure post-event. This research work focuses on the model adopted by Dubai to manage the delivery of the exhibition of Dubai Expo 2020 and the sustainable development that will stay beyond the event. Over the course of planning for this event and its post-event legacy, the Dubai government formed and implemented a system of governance and project management designed to ensure the effective development and delivery of the event and its expected legacy and to safeguard the interests of the city throughout its life-cycle. This research examined the sustainability factors considered in the planning of Dubai's Expo 2020, considered essential in providing the necessary legacy and that maximized the cost effectiveness of investment. Some of the mega projects implemented as part of the delivery of Dubai's Expo 2020 and legacy will be outlined in this paper. The main aim of this study is to represent a case study of best practice in the hosting of a mega event and in planning for its legacy.

1. Introduction

The planning and development of a site for hosting large scale mega event such as EXPO, Olympic Games and World Cup, that attracts numerous numbers of visitors and global attention, is a challenging mission and requires a massive and resource intensive effort of coordination and cooperation between different authorities to ensure the timely delivery of the required facilities and infrastructure, on budget and without unanticipated cost overruns. Moreover, (Roche, 2017) the limited period available for the development of the project, that results from the simultaneous execution of multiple mega projects required for the staging of the project adds considerably to the project challenges.

Usually, these mega events last for a relatively short period (i.e., six months for a World Expo and less than one month for an Olympic Games or a FIFA World Cup), which presents a significant financial risk that requires addressing, in order to avoid building surplus assets and infrastructure that will be only used for the limited duration of the event which is fraction of its potential asset life, potentially resulting in it being left unutilized after the event. This risk can be controlled by forming a governance body to ensure appropriate coordination between different authorities to ensure that the plan for hosting a mega event is embedded in and integrated with the plan for the hosting

city's growth and with the objective of ultimately deliver a lasting legacy that efficiently capitalizes on the potential asset life of all of the mega event's buildings and infrastructure post-event. This research work focuses on the model adopted by Dubai to manage the delivery of Expo 2020 and the Legacy beyond the event. Over the course of planning for this event and its post-event legacy, the Dubai government formed and implemented a system of governance and project management designed to ensure the effective development and delivery of the event and its expected legacy and to safeguard the interests of the city throughout its life-cycle. This research examined the sustainability factors considered in the planning of Dubai's Expo 2020, considered essential in providing the necessary legacy and that maximized the cost effectiveness of investment. Some of the mega projects implemented as part of the delivery of Dubai's Expo 2020 and legacy will be outlined in this paper. The main aim of this study is to represent a case study of best practice in the hosting of a mega event and in planning for its legacy.

Mega events such as the international expo's, Olympic Games and World Cup draw the interest of enormous numbers of visitors. These events are also planned to encourage local and regional economic development by attracting regional and often global investment, tourism, and media attention for the host city. Mega-events have been utilized by a host of actors to reshape cities around the world (Monclus, 2009); (Roche, 2017). Through

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time and space these events have left substantial and enduring urban footprints in host cities (Mataruna-dos-Santos & Pena, 2017). Cities and local government have managed to benefit from hosting mega-events to achieve intangible targets such as the regenerating urban imaginaries (Jennifer & Martin, 2019), (Broudehoux, 2007); (Broudehoux, 2017). While planning for hosting mega events, the hosting cities are generally focusing on important factors such as the event's economic implications, event related income, urban development and regeneration, building and upgrading infrastructure, providing a transportation system capable of transporting the expected numerous visitors to and from the event location and the development of tourism (Taha & Allan, 2019). Most cities aim to maximise the benefits of hosting mega-events to develop infrastructure and push urban renewal, often through leveraging funds that would be available for hosting mega-events are also used by local hosts to restructure urban land and create new civic centres and public spaces, transforming the uses and users of the land (Grix, 2013), (Hiller, 2000), (Hiller, 2000) & (Smith, 2012). In general, mega event is considered to be a great opportunity to encourage development and raise a city's international profile, enriching its reputation, and accelerating improvement of infrastructure, and urban development. In addition to the substantial benefits conferred on a host city of a mega event, the region and nation state of the host city invariably experience lasting prestige and improved economic performance. For cities that are not within the global consciousness of "must see" destinations, the hosting of a signature mega event can confer an international competitiveness and reputation that investment in capital assets and infrastructure alone would not produce. It may be seen as "boosterism" hosting a mega event, notwithstanding the reputational benefits, the growth in the construction industry associated with development in preparation for hosting a mega event generates significant job opportunities, during the event and post event, and improves the global business and investment environment of the country.

As the delivery of mega event is linked to a distinct and definite timing, it is an incredible commitment challenge for any government to undertake, particularly when producing high quality development outcomes compliant with world class sustainability principles, requiring a tightly controlled schedule with minimal tolerance for delays and quality failings to ensure timely completion a mega event's many major projects, that involves securing the required budget before project commencement, ensuring that there is overall financial feasibility and procuring the necessary resources to deliver the event in a timely manner. Sustainable and smart plans are therefore a prerequisite to maximising the benefits from upgrading the existing built environment where applicable and investment in constructing new buildings, infrastructure, and facilities. The integration in planning for both the short-term mega event and the long-term legacy is an outstanding example of where best practice and exemplars of the most advanced sustainable planning can be demonstrated to local, national, and international audiences. Focusing on maximising the benefits from investments envisaged in grand plans for a mega event with its lasting legacy and the generation of new urban development will add great value to a city and it may provide a catalyst for urban expansion at a metropolitan scale through initiating a future growth pole.

According to Muller (Muller, 2015), mega-events can be characterised as ambulatory occasions of a fixed duration that attract a large number of visitors, that have a large mediated reach, high costs, and substantial impacts on the built environment and the host city's existing residential population. Muller concluded that mega-events are in effect a large-scale

urban development project for a city. Previous researchers were mainly focused on the history of mega-events and their cultural impacts, as well as measuring their economic impacts, less research has systematically studied land uses and development at and around such sites over larger time scales.

The International Exhibition is the archetypical large-scale global mega-event, whose official history commenced with the Great Exhibition of the Works of Industry of All Nations held in London 1851. Since 1928, the Bureau International des Expositions BIE has orchestrated expos throughout the world. Whilst mostly held in Europe and North America in the early history of these events, the geography of expos has shifted since the 1970s as more of these events were held outside this sphere of influence, with many of the larger "World Expos" hosted in China, Japan, and most recently with the 2021-2022 Dubai Expo 2020 in Dubai, UAE.

The main aim of this study is to represent a case study of best practice in the hosting of a mega event and in planning for its legacy. In addition to, present the governance model adopted to deliver the event. This research work will focus on the preparation for the hosting date of the event, the rapid development in generating new urban areas and constructing new infrastructures required for the event, besides, the integration in planning between the event and legacy to introduce a cost effective and sustainable development. However, other associated risks with hosting mega event such as slowdown in economy and drop in employment post the event due to the acceleration in constructing mega projects in considerably short timeframe is not covered in this study, nevertheless, it is an interesting topic and an opportunity for future research.

2. Literature Review

In a fast growing and rapidly urbanizing and populating world, the need for generating new urban developments, wide availability of omnipresent transportation, the provision of high levels of accessibility and flexible instantaneous connectivity are very important for people to maintain business continuity which provides the economic basis for a high standards lifestyle, essential to cater for the growing needs of communities and cities.

Due to the large number of visitors during the event, hosting mega event will place critical and intense demands on urban development, its transport system and other infrastructure. Hence, the hosting city will be required to improve the existing infrastructure systems by adding new infrastructure and upgrading the capacity of existing ones. A 'Mega Event' has often been described as a lucrative tool for place promotion and marketing and as a key link between local and global. Chalkley and Essex (Chalkley & Essex, 1999) reported that different cities have shown increased interest in the idea of promoting urban development and change through the hosting of major events. This approach offers host cities the possibility of a 'fast tracked' urban regeneration, a stimulus to economic growth, improved transport, and cultural facilities, and enhanced global recognition and prestige. For example, South Korea can be considered as model of utilizing the opportunity of hosting a mega event as an effective pathway to mega urban redevelopment, such as through developing a new national capital Songdo within a tight deadline (Surborg, et al., 2008) and (Short, 2008).

In their research work, Chen and Spaans (Chen & Spaans, 2009) concluded that planning for hosting mega events must be

interwoven with urban economies and urban development to create a lasting legacy.

by owing to its use of the Olympic legacy, increased capital flows and its improved attractiveness, the city Barcelona was able to boost its economic growth, enhance its image and transform itself into a globally competitive city. Barcelona's success can be considered as an indication of the significance that Olympic Games can have on urban development practices and urban policy in host cities and equally provides valuable insights into the importance of understanding Olympic Games from an urban development perspective (Chen & Spaans, 2009).

The Olympic Park site at Stratford, London is one of best examples of an urban regeneration initiative and sustainable development that resulted from hosting the 2012 Olympic Games in London (Richter, 2012). The land of the Olympic park was undeveloped and only used as landfill after the 2nd World War bombing of London, and was compromised by poor drainage problems, with utility and transport infrastructure crisscrossing the site resulting in its functional fragmentation. The main target of using the Stratford site was to provide quality infrastructure, so, the value of the site and its surrounding areas was to be improved socially, physically, and economically. The key success for London's 2012 Plan was to arrange and maximize the efficiencies of its transport infrastructure to serve the Games and assist in regenerating the area around the Olympic Park afterwards (Richter, 2012).

In another place in Europe, the ancient city of Athens hosted the Summer Olympics in 2004. Because of the city's urban form and the challenge of lack of large parcels of available public land, Athens had to spread out its Olympic venues across the Attica Plain. This was problematic due to the notorious traffic congestion facing Athens and the limited existing public transport infrastructure within the city. Thus, by agreeing to host the Olympic Games, Athens embarked on a large-scale program of transport investment. The direct and indirect investments in transport infrastructure included a new international airport, two metro lines, a tram system, and a suburban railway. All these infrastructure improvements were built with the goal of making transport more efficient during the Olympic Games (Richter, 2012).

However, there are other examples of hosting cities that revealed a lack of consideration for sustainability and planning for the future, therefore, huge financial risk was imposed on economy, as a result of investing capital in underutilized developments and infrastructures, such as the case of Montreal's 1976 Summer Olympic Games, where that mega event saddled government with massive debts and created potential urban blight with underutilized assets or white elephants (Taha & Allan, 2019; Taha & Allan, 2020). Similarly, the Sydney Summer Olympics in 2000 was a significant catalyst for urban infrastructure development that includes better transport connectivity, capacity expansion of Kingsford Smith International airport and capacity improvements at its main metropolitan rail hub, Central Station (Richter, 2012). The 2000 Summer Olympics Games reinvigorated and rehabilitated a part of Sydney that was largely brownfield land with little development or recreational appeal to the community prior to 2000, hence, the Games were transformational in creating an impressive and lasting legacy well into the foreseeable future. However, it is worth noting that the Homebush Bay site is not quite what the State Government wanted it to become with it being unable to capitalize on tourism and only achieving partial success in transitioning itself to an office park precinct. Additionally, many of the sporting facilities

were surplus to requirements post Olympics, and the Olympic Stadium was downscaled immediately after the Games and was planned to be replaced with a new up-to-date stadium (Surborg, et al., 2008) and (Taha & Allan, 2020), although a strong community backlash hinted at a high potential political cost, which resulted in the New South Wales (NSW) Government cancelling the proposed rebuild in 2018 in favour of a renovated stadium despite the facility remaining perfectly functional and serviceable. The global COVID-19 pandemic (2020-) resulted in shift in the NSW Government's budget priorities and even the planned renovations in place of the stadium redevelopment were subsequently shelved.

3. Research Methodology

The plans developed by Dubai government to deliver the Dubai Expo 2020 mega event were conceived around sustainability principles and to create a legacy. These plans were explored to identify best practice performed in maximising the benefits of capital expenditure investment in building new infrastructure and the generation of new purposeful urban development required for hosting the mega event, yet with sufficient flexibility to allow an asset life post mega-event.

The research methodology was based on gathering information and collecting data via site visits and interviews with key members of local authorities such as Expo 2020 Office, Roads & Transport Authority (RTA) and Dubai Municipality (DM). The collected data and information were reviewed, examined, and analysed to shed light on the efforts made in Dubai to manage the delivery of the event and plan for delivering a lasting legacy.

The Dubai governance model will be explored and presented as a benchmark for other cities with the lessons learnt from the Dubai experience during preparation period for the event examined and analysed. The list below is of government authorities approached during the course of collecting data:

- 1) Dubai Expo 2020 Office: Development & Delivery Office
- 2) Roads & Transport Authority:
 - Rail Agency: Rail Projects Planning & Developments Department
 - Strategic & Corporate Governance Sector: Transportation Strategic Planning Department
 - Traffic & Road Agency: Road Department and Traffic Department
- 3) Dubai Municipality: Drainage & Irrigation Department, Infrastructure Services Sector.

4. Dubai Expo 2020 – Governance Model

In accordance with the hosting requirements for an Expo, Dubai developed the necessary legal, financial, and organisational measures to ensure its efficient administration and success through meeting its planning and urban development objectives (social, environmental, and economic). In 2013 the Dubai Government established the World Expo 2020 Higher Committee (Dubai Expo 2020, 2019) and (Dubai Expo 2020, 2018). There are three subcommittees supporting the Higher Committee to discharge its duties, namely: Procurement Committee; Finance Committee & City Readiness Committee. To empower and facilitate the decision making required for the development and delivery of Expo and its Legacy, the Higher Committee is chaired by president of Dubai Civil Aviation Authority, the Chairman and Chief Executive of the Emirates Airline and also consisted of high level leaders representing the following authorities:

- Ruler’s Court of Dubai;
- Ministry of State for International Cooperation;
- Abu Dhabi Executive Council;
- Cabinet Member and Minister of State;
- Roads and Transport Authority;
- Dubai Police;
- Emaar Properties PJSC (Developer);
- Dubai Department of Tourism and Commerce Marketing;
- Ministry of Industry and Advanced Technology;
- Dubai Municipality;
- Dubai World Trade Centre Authority; and
- Dubai Aviation City Corporation (Developer).

4.1. The Higher Committee

The main function of the Higher Committee is to centralise strategic decisions and oversee the overall planning and delivery of Expo 2020’s requirements and activities. To support the higher committee to discharge their duties, other entities were formed under the Higher Committee, namely, the Bureau and the Company as shown in Figure 1 below.

4.2. The Bureau

The Bureau of Expo Dubai 2020 is chaired by the UAE Minister of State for International Cooperation, as the Director General of the Bureau. As a government entity, the Bureau is empowered to discharge its legal and financial jurisdiction directly from the Government of Dubai and acts as the executive arm of the Higher Committee and supervising the delivery of Expo 2020.

4.3. The Company

The Company was formed to assist with the operational delivery and hosting of Expo 2020 Dubai, the Bureau incorporated Expo Dubai 2020 LLC (the Company) to oversee the operational development of the Expo and support the timely reporting of information through the Bureau to the Higher Committee.

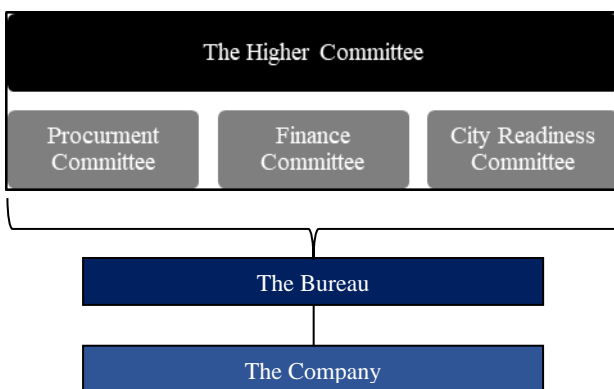


Figure 1. Dubai Expo 2020 Governance Model (Dubai Expo 2020, 2018)

5. Dubai Expo 2020 Site - Sustainability Consideration

The planning for Dubai Expo 2020 and its legacy is interwoven with the Dubai South urban development to ensure that the investment in CAPEX required for the event by generating new urban area and constructing new infrastructures and facilities will be utilised as permanent completed development after the event. The 4.38 sq.km Dubai Expo 2020 site was carefully chosen to be integrated with and be part of strategic plan of future development called Dubai South which is managed by the Dubai

Aviation City Corporation (DACC). Dubai South consists of 8 future districts (Commercial district, Golf district, Humanitarian district, Logistic district, Residential district, MBR Aerospace Hub, Al Maktoum airport & Expo 2020) as shown in Figure 2 below.

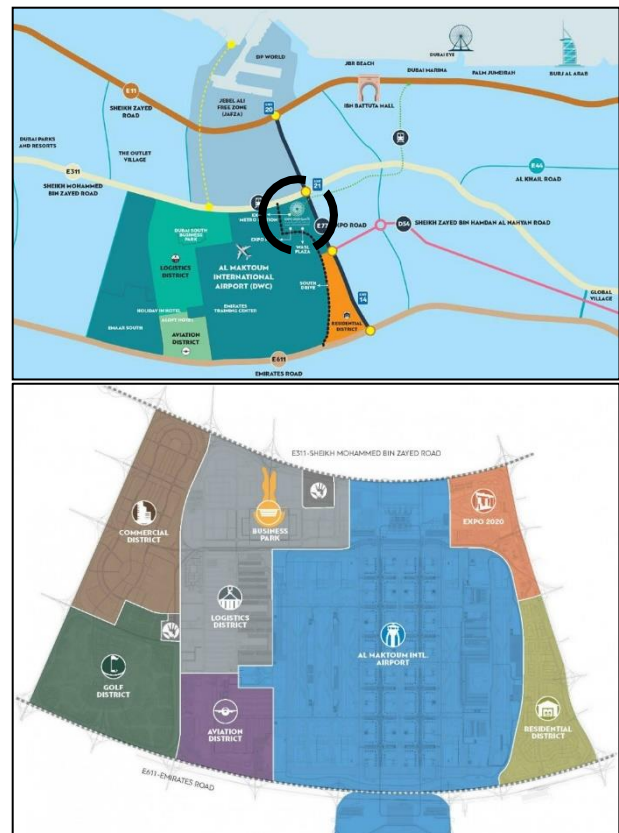


Figure 2. The location of Dubai Expo 2020 Site within Dubai South (Dubai South, 2022).

The most important and high-level target that was considered in the sustainable development strategy is achieving the reusing of 90% of expo site, and repurposing of the site that includes all the buildings and facilities of Expo 2020, thereby providing lasting development assets and an impressive legacy for Dubai.

The adopted sustainability strategy by Dubai Expo 2020 was conceived around six main sustainability focused pillars listed below:

- 1- Retaining the Expo Phase Road and infrastructure;
- 2- Retaining existing assets;
- 3- Maintain key anchors/buildings;
- 4- Legacy phase land use transformation;
- 5- Promoting green and public spaces; and
- 6- Focusing on public and alternative transport models.

Figure 3 below illustrates Dubai expo plan and the main six pillars of sustainable planning (Dubai Expo 2020 Office, 2019) & (District 2020 by AECOM, 2019).



Figure 3. Main Factors of Sustainability Strategy of Dubai Expo 2020 (Dubai Expo 2020, 2019)

According to the sustainability report of Dubai Expo 2020 issued in 2019 (Dubai Expo 2020 Office, 2019), there were different sustainability criteria adopted to be part of the sustainable development plan of the site of Dubai Expo 2020 and future development shown in Table 1

Criteria	<ul style="list-style-type: none"> ➤ Objectives - Key Performance Indicator KPI
Transport	<ul style="list-style-type: none"> ➤ Encourage the use of sustainable, lower carbon transport by providing alternative transport options such as the metro and the Expo Rider bus service - Encourage significant shift from private vehicles to alternative transport options
Energy	<ul style="list-style-type: none"> ➤ Reduce energy consumption - Reduce energy demand in buildings by 20% in comparison to international standards
Public Realm	<ul style="list-style-type: none"> ➤ Create people-centric, comfortable, and walkable spaces - Provide shading for 75% of primary walkways in Thematic Districts at mid-day peak. - Provide shading for 60% of hard landscaping areas and public open spaces at mid-day peak
Sustainability Awareness	<ul style="list-style-type: none"> ➤ Enable visitors, participants, and facility managers to appreciate, understand and contribute to responsible use of resources. - 75% of sustainability features with educational awareness, collateral, or activities
Ecology	<ul style="list-style-type: none"> ➤ Enhance the ecological value of the site and promote local species - 50% of landscape plants (during Expo 2020) and 95% of landscape plants (post Expo 2020) are native and adaptive species - 95% of landscape area managed without the use of chemical pesticides, herbicides, or fertilisers
Water	<ul style="list-style-type: none"> ➤ Reduce the demand on potable water systems and reduce water consumption - Recycled water is used for 100% of non-potable applications - Collect and use 95% of condensate water recovered from buildings - Reduce water demand in buildings by 40% in comparison to local standards

Materials	<ul style="list-style-type: none"> ➤ Minimise depletion of natural resources through design for reuse and Legacy - 90% of materials used in permanent construction to be retained for the Legacy - 75% of materials in temporary construction to be recycled.
Waste	<ul style="list-style-type: none"> ➤ Minimise quantity of waste to landfill - 85% of waste segregated into different streams, during construction, operation & decommissioning, to allow for diversion from landfill
Operations & Management	<ul style="list-style-type: none"> ➤ Communicate sustainability progress and achievements in a transparent and stakeholder responsive way. - Achieve ISO 20121 Sustainable Event Management certification - Publish sustainability reports based on internationally recognised guidelines
Sustainability Certification	<ul style="list-style-type: none"> ➤ Demonstrate added value through sustainability certification. - Achieve LEED Gold Certification for Expo building projects - Achieve CEEQUAL Excellent Certification for Expo infrastructure projects
Carbon	<ul style="list-style-type: none"> ➤ Minimise carbon emissions in Expo 2020. - Fully implement a greenhouse gas (GHG) mitigation and off- setting strategy

Table 1. Dubai Expo 2020 - Sustainability Criteria, Objectives and KPIs (Dubai Expo 2020 Office, 2019).

6. Infrastructure Projects

Dubai invested in building new infrastructure and facilities required for the delivery of the Dubai Expo 2020 and subsequent Legacy post event. According to BNC Construction Intelligence Report published on the Construction Week website (Bhatia, 2018), the estimated cost of total projects linked to Expo 2020 for the various projects constructed across various UAE sectors are listed below:

- Infrastructure and energy projects account for US\$17.4bn (AED 64bn).
- Housing projects are worth 13.2bn US\$ (48.5bn AED).
- Hospitality developments, such as hotels, and destination and theme parks, worth 11bn US\$ (43.4bn AED) are under way.
- Other developments under construction around the Expo 2020 Dubai site include Al Maktoum International Airport's (DWC) Phase 1, worth 8bn US\$ (29.4bn AED), and the Villages at Dubai South homes, worth 6.8bn US\$ (25bn AED).
- Dubai Exhibition City, worth 6.6bn US\$ (24.2bn AED).
- Dubai Metro Red Line extension to DWC, estimated to be worth 2.9bn US\$ (11bn AED).

6.1. Deep Tunnel Storm Water System

Dubai Municipality planned and executed major projects that serve the Dubai Expo 2020 event and creating the Legacy which would provide a powerful catalyst to new development and urban regeneration in the surrounding areas.

The Deep Tunnel Storm Water System is planned to develop and implement a long-term catchment- wide plan for capturing and conveying stormwater and groundwater flows to the Gulf from

the Dubai Expo 2020 site, Dubai World Central (DWC) and the surrounding areas (i.e., the resulting Legacy which will include Dubai South, Al Maktoum International Airport, DWC Commercial and Residential, and other adjacent development communities along the conveyance system route). The total coverage area of the project is approximately 490 km², which is almost 41% of the entire existing and future urban area of Dubai (Dubai Municipality DS 233, 2017). According to DM, the total estimated construction cost of the project is approximately 1.6bn US\$ (6 bn AED) that will be secured through cost sharing with developers by establishing a fair and equitable method for recovering costs. The project was executed in phases and the focus of the current phase was to serve EXPO and DWC areas with an estimated construction cost of 0.6bn US\$ (2.1 bn AED) (Dubai Municipality DS 233, 2017).

6.2. Dubai Strategic Sewerage Tunnel

Dubai Strategic Sewerage Tunnel is another strategic that is currently in the design phase. The project is established to expand and improve the existing sewage system of Dubai City including the new development of Expo site, the Legacy projects and DWC (Dubai Municipality DS 215, 2016). Once announced for tenders, the estimated total cost of project DSST will be approximately 4.4bn US\$ (16 billion AED).

6.3. Dubai Expo 2020 Roads Network Upgrade

The project objectives are to provide access to Expo site and meet the projected daily traffic demand required for Dubai Expo 2020 and future developments in the area. The project scope consisted of constructing the road network surrounding Expo 2020 that included new 9 intersections that consisted of 64 bridges to provide grade separation for efficient and smooth traffic, adding 38 km of roads to the surrounding area and expanding the road system supporting the Expo from 4 to 6 lanes in each direction to increase traffic capacity to 120,000 veh/hr. in addition to providing 23 lanes for entry to Expo with traffic capacity of 34,500 veh/hr, and 24 lanes for exit from Expo with traffic capacity of 36,000 veh/hr. The total cost of the road network upgrade was 3.2 billion UAE dirhams (The Higher Committee for Roads and Transport, 2017).

6.4. Route 2020 Dubai Metro Red Line Extension

Dubai launched new metro line project to upgrade the existing metro network and provide public transport mode that connect the city with expo site and future development. The new metro line was a centrepiece to the transport planning of Dubai Expo 2020 and a main factor to ensure sustainable investment in this mega event and its subsequent legacy developments. In this regard, and to ensure that the new metro line project is a sustainable investment, different alignment options were examined to obtain the optimum and best route among other options to maximises the benefits from the investment and its social and environmental sustainability as shown in Figure 4 below (Roads & Transport Authority Dubai, 2015).



Figure 4. Alignment options for Dubai metro route 2020 (Roads & Transport Authority Dubai, 2015)

A multi criteria assessment method was applied to identify best option among other options. Each of the proposed alternative alignments were assessed and scored from 1 to 5 as score of 5 being the highest and a score of 1 being the lowest based upon each measuring criteria for the evaluation of the proposed alignments. The measuring criteria consisted of: Transportation & Future Developments; Route Insertion; Constructability; Sustainability; Cost; and Operation & Interoperability

As illustrated in Figure 5 the best alignment option was No. 4 due to the following reasons (Roads & Transport Authority Dubai, 2015):

- Meets project objectives and requirements and providing optimum travel time to EXPO 2020 site.
- Increases catchment area and penetrates the dense area of the major existing developments and the proposed Stations with the potential to serve future developments areas to provide a basis for Transit Oriented Development (TOD) around the Stations
- Reduces the impact on existing and future roads/interchanges.
- Reserves its future expandability to Al Maktoum Airport area.
- Provides integration with other travel modes.

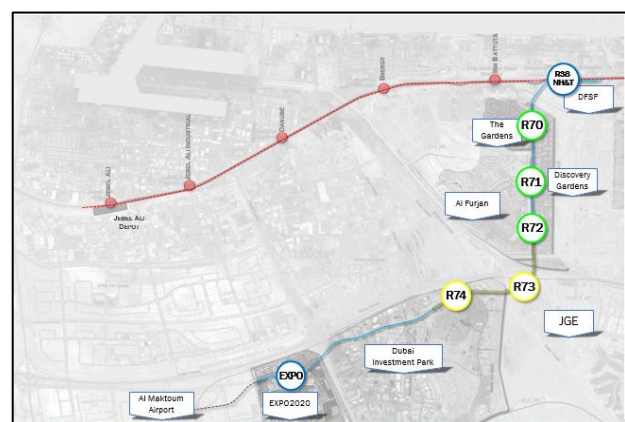


Figure 5. Preferred alignment No. 4 (Roads & Transport Authority Dubai, 2015)

The total length of the selected line is 15 km with 7 station (5 overground and 2 underground). The estimated cost of the new metro line is approximately 11 bn AED. Route 2020 is planned to serve commercial and residential areas with medium to large urban densities and a population of approximately 270,000. The capacity of the route is estimated at about 46,000 passengers per hour in both directions 23,000 passengers in each direction per hour. The number of users of the route is expected to reach

125,000 passengers per day in 2020 and will rise to about 275,000 passengers per day by 2030. It is anticipated that about 35,000 of Expo visitors per day will use metro station of route 2020 and this number will rise to 47,000 visitors a day during the weekend. These figures represent about 20% of the total number of daily visitors expected to visit Expo during the event. The alignment of route 2020 was coordinated with Al Maktoum International Airport to identify future extension of the route inside the airport. The Route 2020 metro extension line will also serve as an integrated transport mode for the area and provide a link to the heart of Dubai.

7. The Impact of COVID 19 Pandemic on Dubai Expo 2020

Usually there is no leniency in extending development schedules for such events. However, due to the impact of pandemic of COVID 19 late 2019 and early of 2020, The Government of the United Arab Emirates (UAE) requested a change in dates of Expo 2020 Dubai following a meeting of the Expo 2020 Dubai Higher Committee in which participating countries had requested a postponement due to the challenges posed by the Covid-19 pandemic. In accordance with the BIE Convention, the change in dates required a two-thirds majority vote of Member States for the change of dates to take effect. Voting on the postponement was carried out remotely by the government-appointed delegates of the BIE's 170 member states and the two-thirds majority in favour of the postponement was reached as early as 4 May. The 29 May decision of the General Assembly gave that final assent. As a result of the postment decision, Dubai Expo 2020 will officially take place between 1 October 2021 and 31 March 2022. The event will keep the name 'Expo 2020 Dubai' (Dubai EXPO, 2020).

Consequently, projects timeline extended out to the later timing of the Expo to allow more time for the project due to the restriction and lock-down imposed during the pandemic.

8. Findings and Discussion

The research work reveals that the UAE and Dubai Emirate have established a structured governance system with organisations that contain high profile managerial members from different authorities to facilitate decision making occurring at a high level of executive authority to ensure the successful delivery of the event.

According to the model adopted by the Dubai government to ensure achievement of sustainable investment objectives (as set out in its "six sustainability pillars"), plans for Expo event were interwoven and integrated with future holistic development of the Dubai Emirate, hence, the planned and implemented mega projects to build new infrastructure and buildings will serve the relatively limited 6 month duration of the Mega Event, whilst subsequently addressing the post Mega Event demands for future developments in this sector of Dubai's metropolitan area. For example, 90% of buildings and facilities planned for Expo will be part of its lasting legacy "District 2020". Furthermore, the mega projects such as the new metro line, road network and strategic tunnels for storm water and sewer were carefully planned to address the delivery requirements of Expo, future plans and city growth demand. The holistic plan for Dubai Expo 2020 can be considered as benchmarking and best practice for future hosting of mega events in different cities in the globe.

9. Conclusions

- Hosting Dubai Expo 2020 was planned with consideration to meet the requirements of the event yet providing a legacy to maximise the benefits from investment and address the demand of future development and growth of the city.
- The adopted governance model and the level of participation from local authorities helped to facilitate decision making and integration between short-term and long-term during planning phase for Expo and the Legacy
- The cooperation between local authorities and developers is very important to maximise the benefits from huge investment in hosting the expo i.e. the site of expo and legacy is integrated in future urban development of Dubai South urban area.
- This Mega Event provided an outstanding opportunity to extend the railway network of the city, which is critical to supporting environmentally sustainable urban form in Dubai's future. Infrastructure projects such as the planning of a new route of metro line to connect the Expo site with the city at a cost of 3bn US\$ (11 bn AED)
- A multi criteria assessment and different factors were applied to identify the best alignment to serve the event, existing urban areas, and future development to ensure that the new metro line will boost future sustainable development in this sector of Dubai's metropolitan area.
- One of the most important criteria in choosing the alignment was the concept of transit-oriented development TOD because of the substantial commuter carrying capacity of the metro, while planning for the route.
- Other major infrastructure projects executed to support the event such upgrading road network, Deep Tunnel Storm Water System & Dubai Strategic Sewerage Tunnel were planned to address the requirement for hosting the event and the forecast demand of future development due to the anticipated growth of the city.
- The study of Dubai model for hosting a Mega Event presents a substantial amount of information that can assist other cities in planning for the hosting of future mega events by presenting a benchmark of what can be achieved. However, it is recommended that further research work is conducted with post event studies (1-20 years hence) to assess the value of the project outcomes and to measure the effectiveness of the sustainability focus of plans implemented by the Dubai Government in hosting the Dubai Expo 2020, particularly with regard to assessing the Legacy benefits of this Mega Event, with a view to providing a globally relevant exemplar for the future hosting of sustainable mega events through enduring legacy benefits that are compatible with life in a future carbon neutral world.
- The impact of accelerated mega projects executed in considerably short period to address the demand of hosting mega event, and the massive budgeting required for these projects on future development, economy and growth of the hosting city is an interesting point that required further investigation and study to provide mitigation measures for any anticipated risks of slowing down in economy, job opportunities, growth and city development post the event.

10. Acknowledgment

The authors would like to acknowledge Dubai Expo office, Dubai Municipality and Roads Transport Authority of Dubai for their support in providing the access to and sharing the information required by this research work, that without their support the research work wouldn't be successfully delivered.

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