

# Approaches to sustainability in the Global North and Global South: Sharing lessons on sustainable water systems

Celia Way<sup>1</sup>, Emilia Melville<sup>1</sup>, Joanne Beale<sup>2</sup>, Zareen Sethna<sup>3</sup>

<sup>1</sup>Buro Happold, Bath, United Kingdom

<sup>2</sup>Buro Happold, London, United Kingdom

<sup>3</sup>Happold Ingenieurbüro, Berlin, Germany

**ABSTRACT:** The Global North and Global South can be understood as having very different resource consumption patterns, historically and in the immediate future. This means they have developed specific knowledge for managing their resources in their particular context, presenting the opportunity for mutually beneficial knowledge sharing. This paper considers different models and approaches to sustainability, developed in the Global North, and explores their application in practice, in both the Global North and Global South. This is framed around the issue of water management, and four case study project examples are reviewed. These highlight many learning points for both the Global North and Global South including insight into the importance of public space to wellbeing, the need for a transitional approach to sustainability and the benefits of collaborative and open knowledge sharing.

Conference Theme: Water and Waste Management in the Built Environment

Keywords: sustainability, water systems, lessons learnt

## 1. INTRODUCTION

This paper began with the idea that the Global North (characterised by the more industrialised countries) and Global South (characterised by less industrialised countries) can be understood as having very different resource consumption patterns, historically and in the immediate future. They have developed context specific knowledge for managing their resources, alongside a range of ideas around what constitutes sustainable development.

Design and professional services are currently delivered internationally, often with experts from the Global North providing consultancy services to countries with less technical expertise. Advice around sustainability issues, including resource consumption and environmental impact, is increasingly forming part of this service.

There are many different ways of approaching sustainability, and different models have been developed as the concept of sustainability, and experience of trying to implement it, has evolved. These models have largely originated in the Global North, whose conception of sustainability typically revolves around reducing consumption, reducing the effect of that consumption on the environment and reconciling this with the underlying demand for economic growth. This has potential to create tensions between the Global North and Global South in terms of how sustainability ideas are developed and communicated, and how priorities are defined going forward.

Figure 1 below presents a simplified model for understanding the resource consumption pathways of the Global North and Global South, their respective areas of expertise and their potentially different perspectives on a sustainable future. This highlights the potential for mutually beneficial knowledge sharing, using the experience and knowledge from both north and south to design context appropriate, sustainable urban environments, which deliver high levels of human wellbeing.

A key element of this knowledge transfer has to be an understanding of the embedded nature of knowledge systems (Byrne, R. and Day, J. 2011). For example, technologies cannot be transferred simply with a set of design drawings and a user guide. They are embedded in an implicit understanding of why and how it 'works', and how it was designed, and without this understanding and a capacity for further design work, they cannot be developed or adapted effectively and self-sustaining innovation on the part of the recipient cannot happen.

The authors have chosen to focus their attention on how these issues relate to water systems. There is much existing debate around energy consumption and its carbon impacts around the world, but reflection about sustainability ideals and water systems across different global contexts is considered an emergent field.

This paper explores some current approaches to the design and construction of sustainable water systems through the study of four projects that Buro Happold has had some involvement with, either as a consultant or in a pro-bono capacity. It considers what lessons could be learnt from these quite different experiences, and how sustainability was framed and understood in each.

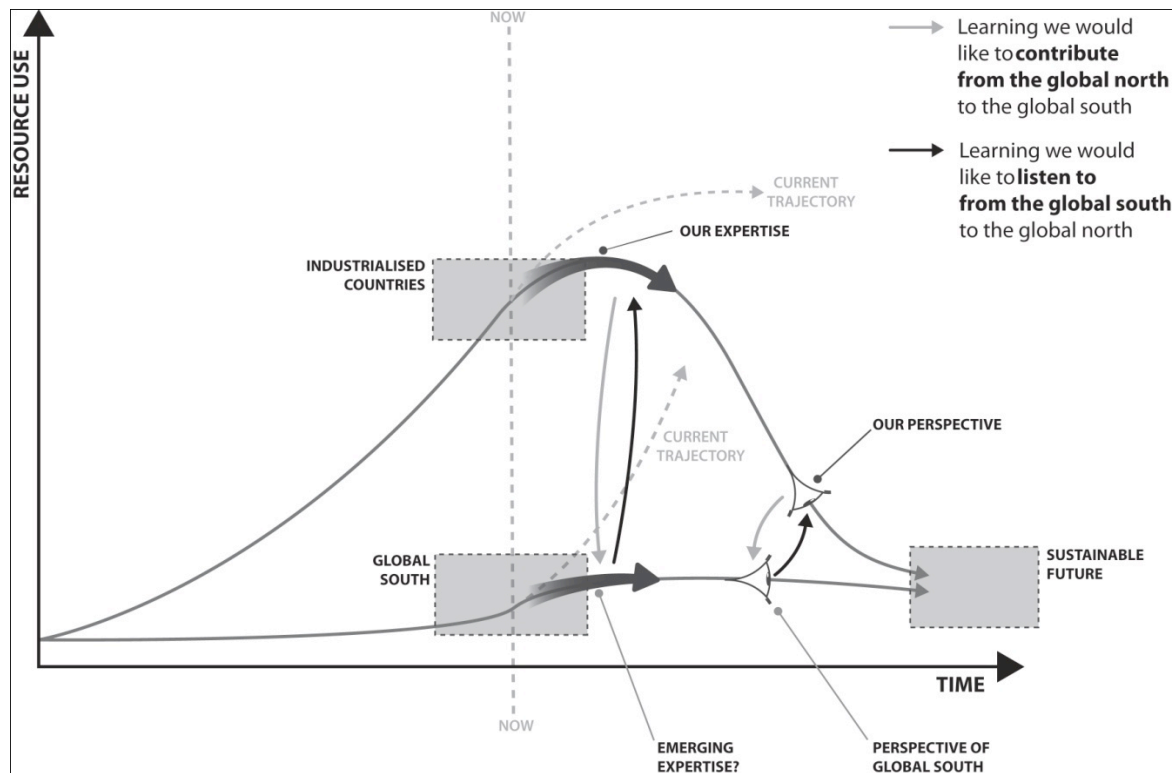


Figure 1: Sketch illustrating paths of resource consumption over time, indicating areas of potential knowledge sharing

## 2. APPROACHES TO SUSTAINABLE DEVELOPMENT

There is widespread agreement on the definition of sustainable development as being “development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (WECD 1987). However it is a difficult to concept to define practically (Pope et al 2004) and can be challenging to integrate into the design approach (Mulligan et al 2011). There are three common approaches, used frequently in contemporary practice, and these are described briefly below.

*The three pillars:* This understanding of sustainability is perhaps the most established holistic approach (one that doesn't focus solely on environmental sustainability). It was formally captured as a framework at the 2005 UN World Summit (United Nations General Assembly 2005) with environmental, economic and social aspects termed the ‘three pillars of sustainability’ or ‘the triple bottom line’. The triple bottom line as defined by the UN has not been universally accepted and has undergone various interpretations, for example by Forum For the Future as the ‘Five Capitals’ model (Forum for the Future 2007).

*Eco-efficiency:* Eco-efficiency is a term coined by the World Business Council for Sustainable Development (Schmidheiny, S.1992) and is described by the United Nations (United Nations 2011) as creating ‘more value with fewer resources and less impact’ namely ‘doing more with less’. The concept of eco-efficiency tries to:

- maximise quality of life
- maximise competitiveness
- maximise environmental sustainability

It is a management philosophy that encourages municipalities and businesses to seek environmental improvements that generate social as well as economic benefits. It promotes innovation, growth and competitiveness while protecting the environment.

*Lean, mean, green:* The lean, mean, green framework considers specifically resource consumption, and the environmental ‘pillar’ of sustainability. It is used extensively by Buro Happold as a tool for encouraging sustainable systems in projects of all scales across the Global North. It can be used across the environmental sustainability spectrum but in terms of water management, it is best applied through a water hierarchy where demand for potable water is first reduced at source as far as possible, before considering fitness for purpose, and then seeking alternative sources for lower grade or non-potable demands.

## 3. METHODOLOGY

This paper presents the approaches taken and the lessons learnt through four Buro Happold projects which are examined as case studies on the implementation of ideas around sustainable water systems. The four projects were chosen as they are seen to represent current best practice and cover a variety of scales (single building through to master plan), economic and geographical regions, cultures, budgets and approaches (top down/bottom up). The authors recognise that the sample is too small to be representative; however we do believe that the case studies and the lessons learnt from them are relevant to other projects across the globe seeking to implement sustainable systems.

For each case study a qualitative, semi-structured interview was undertaken with a key member of the project team from Buro Happold. The questions on which the interview was based were the same for each project to enable comparison between the projects and to draw out key themes, and at the same time the interviews were flexible and fluid so as to enable the interviewee to explore and go into greater depth in areas relevant to the particular case study.

The case studies presented in this paper are explored from the perspective of engineering consultants from the Global North. They bring their experience and culture of sustainability as practised in the Global North, developed primarily in the context of reducing resource consumption in a culture of high consumption. This is supplemented with a sensitivity to what is appropriate in the context of each project, and experience of working on projects all around the world. However, the inherent one-sided approach of this paper is acknowledged, and it is hoped that it will lead to responses from different perspectives from the Global South, initiating open discussion and knowledge sharing around the topic of sustainability. The case studies are described in the following section under the following headings:

- Project description – introducing the context, background and scope of the project.
- Sustainability drivers – the sustainability priorities of the client and critical issues arising from the context.
- Approach – the approaches of the client and the design team and the differences and similarities between them.
- Knowledge transfer – the opportunities for and mechanisms of knowledge transfer within and arising from the project.
- Lessons learnt – the lessons learnt by the design team and the broader lessons that can be shared regarding approaches to sustainable water systems in the Global North and Global South.

#### 4. CASE STUDIES

<i>Project</i>	<i>Date</i>	<i>Country</i>	<i>Description</i>
Wessex Water	1997-2001	UK	Corporate Headquarters
Wadi Hanifah	2001-ongoing	Saudi Arabia	Watershed restoration
Dar es Salaam Masterplan	Ongoing	Tanzania	City Masterplan
Kibera Public Space Project	Ongoing	Kenya	Public space in Kibera

##### Case Study 1: Wessex Water

*Project Description:* This project centred on the design and construction of an exemplar new headquarters building for Wessex Water, a company delivering water services in the south west of the UK. Buro Happold provided engineering consultancy services for the project, which commenced in 1997. The site is in a semi-rural location on the outskirts of Bath. A rainwater harvesting system, onsite stormwater management approaches and a greywater recycling system were specified, as part of an innovative approach to the implementation of sustainability features.

*Sustainability drivers:* The brief for the project was to build an exemplar office development, which provided innovative sustainability solutions in terms of energy, transport, water, comfort, ecology and materials, and which could be replicated in other projects by other organisations. This meant there was an emphasis on using tried and tested technology, with realistic cost implications. Water was a particularly important consideration, as it relates to the core business of the client, and they wanted to exemplify best practice. At the start of the project (mid-late 1990's), the sustainability of water systems was a fairly new concept in the UK, and technologies such as rainwater harvesting were mostly aimed at the residential sector. There was generally little enthusiasm for reducing demand through fixtures such as low-flow taps or waterless urinals. This changed markedly over the course of the project and since its completion in 2001. There is now much more interest in utilising alternative sources, although the associated technologies are still often perceived as expensive and with questionable returns. This change in attitude closely paralleled the rise of BREEAM which promotes demand reduction through the use of alternative sources (predominantly rainwater harvesting and greywater recycling), specification of low-flow fixtures, and on-site stormwater management. The project sought and achieved a BREEAM excellent rating (BREEAM 2009).

*Approaches:* The client had a very strong commitment to sustainability, at the highest level, and the Chief Executive (CE) maintained a 'hands-on' approach through working closely with their facilities manager and chief engineer. This meant that there could be client representation at all the design team meetings. Critically, and

unusually, members of the client team were empowered to make decisions (as they were so closely aligned with the CE) and this facilitated project progress. The use of simple, tried and tested, cost-effective technology, was central to the philosophy of the project. This was coupled with the architect's ethos around embedding sustainability features – that they should not stand out, but be an integral part of the design.

The members of the project team each had different levels of knowledge and application experience of sustainability. An open approach to learning and sharing enabled effective knowledge transfer between members. The client team received additional advice on sustainability from a renowned sustainability advocacy body, which helped frame the project's approach to sustainability. As part of this open-learning approach, technologies were trialled with varying success – the contractor installed a small rainwater harvesting system on the site office, which had some discolouration issues, the main rainwater harvesting system was installed in the project nonetheless, and over ten years later is still providing high quality water to all the toilets in the building. A greywater system was initially installed, but later removed due to maintenance problems.

Conventional approaches to stormwater drainage would have required a new stormwater sewer to be installed along the length of one of the major roads into central Bath. This would have incurred significant cost and disruption, and meant the use of sustainable drainage systems (SuDs) and on-site attenuation and infiltration techniques had multiple benefits. The landscaping on site was naturalised as far as possible, including the green roofs.

*Knowledge Transfer:* As previously described, there was a strong learning culture from the outset. The design team and the client team worked very closely together, and developed an ongoing relationship from the design through to post occupancy evaluation processes after completion. This was assisted by the geographical proximity of the teams, and Buro Happold maintained this good relationship with the client team.

One of the key learning experiences was around the building's energy consumption. The building initially did not meet its energy targets, but a budget was made available to understand and improve consumption through a post occupancy evaluation. Over the course of three years, this led to achievement of the targets and greater understanding of how the building works. The handover phase was conducted alongside a process of staff engagement and a thorough induction, resulting in a high level of awareness of effective building management.

#### *Lessons Learned:*

- 'Hands-on' involvement of senior management in innovative projects can be a key success factor. Symbolic endorsement is likely to be insufficient.
- Good design has longevity. The Wessex Water headquarters building is still seen as an exemplar office building, a decade after its completion.
- Thorough handover and staff induction processes are likely to lead to effective building management.
- Developing good relationships between client and project teams can lead to mutually beneficial outcomes. In this project, the client has an exemplar building that performs well in intended areas, and the project team have developed expertise around sustainable office buildings.
- The focus of attention (in terms of sustainability) is in constant flux. At the start of the project, energy consumption (kWh/m<sup>2</sup>) was the key issue, but over time the concept sustainability has become broader and more holistic, requiring consideration of diverse elements.
- Context is critical for technology performance: appropriate implementation is important. Rainwater harvesting works very well in this project, but greywater was not appropriate.
- Good water quality for rainwater systems can be achieved with simple means. This system uses only simple filters and UV disinfection.

#### **Case Study 2: Wadi Hanifah**

*Project Description:* The Wadi Hanifah is a seasonal watercourse (wadi) which runs through the centre of Riyadh. Historically it acted as an oasis, with shallow groundwater resources, and as a natural drainage system for seasonal flood water. It supported the early development of Riyadh, with the human and environmental demands for water balanced by this local supply. Following the exponential increase in population from the 1960s, the Wadi has been under increasing stress. Prior to this project, it was being used as a convenient place to dump municipal waste and polluted groundwater drained and was pumped into it. It acted as a utility corridor and transport route with roads built within it. The Wadi was also used as a source of aggregates for construction projects. The brief set in 2001 by the Saudi Government was in three stages: to carry out a review of previous studies and investigations into Wadi Hanifah; to develop a masterplan for the restoration of the Wadi; and to carry out detailed design of priority projects, focussed on water quality and flood performance improvements. This work was carried out by UK based Buro Happold Consulting Engineers, alongside Canadian landscape architects Moriyama & Teshima. The project scope was expanded throughout the project as the value and importance of the work was better understood, and the programme was extended. The restored Wadi is now a very popular recreational public space, and has won several awards, including the internationally acclaimed Aga Khan Award for Architecture in 2010.

*Sustainability drivers:* The initial brief was centred on delivering improved water quality and restoring of the Wadi to a clean, safe, rehabilitated habitat. Delivering a public space and capturing the emergent social value of any recreational space was not a major part of the initial brief. There has been some tension matching build quality to design quality, as some contractors pursued profit margins at the expense of build quality, potentially jeopardising the long term sustainability of the finished project.

*Approaches:* There were some differences between the approach typically used by the design team and the client's expectations. Public consultation, particularly for projects in the public realm, is essential for UK projects, but is not common practice in Saudi. The client was knowledgeable about sustainability and environmental issues, but had not anticipated the significant public interest in the restored site, and the appetite for public park space. The design team was more familiar with the potential for water bodies as recreational places and included several key park 'nodes' along the Wadi masterplan.

Water in Riyadh is sourced either from deep groundwater (a fossil source of water) or desalinated water from the coast 350km away. The design team would favour the use of treated sewage effluent (TSE), for non-potable uses such as irrigation, but this is culturally problematic in Saudi Arabia when used for crops for human consumption, and faces limited acceptance. The boundaries of this are beginning to change through necessity, as non-renewable groundwater reserves are depleted and energy and environmental implications of desalination become greater. TSE is being used for irrigation of landscape planting in the Wadi.

The landscape architect initially advocated the use of non-irrigated, drought tolerant planting in the Wadi, whereas when the client saw the value and popularity of the recreational space, there was a desire for more intensive green planting with immediate impact. This is attractive, but there are now some issues with salination in certain irrigated areas, and the approach to irrigation needs further consideration.

*Knowledge Transfer:* The demand for outdoor public recreational space is now clear, and other tributary wadis are being developed in a similar way by local designers. Skills and knowledge from the Wadi Hanifah design team is being shared formally through design reviews of these similar projects, and informally by example. In addition, the maintenance of the Wadi is being carried out by local people (the technologies in place are not significantly more complex than other systems already managed and developed by indigenous expertise) with some ongoing support from Buro Happold. This builds local capacity and allows for continuous learning by both groups.

Detailed study of the water balance of the city was carried out as part of the project, and subsequently developed, and is now informing future water policy in the area. Discussions with the water and agriculture ministries and with water companies at the start of the project (2001-02), and four years later (2006-07), showed a change in attitude to water efficiency, which may have been influenced by the Wadi Hanifah project. There is now an increased awareness of the need for water efficiency, and new developments must install dual plumbing systems to allow for future dual supply systems (potable and non-potable supplies). There has also been a recent Royal Decree allowing the use of TSE of appropriate quality to irrigate crops for human consumption.

#### *Lessons Learnt:*

- Attractive public space is a critical part of liveable cities. There was significant demand for public recreational space, as Riyadh is a dense city with little public amenity area. The Wadi Hanifah parks are now very popular at weekends, triggering further demand for similar public spaces. Social sustainability in this context is about creating lively communities who have space to interact with each other. Providing a place where social cohesion can happen is a key characteristic of sustainable cities.
- Unlocking one problem, can lead to many emergent benefits. Previously, watercourses or waterbodies were avoided due to a fear of waterborne diseases such as dengue fever. Restoring the Wadi and improving the water quality not only made it an attractive place to visit, but it increased the land values alongside the Wadi by a factor of ten, making the area more favourable economically.
- Balancing competing demands can be difficult. This was highlighted by the differences of opinion over a naturalised (non-irrigated) and irrigated landscape. The irrigated landscape was seen to be more attractive and provide a 'better' environment for the public, but it comes at the cost of increased water consumption.
- Trust is a vital component of successful projects. There was significant scepticism about the technical feasibility of the project which was only overcome after successful completion and sanctioning by public figures.
- Projects' close-out phase should include consideration of long term impacts and opportunities. Long term, ongoing involvement from design teams support local professionals and maintenance workers, allowing them to deliver similar projects in the future. Following-up projects and establishing a long term vision is usually advocated as an integral part of projects in the Global South, particularly development projects which involve implementing new technologies. However this concept is not widespread in the Global North, and approaches such as post occupancy evaluation is only just beginning to become a standard service.
- Political context needs to be understood fully. For example it was found that political factors regarding land ownership impacted the use and delivery of TSE.
- There is a difference between value and cost. Water is a precious resource in arid environments, and is intrinsically valued for the services it facilitates (personal hygiene, clean clothes, hydration for humans and animals, food and agriculture) and yet when it is given a low economic cost, the implication is that is of low value and is a disposable commodity – resulting in high consumption.

#### **Case Study 3: Dar es Salaam Masterplan**

*Project description:* Buro Happold is part of a consortium which has been commissioned by the Ministry of Lands, Housing and Human Settlements Development in Tanzania to deliver a new masterplan for Dar es Salaam. The consortium includes organisations from Europe and Tanzania. The project started in early 2011 and is ongoing, this needs to be kept in mind while analysing the approaches and lessons learnt, as the approach will continue to evolve over the course of the project and further lessons will be learnt going forward.

*Sustainability drivers:* The last masterplan for Dar es Salaam was issued in 1979 and the new masterplan is designed for Dar es Salaam over the next 20 years, in which time it is anticipated that the population of the city will double from 4 to 8 million people. Population growth is one of the main drivers of change that forms the basis of the masterplan. The second driver is economic growth. This must be fostered, and designed for, in the masterplan to support the growing population and improve the quality of life for residents. At the same time the Tanzanian government aspires to create a sustainable city, one which is resilient to the increasing pressures of climate change and plays its role in climate change mitigation. Climate change is the third driver of change which underpins the masterplan.

*Approaches:* With the global attention on “green cities”, carbon footprinting and the frequent intermixing of the terms “green” and “sustainable”, there was initially a feeling that the approach being taken was more pragmatic than sustainable. However it was recognised that the social and economic factors are intrinsic to the sustainability of the project and that the issues around cost and social acceptance are part of the sustainability equation and not external to it. It was also an important reminder that the definition of sustainability needs to be examined on a context specific basis – for instance with only 50% of the population currently having access to mains supply water, sustainability in the case of the water supply for Dar es Salaam is very much about securing a reliable supply for the population, and enabling resource consumption.

In the Global North Buro Happold often uses the “Lean, Mean, Green” approach to reduce resource consumption; starting with reducing demand, then improving the efficiency of distribution and lastly seeking alternative or renewable sources of the resource (rainwater harvesting, grey-water etc.). For this project, the framework is not applicable since resource consumption is already low (currently 60-140 litres of water per person per day in Dar es Salaam), and demand reduction is not desirable as it would compromise achievement and maintenance of an adequate living standard. The “Green” label usually denotes seeking alternative sources, and therefore requires expensive options such as grey and blackwater treatment, and to a lesser extent rain water harvesting, which are mostly not appropriate to this context. The efficiency of supply therefore becomes a critical factor, and the term ‘eco-efficiency’ has become synonymous with sustainability in this project.

For this project, the sustainability issues tended to be more local than global, more about local resource use and how to use these in a sustainable manner than the more classic metrics of CO<sub>2</sub> and energy consumption.

*Knowledge transfer:* The consortium structure with both local partners and partners from the Global North ensures a continual knowledge transfer in both directions. At the same time the project is raising awareness locally, within the local government and without, and it is hoped that Dar es Salaam will become an exemplar city for other cities seeking to develop sustainable ways of planning their future growth. The masterplan also has World Bank funding for some schemes that will then act as demonstration projects and so further disseminate knowledge and best practice.

#### *Lessons learnt:*

- Preconceptions around sustainability restrict thinking. The priorities for this project differ from priorities in Buro Happold work in the Global North, with more emphasis on the social and economic aspects of sustainability. Design teams and clients often don’t see these elements as ‘sustainability’, and are more used to ‘green cities’ and tackling environmental issues, and so the importance of economic and social sustainability can be seen as detracting from, or acting as barriers to, the ‘eco’-sustainability of the project. Encompassing these elements requires a broader understanding of sustainability, moving beyond ‘buzzwords’ such as ‘carbon neutral’ or ‘eco’.
- The ‘social, economic, environment’ triad was found to work well in allowing the design team to propose solutions, take into account costs and practicalities, without feeling they are moving away from sustainability.
- Familiar models may need to be reconsidered or reconfigured. ‘Lean Mean Green’ is very popular in the Global North, but falls down very quickly in the Global South, as the ‘lean’ is already happening through necessity, and indeed consumption of resources may need to be increased to improve quality of life.
- There is likely to be a need for *transitional* sustainability before *long term* sustainability. There is a contrast between the optimum solution (100% mains water access) and the transitional/interim infrastructure which is required, as the end goal cannot be achieved immediately and will require significant investment over time.

#### **Case study 4: Kibera Public Space Project**

*Project description:* The New York office of Buro Happold provided engineering expertise to a USA registered NGO of urban designers, architects, landscape architects and engineers initially from the Harvard University’s Graduate School of Design in 2006. The NGO (Kounkuey Design Initiative) aims to, and is currently developing, productive public space in Kibera, the largest informal settlement in Nairobi. This is a grassroots approach, with the community involved in defining, designing and building the projects, and income generation for long term management of the projects included in the project selection process. Kibera is very densely populated and built up, with the only areas available for public space development along the watercourses. These are very polluted, and used for solid waste and sewage dumping, as there are limited alternatives. The three completed projects in Kibera each have multiple uses, including a multi-purpose hall, a public sanitation block, an urban farm, school, kiosks for selling products, poultry farm, health clinics, and much more. The sites are owned by the community, and income from the businesses pays for long term maintenance. Cleaning of the watercourse and consideration of solid waste and wastewater management are a key part of the development of these sites.

*Sustainability drivers:* The Kounkuey Design Initiative (KDI) was initiated by design graduates from the USA. The dialogue and narrative around sustainability taking place in design schools in the USA, including the 'triple bottom line' and 'five capitals' frameworks were part of the theoretical approach. In practice, the sustainable features of the project were essential to its function. The economic and social aspects of the 'triple bottom line' were of great importance in Kibera.

*Approaches:* The formal or academic language of sustainability was not useful for communication with residents of Kibera, although many of their practices were inherently sustainable. The projects were community-led, with a request for proposals sent out, and community groups making the case for their project to be selected. The project had to demonstrate a need, and to demonstrate how income would be generated to pay for maintenance of the scheme.

*Knowledge transfer:* The community was involved throughout the project, and learnt about areas such as formal working structures, IT and construction techniques. For example, professional engineers advised on the potential impact of gabions strengthening one bank of the watercourse on the erosion of the other bank of the watercourse. In return, US employees and interns have learned about applying appropriate construction techniques and the implementation of grassroots projects. Specialist training was provided from outside Kibera where needed, for example the use of machinery for making compressed earth blocks. The brick compressor was imported from outside the community, but can be mended using skills of welders and metal workers within Kibera, and the community have fully learned the skills required for using it to a level where those skills can now be passed on within the community. Low technology solutions and local materials were used throughout, which means that the community is able to maintain, innovate and develop the systems into the future. Many interns from the USA and from Kenya spend time working on the project each year, and are paired with KDI employees from Kibera. There are significant learning opportunities for everyone involved.

#### *Lessons Learned:*

- Political influences can be significant. In this project, land tenure issues are critical – there are land ownership tensions, and many landlords who make money out of the area are resistant to change.
- The density of existing development can be a significant issue. In Kibera, the very high density is a massive constraint on development of public space and infrastructure. For example installing sewerage would require many peoples' homes to be removed. Where the public rights of way are wider, for example in many slums in South America, these sorts of interventions are easier to install.
- Play and socialisation are fundamental to human wellbeing. Multi-use spaces, public space, and children's playgrounds have been incredibly popular in Kibera, where no such facilities exist.
- Different elements of sustainability have different significance in different contexts. Social and economic issues were more important than environmental issues in driving the project in this context.
- The role of an engineering consultant can be broad. In a Global North context, an engineering consultancy tends to focus on the environmental and technical implications of a project, rather than its social or economic impacts. Those issues are still important, but they are not within the core expertise of engineers. Their role is more about advocacy for these holistic approaches. In projects in the Global South, they need a much greater working understanding of the issues, and this adds nuance to the role of an engineer working internationally.
- Phased approaches to a goal can be useful. There is a strong drive towards decentralisation in the Global North, but in the context of urban slums it could be less appropriate, as there is a lack of capacity to manage the systems, which can be dangerous when dealing with sewage. However, centralised infrastructure will take some time to be developed, and so there is a need for transitional intermediate infrastructure.
- Technical problems can be very similar across the world. Although slums in different parts of the world are in many ways incomparable, due to different cultural and social issues, the technical and physical problems of solid waste and sewage disposal in watercourses are very similar around the world.
- There is no 'silver bullet' that will solve problems in one hit. Genuine solutions are interdependent and interrelated. There are a large number of NGOs working in Kibera, who have been very successful in handwashing and hygiene education programmes, leading to high levels of awareness of the problems, but sewage disposal options are still extremely limited. However, neither the technical solutions or knowledge development would work in isolation.

## 5. CONCLUSIONS

Four key themes emerged from the assessment of the case studies, indicating common areas of learning for both Global North and Global South:

#### **Relationships, roles and effective knowledge sharing**

- The involvement of senior management with a drive to achieve a sustainable outcome is a key success factor for projects.
- Developing good relationships between client and project teams can lead to mutually beneficial outcomes over the long term.
- Thorough handover and staff induction processes are likely to lead to effective building/ project management.
- Long term involvement and support from technical expertise is needed for effective knowledge transfer.
- Different ideas around sustainability should be shared and explored as they can lead to identification of novel opportunities for innovative development.
- Trust and accountability are vital components of successful projects.

- The political context needs to be understood fully as political influences can be significant.
- The role of an international engineering consultant is broad, and extends beyond provision of traditional technical expertise.
- Taking a collaborative approach to projects is a viable knowledge transfer mechanism and could be further exploited.
- Community based projects in the Global North could learn from similar community project experiences in the Global South.

#### **Framing sustainability**

- The focus of attention (in terms of sustainability) is in constant flux, and is very context dependant. Balancing competing demands can be challenging.
- Preconceptions around sustainability can restrict thinking in new contexts, and familiar models may need to be reconsidered or reconfigured.
- There is likely to be a need for *transitional* sustainability before *long term* sustainability can be achieved.
- Projects' close-out phase should include consideration of their long term impacts and opportunities.
- It is important to value all three of the 'pillars' of sustainability – the social, environmental and economic while remembering that there is a difference between value and cost.

#### **Emergent or Unexpected benefits**

- Unlocking one problem, can lead to many emergent benefits.
- There can be unintended positive outcomes of projects, and it is important to identify and take these opportunities when they present themselves.
- Attractive public space is a critical part of liveable cities and providing a place where social cohesion can happen is a key characteristic of sustainable cities. Play and socialisation are fundamental to human wellbeing.

#### **Application of Technology**

- Good design has longevity.
- Technical problems can be very similar across the world, but context is critical for technology performance: appropriate implementation is vital. Solutions which are popular in one part of the world are unlikely to be appropriate globally.
- The density of existing development can be a significant issue.
- There is no 'silver bullet' that will solve problems in one hit.

## **6. FURTHER WORK**

Community management of systems: The ramifications of decentralising utilities, such as water, in terms of management capacity is yet to be fully understood. The decentralised approach is gaining popularity in the Global North, and is the norm in some areas. The Global South is largely decentralised by necessity and in the urban context is seeking a centralised solution. There is much more work to be done in understanding these two trajectories and developing a reasoned idea of what constitutes an appropriate scale for different infrastructure interventions globally.

Urban/ Rural implications: All of our case studies are in very urban contexts. It is interesting to reflect on what the differences would be, and what lessons could be learnt if rural contexts were considered.

*The views expressed in this paper are those of the authors, not of Buro Happold. However the support from Buro Happold in developing these ideas has been invaluable, and the authors would like to thank all the project teams we spoke with.*

## **REFERENCES**

*Aga Khan Award for Architecture* (2010). Retrieved from <http://www.akdn.org/architecture/project.asp?id=2258>

*BREEAM: the Environmental Assessment Method for Buildings Around The World* (2009). Retrieved from [www.breeam.org](http://www.breeam.org)

Byrne, R. and Day, J. (2011) Energy Pathways in Low-Carbon Development. *STEPS Briefing*, No.(46).

*Forum for the Future: The Five Capitals Model* (2007). Retrieved 10/11/10 from <http://www.forumforthefuture.org/projects/the-five-capitals>

Mulligan J., Tuzzolo G., Stigge B. and Guthrie P. (2011) Tailored sustainability assessment for urban master planning. *Proceedings of the Institution of Civil Engineers, Urban Design and Planning*, Vol.(164), Pages 61-73.

Pope J., Annandale D. and Morrison-Saunders A. (2004) Conceptualising sustainability assessment. *Environmental Impact Assessment Review*, Vol.(24), Issue 6, Pages 595-616.

Schmidheiny, S. (1992) *Changing Course: A Global Business Perspective on Development and the Environment*. The MIT Press: United States of America



*United Nations General Assembly, 60/1. 2005 World Summit Outcome* (2005). Retrieved from [http://data.unaids.org/Topics/UniversalAccess/worldsummitoutcome\\_resolution\\_24oct2005\\_en.pdf](http://data.unaids.org/Topics/UniversalAccess/worldsummitoutcome_resolution_24oct2005_en.pdf)

United Nations (2011) *Are we building competitive and liveable cities? Guidelines for developing eco-efficient and socially inclusive infrastructure*. United Nations Publication & Clung Wicha Press Co., Ltd.: Thailand

World Commission on Environment and Development. (1987) *Our Common Future ('The Brundtland Report')*. Oxford University Press: Oxford, UK