Abstract:
Sustainability is based on a simple principle: everything that we need for our survival and well-being depends, either directly or indirectly, on our natural environment. This paper aims to emphasize that it is possible to achieve different types of goals – economic, social and environmental - in the same time with appropriate strategies. All the activities developed for the organization of the Olympic Games 2012 were based on the principle of sustainability and the results are remarkable. Compared with previous two editions, we concluded that the Olympic Games from London 2012 are a very good example of best practices for green investment and building sustainable infrastructure that has to be understood and promoted.

Key words: sustainable infrastructure, green policy, green model, clean investment

JEL classification: I3, Q00, Q2, Q5

1. The vision
When London agreed to host the 1948 summer Olympic Games it did so in an age of austerity. With the devastations of World War II still fresh, and the economic reality of a country completely spent, the focus was firmly on staging a morale-boosting event, relying upon existing venues as the most cost-effective means to do so. In 2012, London is again experiencing an austere time, but unlike in 1946, Games organisers upon winning the right to host the 2012 Olympic Games and Paralympic Games, did not know that they would be faced with a looming global economic crisis the size of which is only comparable to the Great Depression.

With all these things, London is the first summer Host City to embed sustainability in its planning from the start. Sustainability underpins everything they do towards this new vision, to use the power of the Games to inspire lasting change. Simply put, sustainability is about making positive and lasting changes in the way we use natural and human resources to improve quality of life for all, now and in the future. In terms of events this means ensuring they [A review of legacy across the London 2012 Program, March 2012]:

- provide an accessible and inclusive setting for all;
- provide a safe and secure atmosphere;
- have minimal negative impacts on the environment;
- encourage healthy living; promote responsible sourcing;
- deliver excellent customer experience;
- and encourage more sustainable behaviour and leave a positive legacy.

Some events, especially large-scale and outdoor events, can cause localised impacts on the environment and communities (including along routes to and from the venue). These may relate to noise and litter, as well as physical impacts on natural habitats and other features.

Climate Change is one of the London 2012 overarching sustainability themes. It encompasses climate change adaptation and climate change mitigation. It, like other themes, is something which concerns multiple stakeholders. Nationally, the Government introduced the Climate Change Act in 2008 which sets legally binding targets to reduce carbon emissions with 80% by 2050 including an interim target of 34% by 2020, in addition to a range of other supporting measures. The London 2012 Programme recognised the important of Climate Change in identifying it as one of five key sustainability themes which have driven sustainability throughout the Programme.
When London bid to host the 2012 Paralympic Games and Olympic Games, then Mayor and Government saw it as a once-in-a-generation opportunity to deliver a sustainable legacy for one of the most deprived areas of the UK and London. East London, a place where employment, life chances, urban quality and amenity did not match up with London’s average, was firmly catapulted onto the world stage. The 2012 Programme stakeholders set an impressive suite of sustainability targets under five key themes and these have driven excellent outcomes on the Olympic Park and beyond in the Lower Lea Valley, and across the UK. Nationally, the picture is also good, with some new venues being created or enhanced and programmes to engage people in the spirit of the Games and its legacy.

2. About London 2012 Olympic Games sustainability policy

The main principle of this environmental approach is the respect for the planet’s ecological limits which encourages the best possible sustainable lifestyle leading towards One Planet Living. The celebration of the cultural diversity and the creation of a legacy for sport, the environment and the local, national and global community is the second one. On this line the principles are diversifying. The principles includes big themes like the development of thriving communities in and around the Olympic Park site in East London with new economic, educational, health, sporting and cultural opportunities, set with an ecologic Parkland and supported by resource efficient infrastructure and utilities; a renaissance of sport in the UK, engaging young people in participatory sport, and the others.

As important as these are 5 themes and projects of sustainable development for London:

Climate Change - the Games can make a real difference by minimising greenhouse gas emissions, from construction to legacy, and by ensuring that legacy facilities are able to cope with the impacts of climate change.

Waste - London 2012 is committed to minimising construction waste, will send no waste produced during the Games to landfill, and will act as a catalyst for encouraging the development of new waste processing infrastructure in east London and promoting changes in public attitudes and behaviour.

Biodiversity – London 2012 will minimise the impact of the Games on the ecology of the Lower Lea Valley and at other Games venues during the planning construction and operational phases; it will leave a legacy of enhanced habitats within the Olympic Park; and will foster an understanding of the importance of biodiversity in supporting healthy lifestyles.

Inclusion – the Games will be genuinely open to all, will promote inclusion and attitude change, especially towards disability, celebrate the diversity of the people of London and the UK, and will create new employment, training and business opportunities, contributing to the social and economic regeneration of communities living around the Olympic Park site and the wider Lower Lea Valley.

Healthy living – the Games will be used to inspire people across the country to take up sport and develop active, healthy and sustainable lifestyles.

2.1 A comparative study of green targets concerning the Olympic Games

In the Table 1 we made a detailed comparison of the green criteria which can be taken into account in the process of the assessment of the sustainability. It is obvious that the basic idea of organization and investments made for the Olympic Games organized this year in London is the sustainability.

<table>
<thead>
<tr>
<th>Table 1 Olympic Games – green or no?</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>London</strong></td>
</tr>
<tr>
<td>Accessibility</td>
</tr>
<tr>
<td>New or improved transport links/</td>
</tr>
<tr>
<td>infrastructure</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Creation of new neighbourhood or</td>
</tr>
<tr>
<td>revitalisation of existing</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>
### Energy and carbon & climate change adaptation

<table>
<thead>
<tr>
<th>Renewable energy infrastructure</th>
<th>Renewable energy target not met due to technical failure of proposed technology for the site. However, compensatory measures in place and exceeded.</th>
<th>Commitment to install Geothermal heating network to cover 16 million square metres. A number of venues fitted with geothermal, water source and air source heat pumps and solar PV systems.</th>
<th>No solar PV incorporated into venues. Conventional design approach to all venues. No water saving measures.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon reductions</td>
<td>Carbon reductions of 50% on operation of venues in legacy use has been exceeded (although this has only been possible through off-site solutions)</td>
<td>Higher taxes imposed on larger vehicles. 90% of buses and 70% of taxis to use natural gas.</td>
<td>No information</td>
</tr>
<tr>
<td>Air quality</td>
<td>Target for an average 30% reduction in congestion through increased walking and cycling and increased use of public transport.</td>
<td>Closure of heavy steel mill in the city. Reduction in number of older vehicles on the roads. Restrictions on Games-time vehicle use and extended for a further 12 months post Games.</td>
<td>Public awareness campaign to reduce car use</td>
</tr>
</tbody>
</table>

### Waste

| Waste targets                   | Main legacy commitment for the Games to be a catalyst for waste infrastructure in East London will not be achieved. However substantial targets are on track on waste in construction and at Games time. | By 2005 – 96% of all waste and waste water to be safely disposed of and treated. | No active material reuse or recycling. |
| Waste infrastructure            | A wastewater treatment plant which cleans and recycles non potable water has been delivered on-site. | Stated target of building 14 new waste water treatment plants | Remediation of former rubbish dumps. |

### Biodiversity

| Biodiversity plan               | Clear biodiversity action plan to replace biodiversity that was lost through construction and to enhance biodiversity outcomes for the site. Explicit approach to habitat creation. | Creation of a number of green zones including a 680 ha Park and increased tree planting including 240 kilometres of trees and grass. | Proposed but not carried through. |

### Inclusion

| Creation of new business opportunities into legacy | Plans in place to create new business Opportunities through a variety of means. | Aim to move Beijing away from being solely a producer city to being a consumer city with attendant economic benefits. | Modest long term economic impacts, although infrastructure improvements will have knock-on effects. |

### Healthy living

| Food                            | Food vision established which specifies local and healthy food options at Games time. Legacy benefits/ targets still to be determined. | Criticism of food and beverage approach that encouraged consumption of high-energy foods. | No targets proposed |

Source: Adapted after Commission for a Sustainable London 2012 | Legacy Review | March 2012

3. „No compromise” approach

Hosting the Olympic and Paralympics Games is perhaps the greatest opportunity a nation could have to transform its sporting system and structures, leaving a legacy of both sporting performance and participation that will last long after the Games have come to a close. When the UK won the right to host the Games in London in 2012, UK Sport produced a submission to Government on options for increased funding for elite athletes in the run up to London 2012. The submission was based on UK Sport's „No Compromise” approach to delivering performance success [http://www.uksport.gov.uk/pages/london-2012].

The Government responded in March 2006, by announcing an additional 2012 performance funding package of £300 million, £200 million of which coming from public funding, with a further
£100m to be found from the private sector. That enabled UK Sport to start to work towards the ultimate goal – top four in the 2012 Olympic medal table, and second in the Paralympic medal table.

UK Sport moved quickly to deliver a 2012 investment strategy that increased funding for those sports already part of its performance pathway and bring a number of new sports onto the pathway for the first time. Awards were made for the period up until the Beijing Games, where performances could be taken into account before confirming final investment levels up to the London Games. In December 2008, following reviews of the Beijing Games, UK Sport confirmed individual sport investment levels for the London Olympiad, based on known resources assured by the Government together with the overall performance ambitions. It’s „No Compromise” funding strategy of concentrating investment in those sports and athletes most likely to deliver medals sits at the heart of these decisions, while also providing an opportunity for the sports only brought into the scope of funding in 2006 to become competitive by the time the 2012 Games commence.

Public funding levels will fluctuate over time [http://www.uksport.gov.uk]. So to ensure that all sports know where they stand, UK Sport has developed a set of Investment Principles, to guide World Class Performance investment decisions – both those made at the beginning of the London cycle, but also at its Annual and Mid-Cycle Reviews conducted each autumn. The UK’s high-performance system is currently enjoying unprecedented levels of investment ahead of a home Olympic and Paralympic Games in 2012. However, with a policy direction of delivering medal success in London, UK Sport has to determine criteria to ensure that investment is targeted where it has the greatest chance of succeeding. „No Compromise” describes our attitude to engaging with the Mission – with medals being the ultimate aim.

The World Class Programmes have been on a journey since 1997 and the No Compromise approach was developed out of the experiences of the early years. All of the Beijing medal winners were supported by this approach. The policy sets out to reinforce the best, support those developing and provoke change in the under-performing, with investment in sports being determined on a combination of past performance and future potential.

The London Organising Committee of the Olympic Games and Paralympic Games (LOCOG) is the private sector company responsible for preparing and staging the 2012 Games [http://www.london2012.com]. It has a £2bn budget, with almost all of it to be raised from the private sector. This commercial revenue will come from several sources.

The Olympic Delivery Authority (ODA) is the public sector body responsible for the delivery of the new venues and infrastructure required for the London 2012 Games. The ODA budget is drawn entirely from the public sector. The ODA is funded by the Department for Culture, Media and Sport, the Greater London Authority, the London Development Agency and the Olympic Lottery Distributor. This funding is contributing to the construction of the venues and infrastructure in the Olympic Park, the facilities at Weymouth and Portland, Broxbourne and Eton Dorney, and the legacy that will follow the Games.

£2.2bn of National Lottery funds are helping to create the facilities to host the Games, providing a long lasting legacy for the people of east London and the wider UK. The Lottery will share in the profits made from land and property sales in the future. As well as the funding that the National Lottery is providing for the venues and infrastructure for the London 2012 Games, the Olympic Lottery Distributor is providing LOCOG with a grant of £66 million from National Lottery funds specifically for the Paralympic Games.

The Government Olympic Executive in the Department for Culture, Media and Sport (DCMS) leads for Government on delivery of the London 2012 Olympic Games and Paralympic Games.

The Greater London Authority (GLA) is working to deliver the Mayor’s objectives for the London 2012 Games, and ensuring that hosting the Games brings the best possible benefits for Londoners. The GLA is contributing £925 million to the Olympic Delivery Authority. This money will be spent on the regeneration, infrastructure and facilities that will continue to benefit Londoners for generations to come.

The London Development Agency (LDA) is the Mayor's agency responsible for driving London's sustainable economic growth and is involved in the 2012 Games to ensure that London and Londoners maximise the long-term benefits that hosting the Games will bring.

Working in partnership with the ODA the LDA is continuing with its planning for the legacy development of the Olympic Park. In addition the LDA is investing in the future by spearheading a wide range of business support programmes and skills initiatives. The LDA is also providing £250 million
towards the costs of the infrastructure and venues for the Games and is investing £220 million in the clean-up of the Park, which the ODA is managing on the LDA's behalf.

4. The results of green investments – green Olympic Park

The Olympic Park site is being transformed from a brownfield site characterised by large areas of derelict industrial land into a new urban park with improved infrastructure and world-class sporting facilities. The area had suffered from poor connectivity and was fragmented, polluted and divided by pylons and railways. The challenge was to turn an area the size of Hyde Park, much of it contaminated and neglected for decades, into an Olympic Park and a sustainable new quarter of London for the community to live, work and play in after the Games [From brown to green - Transforming the Olympic Park - Olympic Delivery Authority, Olympic Park sustainable development, June 2010].

More than 4,000 trees, 74,000 plants, 60,000 bulbs and 300,000 wetland plants will be used to create a new open green space for London, one of the largest planting projects undertaken in the UK. The Olympic Park and its venues have been designed to create 45 hectares of wildlife habitats and will include reedbeds, grasslands, ponds, woodlands, 525 bird boxes, 150 bat boxes and artificial otter holts.

More than 200 buildings demolished before construction could begin and 97 per cent of material was reclaimed during demolition, much of this material was reused in the creation of the new Olympic Park. Reuse and recycling of materials was maximised on site, reducing waste and therefore the amount sent to landfill. The re-design of The Greenway, a key walking and cycling route, has used materials including bricks, paving stones, cobbles, man-hole covers, timber sleepers and tiles that were salvaged from the demolition and site clearance stages.

Hundreds of thousands of tonnes of soil which would otherwise have been transported off site was cleaned and reused. Contaminants included oil, petrol, tar, cyanide, arsenic and lead as well as some very low level radioactive material. A ‘soil hospital’ was set up on the Olympic Park with machines that washed, sieved and shook the soil free from contaminants, producing clean material which could then be re-used on the Park. Over 20 million gallons of contaminated groundwater was treated using innovative techniques, including injecting compounds into the ground, generating oxygen to break down harmful chemicals.

Wildlife and habitats on the Park have been protected during the demolition and construction phases. An ecology management plan was developed which included translocation 4,000 smooth newts, 100 toads and 300 common lizards as well as fish including pikes and eels. Sandmartin and Kingfishers nests were created outside the Park and a programme of bird and bat surveys was carried out by ecologists on the site. A new wildlife habitat was created on Hackney Marshes to provide a home for insects such as the Toadflax Brocade Moth and species of Solitary Bee.

Two six-kilometre tunnels built beneath the Olympic Park, enabling the power to be carried underground. 200,000 cubic metres of spoil created during tunnelling - the vast majority of which was reused in construction of the Olympic Park. 52 pylons which dominated the Olympic Park landscape have been removed. 130km of overhead wires were removed and replaced underground [From brown to green - Transforming the Olympic Park - Olympic Delivery Authority, Olympic Park sustainable development, June 2010].

Olympic Park venues have been designed and built to be energy-efficient and as sustainable as possible. The Velodrome is almost 100 per cent naturally ventilated, maximises the use of natural light to reduce energy consumption and rain water will be collected from the roof for flushing toilets and irrigation. Water used to clean the swimming pool filters in the Aquatics Centre will be recycled for toilet flushing. The foundations for venues and roads have used recycled materials. Many of the venues and bridges will have living habitat spaces incorporated into walls and roofs.

The waterways which characterise the Olympic Park have suffered from years of neglect and under-investment. River walls were failing, invasive species colonised the river banks and water quality was poor. A multi-million pound dredging programme removed 30,000 tonnes of silt, gravel and rubble as well as tyres, shopping trolleys, timber and at least one motor car. The dredging programme will also help improve water quality, creating a more accessible habitat for wildlife. A new water control structure and lock has been built on the Prescott Channel, creating a navigable route for freight and for leisure boats in the future. River walls have been repaired, invasive species cleared, new water side habitats created and tow path quality and access will be improved.

To reduce the number of lorries on the roads and the resulting carbon emissions, rail and water routes are used to get materials delivered to site and waste taken away. A rail hub built in the south of the Olympic Park receives materials including aggregate, kerbs and drainage units. There is also a rail hub on
the Olympic Village site for bulk materials. Waste is being taken away from the Olympic Park by barges through the newly dredged waterways and a new lock and water control structure. Several projects including the Stadium and Aquatics Centre have received deliveries by water transport.

The ODA requires contractors on site to use environmentally and socially responsible materials. A panel of timber suppliers has been set up for contractors across the Olympic Park to supply legal and sustainable timber with appropriate supporting evidence. To reduce the embodied carbon of venues on the Olympic Park, a concrete batching plant has been set up onsite to supply low-carbon concrete to all contractors. Low-carbon concrete is achieved by substituting raw materials needed to make the concrete mix with secondary or recycled materials, such as by-products from coal power stations and steel manufacture, and recycled glass.

A new Energy Centre and network will provide efficient and low-carbon power and heat to the Olympic Park using new technology including biomass boilers. A Combined Cooling Heat & Power (CCHP) plant will capture the heat generated as a by-product of electricity production and is up to 30 per cent more energy-efficient than traditional generation.

5. Conclusions

The management of resources at a major global event like the Olympic Games is absolutely vital to the successful operation of the venues and official facilities. Furthermore, waste and resource management is undoubtedly one of the more visible elements of the Games sustainability performance. London 2012 promised a truly sustainable approach that will inspire a lasting positive impact before, during and beyond the main event. A development on the scale of the Olympic Park and an event on the scale of the 2012 Games provide the opportunity to create a micro-economy of waste efficiency, putting in place the infrastructure and processes to minimise waste and to maximise reuse and recycling.

One of the unique aspects of the Olympic Games and Paralympic Games lies in the way they can touch so many people in different walks of life. Beyond sport, the Games inspire activities in a wide range of cultural, educational, research, environmental and business spheres – locally, nationally and internationally.

There are great expectations of London 2012: not only was sustainability flagged as a major element of the bid, there is also a societal expectation that these Games will mark a step change in sustainability performance [Towards a One Planet 2012 - Sustainability Plan, 2nd Edition, December 2009]. This goes beyond merely delivering against technical commitments in the bid. It is in keeping with the mood of the time – and the sense that this is the moment when sustainability must come into sharper focus for everyone.

The Resource Management Strategy is that waste materials should be viewed as a resource [London 2012 - Zero Waste Games Vision, London Organizing Committee of the Olympic Games and Paralympic Games Limited, February 2012]. Key to achieving this strategy is a consistent and integrated approach to waste and resource management. All these are the result of one lengthy and detailed process, and the start of another. It is the product of several years of research, analysis, and consultations with industry and sustainability experts, advisory groups and key partners – and all these will be seen around the world for new examples of future development.

REFERENCES:

* Assuring a legacy – promises, progress and potential, A review of legacy across the London 2012 Programme, March 2012
* From brown to green- Transforming the Olympic Park - Olympic Delivery Authority, Olympic Park sustainable development, June 2010
* http://www.epa.gov
* http://www.green-report.ro/
* http://www.london2012.com
* http://www.uksport.gov.uk
* http://www.uksport.gov.uk/pages/london-2012
“ACKNOWLEDGMENT
This paper has been financially supported within the project entitled „Doctorate: an Attractive Research Career”, contract number POSDRU/107/1.5/S/77946, co-financed by European Social Fund through Sectorial Operational Programme for Human Resources Development 2007-2013. Investing in people!”