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State of Environment Rapid Assessment (SoERA): Development of a Tool for Framing and Managing Urban Environmental and Social Challenges

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Abstract

This paper sets out a cost-effective solution to one of the key challenges facing developing urban centres around the world, namely how to manage a seemingly vast array of environmental and associated social issues in an integrated, technically valid and economical way. We describe an approach which was developed and applied in a study of a rapidly expanding city in the Middle East between July 2012 and January 2014: in this case, significant investments of time and effort had already been made in data collection, but had failed to bring benefits in terms of coherent assessment, planning and management of urban development. To remedy this, a 'State of the Environment Rapid Assessment (SoERA)' approach was used to gather, collate, and report relevant baseline information on not only the status and trends but also the dynamics of the human and natural environment in a city of over 5 million people within a period of 18 months. The comprehensive overview gained of the environmental and social conditions and their dynamic interactions provided a clear basis for management planning. The 'State of the Environment Rapid Assessment (SoERA)' approach is presented and reviewed in this paper.

We describe and critically examine the 5 step SoERA process which takes an existing framework – State of the Environment Reporting – and adapts it into an integrated rapid assessment and communication tool which can be undertaken within 12-24 months and thus sits comfortably within a political cycle of many administrations. Used judiciously, SoERA has the potential to transform uncoordinated sectoral data collection into a coherent and meaningful picture of status and trends, providing a robust and auditable platform for future policy development and decision-making, and for effective management of environmental and related social issues on a local or regional scale. In light of the lessons learned during this study, we propose that this approach is appropriate for use in any local and national economic, political, social and environmental conditions. Most importantly, SoERA is effective even in the absence of a robust set of environmental and social baseline data. This is particularly applicable in the context of urban development policy, planning and management in developing countries.

1. Introduction

More than a quarter of the 100 fastest-growing cities in the world are in Africa. By 2050, Africa's urban population is projected to have increased from 400 million to 1.2 billion[1]. This creates challenges not only in terms of the population size but also in understanding how to build climate change resilience. Existing initiatives such as the ICLEI toolkit[2] are being developed to address the latter, but these rely on there being readily available and robust baseline information on the environmental and social status quo and trends in their urban setting. This is often not the case, and one of the key challenges therefore facing these and other developing cities around the world is how to obtain relevant data and use it to address the seemingly vast array of associated environmental and social issues in an integrated, technically valid and cost-effective way.

This paper sets out a cost-effective solution to this challenge which can be adapted to the characteristics of local and national economics, politics and socio-environmental conditions. We describe and critically examine the process by which we have adapted and applied an established approach - State of the Environment reporting - into an integrated rapid assessment and communication tool which we found to be effective in practice even in the absence of a robust set of baseline data. This is particularly applicable in the context of urban development policy, planning and management in developing countries.

The approach is sensitive to a country's own development trajectory and avoids the assumption that cities should all be progressing towards the example set by the predominant northern paradigm. In particular, solutions developed in the context of abundant and accessible energy supplies often fail to translate to the developing country context and fail to deliver societal benefits or to improve urban sustainability. The SoERA can be used to support local and national policy and strategic directions that incorporate long-term sustainability for social, environmental and economic development and that have the potential to deliver better outcomes than the imported urban models have done so far.

SoERA should in our view have as its central objective to inform and then monitor management and planning decisions and actions.

The outcome of the Rapid Assessment resembles the established State of Environment (SoE) reporting framework to the extent that the latter is a widely recognised approach to preparing environmental assessments and informing policies for large areas (often states, counties and municipalities[3]). However, unlike the Rapid Assessment proposed here, the production of a full State of Environment Report is time-consuming and administration-heavy, and traditionally involves 9 steps (implemented to a greater or lesser extent in practice):

1. Identifying the issues

2. Relevant and ongoing data gathering

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1. State of African Cities Report, 2014. Reimagining Sustainable Urban Transitions. ICLEI-UN Habitat-UCLG Africa.
2. ICLEI toolkit, 2015. http://www.acclimatise.uk.com/login/uploaded/resources/ICLEI_ACCCRN_Workbook_WORKBOOK.pdf accessed 11/02/2015.
3 see for examples: http://data.london.gov.uk/documents/SOE-2011-report.pdf; http://www.eea.europa.eu/soer-structure-overview; http://www.cec.org/soe; http://www.grida.no/soe/americas/index.htm; http://www.environment.gov.au/soe/2011/report/index.html; http://www.unep.org/pdf/DPRK_SOE_Report.pdf;http://www.nema-ug.org/reports/national_state_report_2010.pdf;http://www.eeaa.gov.eg/english/reports/SoE2010En/EgyptStateofEnvironmentReport2009.pdf.

3. Data collation and management

4. Identifying and selecting meaningful indicators

5. Monitoring by government (local, regional, national depending on scale of the report)

6. Monitoring by the public

7. Interpreting and presenting indicator data

8. Integrating the SoE Report with local plans and development programmes

9. Regular, periodic State of the Environment reporting at local, regional and national levels.

The global impetus for SoE reporting increased after the adoption of Agenda 21 at the Conference on Environment and Development in Rio in 1992. Chapter 40 of Agenda 21 specifically calls for improved environmental information for decision making. This established the critical link between environmental information management and good decision making for sustainable development. During subsequent years the OECD - along with other organisations (e.g. Eurostat 1999, OECD 2003, and ECE 2007) - developed a 'PSR model' linking explicitly known or suspected Pressures with environmental States and possible Responses (the link with social issues is only now beginning to be made). This approach has been adopted, with some variations and continued refinements, by regional, national and state reporting authorities worldwide.

However, in some countries SoE reporting, particularly at the national and regional levels, is a still evolving field and in general is not yet prevalent in the Middle East and Africa (notable exceptions being Jordan and Egypt, Morocco, South Africa, Ghana and Uganda). We suspect that this is because the development of SoE Reports can place high demands on the administrative and organizational capacities of local authorities. As a result, despite its 20 year history, SoE reporting is not as geographically widespread as one might expect, and wide access to effective, relevant and understandable environmental information remains to be universally achieved. We suspect that the reasons for this are twofold:

(i) the perceived lack of baseline environmental and social data, and

(ii) weak institutional and administrative capacity: for example where cross-sectoral communication in areas such as land use planning, water supply, transport or infrastructure services is limited and collaboration often non-existent. This hinders any attempt to gain a coherent and viable picture of the status and trends of environmental and social conditions.

The SoERA approach, then, is an attempt to address this challenge while recognising that environmental and social issues are complex and that their dependencies are often poorly understood. While being a more manageable process, the emphasis remains on the need to understand causalities of the identified environmental and social issues before we can devise effective policies to manage them.

2. SoERA Approach

The SoERA uses a 5-step approach to combine existing data, gap analysis and targeted baseline studies with expert and stakeholder knowledge, causal pathways and scorecard reporting. Set out below, and informed by implementation in practice, this provides a robust and auditable platform

for future decision making and effective management of environmental and related social issues on a local or regional scale. Our study produced a SoERA Report that: (i) synthesised known existing information; (ii) collated and analysed new field survey data, gathered between October 2012 and November 2013, and (iii) coordinated expert technical judgments provided by over 30 professionals engaged in the project. The knowledge captured in the SoERA Report therefore had direct relevance at both the strategic and the project levels, for infrastructure planning and the wider aspects of decision-making for sustainable management of the human and natural environment.

Cumulative Steps in the SoERA

SoERA comprises 5 successive steps (Figure 1), each step enhancing the body of baseline information and improving understanding of the human and natural urban environment:

Step 1: Sectoral and discipline baseline assessment

Step 2: Conceptual modelling based on the DPSIR framework

Step 3: Expert and stakeholder consultation to identify key issues and indicators

Step 4: Identification of causal pathways and visualization as event trees

Step 5: Summative environmental and social baseline scorecards

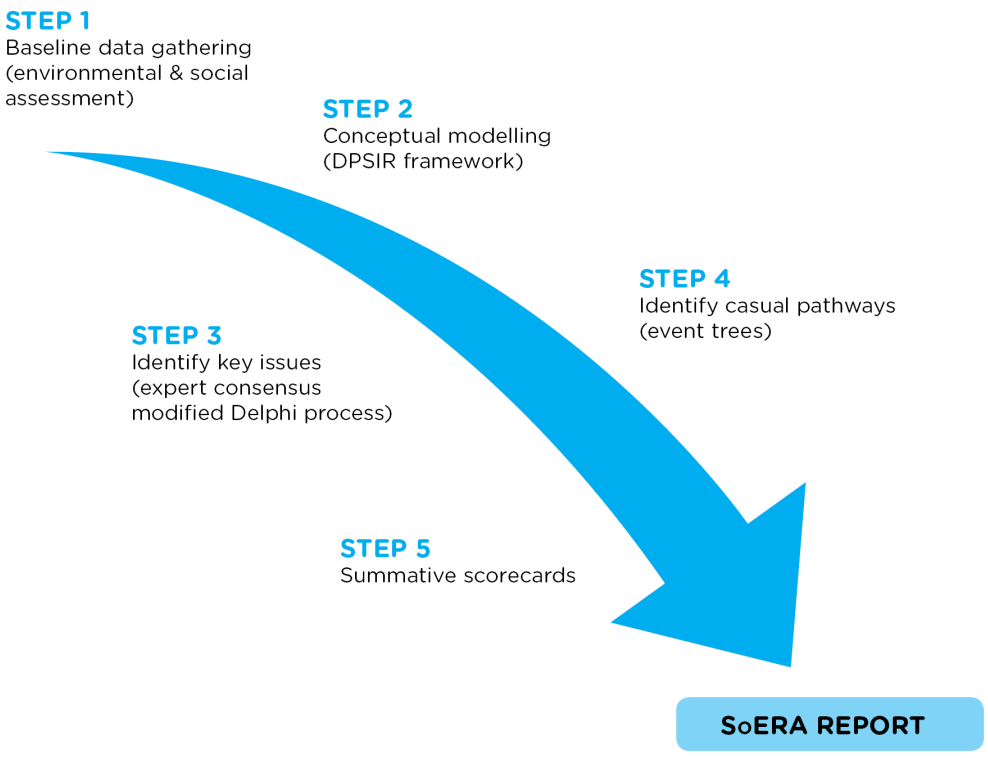

Figure 1: The SoERA Report is a culmination of multiple knowledge enhancement activities

Step 1: Sectoral and discipline baseline assessment

Standard environmental and social impact assessment methodology is used to establish what is known, what is not known, and what needs to be known. This first, enabling, step includes gap analysis and detailed sourcing of existing datasets - often produced in an *ad hoc* and uncoordinated

manner during municipal development programmes and projects and held (somewhere) by the relevant administrative authorities or by the academic or technical institutions involved in their production.

The urban environment is framed by a number of 'sectors' to capture the status and trends in environmental and social conditions. The choice should be derived from an initial scoping exercise and tailored to the local conditions and administration. In our study, these were: Air Quality, Archaeology and Cultural Heritage, Energy and Climate Change, Groundwater, Marine and Coastal Ecology, Natural Hazards, Noise, Public Health, Settlement and Land Use, Socioeconomics, Solid Waste, Surface Water, Terrestrial Ecology, Traffic and Transportation, and Wastewater. A team of 15 sectoral experts with experience and environmental and social expertise relevant to the study area, led the sectoral baseline assessments, supported by data collection teams and facilitators and in collaboration with a range of local partners and stakeholders.

Step 1 results in a baseline data report for each of the 15 sectors presenting status and trends in environmental and social conditions, together with an assessment of the importance of the key findings and their implications for urban development.

Knowledge gaps

As part of the assessments, topic experts are asked to provide information on key knowledge gaps. In our study, some of these knowledge gaps made their way into the headline messages of all the detailed baseline data reports. We found that the quality of the information reviewed was variable in nature and extent for the different technical areas. Sources for some topics covered the whole of the region not just the urban zones, so specific information was occasionally very limited. Where there were significant gaps, this was acknowledged, then further researched and benchmarked against case studies and international experiences and best practice. This knowledge was carried forwards into the Delphi consultation of step 3 (below), and the remaining uncertainty captured in the confidence levels assigned to the scorecard criteria during step 5.

Step 2: DPSIR Conceptual modelling

Once the scope and detail of the baseline assessments is agreed, each expert team develops a conceptual model for their discipline using the accepted Driver-Pressure-State-Impact-Response (or 'DPSIR') framework (figure 2) (Stanners *et al.* 2007). This technique also has a 20-year pedigree and is the most comprehensive framework available for evaluating environmental and social impacts. Each conceptual model outlines the current state of the main components of each system under study in the discipline, and identified clear causal pathways between components including the main pressures. By taking all the conceptual models together, a coherent conceptual understanding of the entire urban system is developed and key pressures and impacts can be highlighted.

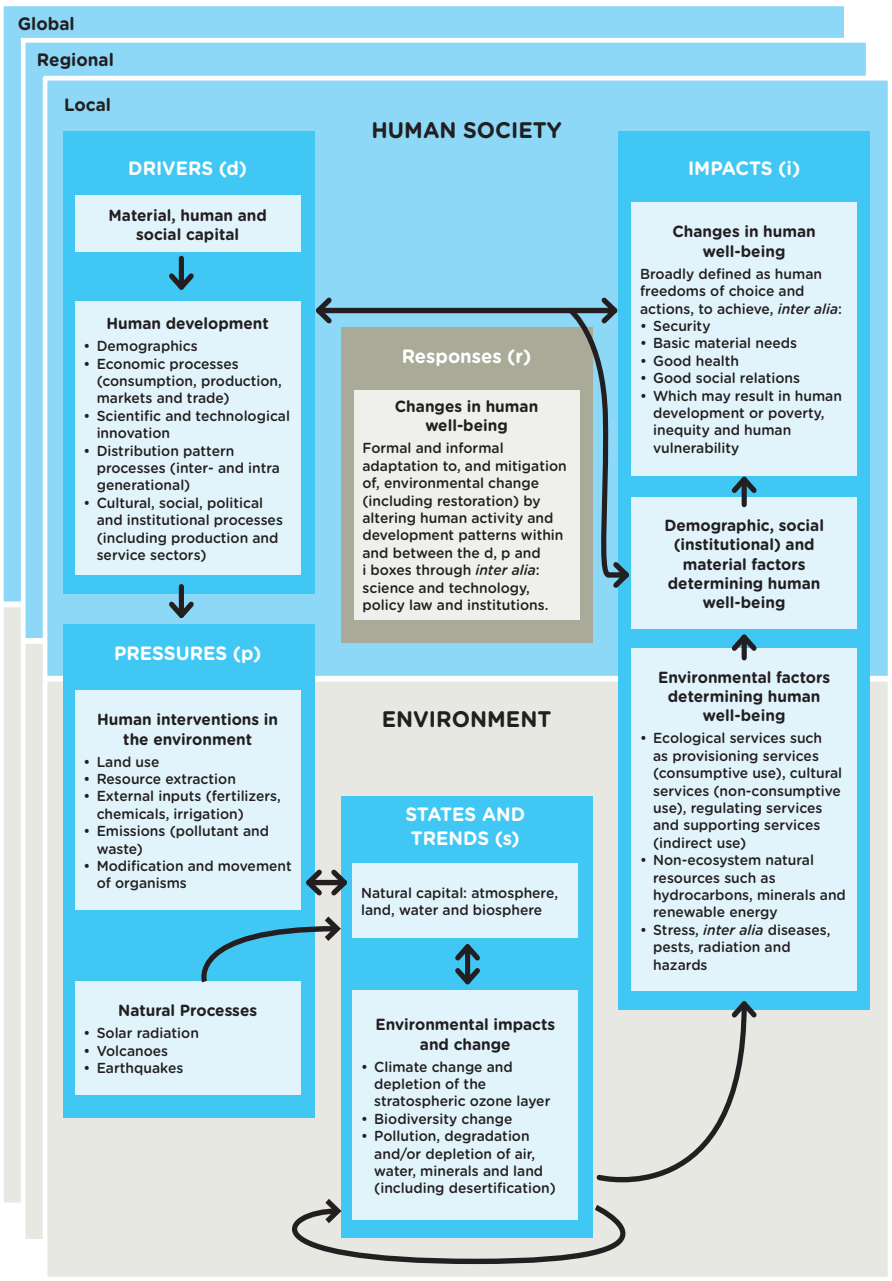

Figure 2: DPSIR framework of the UNEP Global Environmental Assessment (2012)[4]

For this step to be effective across the full spectrum of topics it is essential that:

a) The DPSIR framework must be applied consistently by all experts and across all environmental topics, and

b) All significant interactions and causal pathways, both within and between topics, need to be identified and well understood.

To achieve this, a generic DPSIR framework highlighting all likely interactions should be developed for all topics and communicated to the technical teams through an expert workshop. The experts refine the frameworks during the workshop and adopt these as a blueprint for their subsequent

4 UNEP Global Environmental Outlook GEO-5, 2012.

detailed conceptual modelling and assessment. The workshop design ensures that all experts share comments on all the frameworks: thus all likely inter-topic interactions can be captured. Figure 3 shows an example of the framework for a groundwater topic.

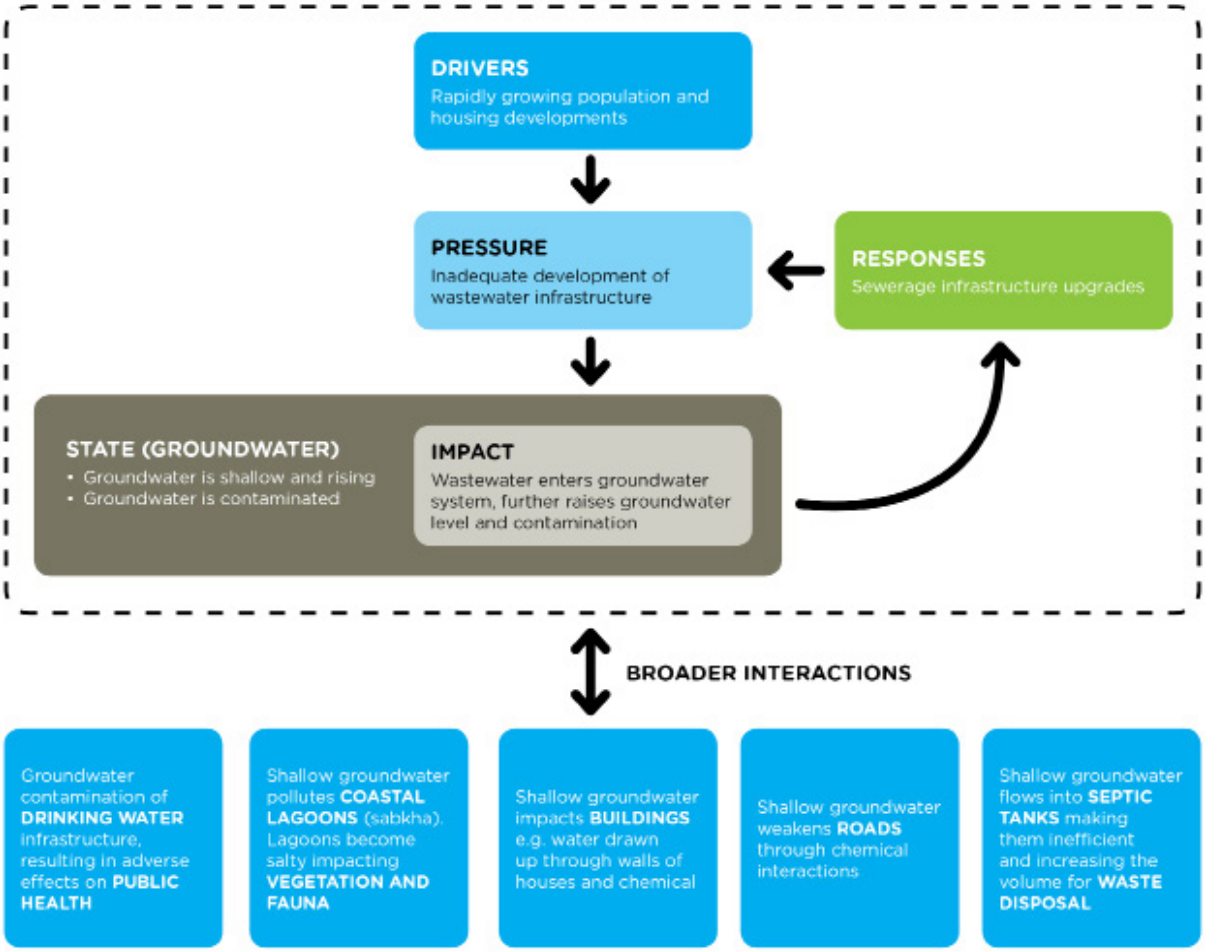

Figure 3: Example DPSIR Framework communicated to expert teams (Groundwater example)

During this process it is important to explain the pathway or chain of events/causality between the pressure and the state (both in the conceptual model and in the baseline data report). In addressing the State, experts try to capture the current condition of all the key elements of the technical area together with trends in condition over time. In our study, in some cases the teams were also able to quantify the Impact that each pressure has on the state, and to indicate its likely duration and reversibility.

The DPSIR conceptual modelling exercise draws on the principles of risk assessment (fate and transport) in order to identify the significant causal pathways. In our study, for example for air quality, this meant consideration of the risks to good quality air, including i) vehicle emissions, ii) industry emissions and iii) dust storms. We found that in most cases, the pressures discussed in the baseline report of step 1 form the majority of the 'risks' to a sustainable urban future. In some instances, there may also be new or emerging risks that are not currently a pressure but are forecast to have an impact in the future (in view of current trends). All this is illustrated by the conceptual model for air quality in Figure 4.

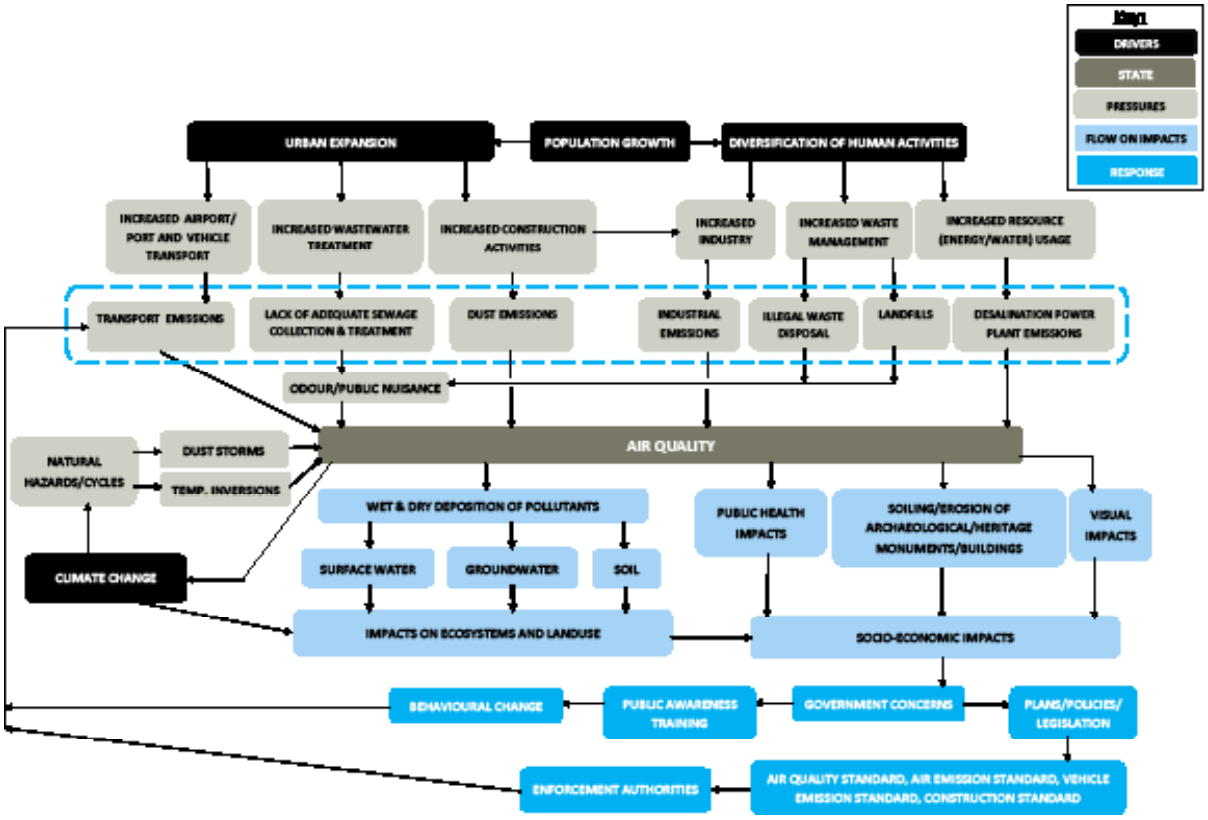

Figure 4: Air Quality DPSIR Conceptual Model

Completion of Steps 1 and 2 yields a comprehensive and structured understanding of the baseline environmental and social conditions and their relationships. However, the information is complex, with common problems and interdependencies not readily visible to the untrained eye. In order to integrate and translate this information into a meaningful tool for decision making it is thus essential to integrate this topical information into a coherent and summative scorecard of key issues or indicators and to develop an integrated cause-effect framework. Scorecards provide focus areas for the policy makers with indicators becoming a key tool for tracking environmental benefits of various policy interventions. The approach is discussed in Steps 3 and 4 below.

Step 3 Expert Consultation to identify key issues and indicators

We used an extended expert Delphi-style consultation process to derive a framework for the development of key indicators for the human and natural environment in the study area. The indicators (initially framed as key issues to be represented) were sourced initially from the baseline assessment and conceptual modelling.

"Delphi may be characterised as a method for structuring a group communication process so that the process is effective in allowing a group of individuals, as a whole, to deal with a complex problem"[5]. When applied to the panel of experts and based on the conceptual understanding gained from Step 2, this step is one of the most important as it facilitates knowledge sharing at all levels including local stakeholders by encouraging flexible engagement. However it is important to be aware that a robust knowledge base and approach is critical so that the output is reliable and credible.

5 Linstone and Turoff, 1975.

This method serves the dual purpose of soliciting further considered opinion from a group of experts and facilitating ranking of their combined views.

The process traditionally begins with an open-ended questionnaire to solicit specific information about the technical area/s. In our case we collated the data in the baseline reports to derive a preliminary list of potential indicators. This became the survey instrument for the first round.

Round 1: The listing is presented in a questionnaire list for the experts to review. The experts must then:

i) Establish preliminary priorities by ranking their 'top 30' issues, and

ii) supply comments if necessary to justify or explain their ranking position.

The questionnaire responses are collated and areas of agreement and disagreement between the experts identified. The list of issues is then narrowed down to the most important ones in accordance with the ranked lists of all experts combined (Table 2).

Round 2: The questionnaires are returned to the experts, with the listing of issues this time in rank order according to the outcome of round 1. This is presented together with a summary of the rationale applied. The anonymised comments are made available to all.

The experts are then asked to select and rank their final maximum 'top 20' issues. Experts remaining outside the consensus must specify their reasons.and all are at liberty to adjust their preferences if they so wish. The initial and final rankings in our study are shown for illustrative purposes in Table 1 below.

Table 1: Results of the Delphi-style consultation: Key issues

Round 1	Round 2	Change
Air pollution	Groundwater pollution	+1
Groundwater pollution / groundwater resource management	Flooding	+2
Freshwater supplies and quality	Infrastructure planning and management	+2
Flooding	Air pollution	-3
Infrastructure planning and management	Freshwater supplies and quality	-2
Land use and settlement planning	*Land use and settlement planning*	0
Sewage and wastewater management	Marine pollution	+1
Marine pollution	Road traffic	+1
Road traffic	Human health	+1
Human health	Environmental education	+2
Solid waste treatment and disposal	Sewage and wastewater management	-4
Population / environmental education / energy (equal rank)	Solid waste treatment and disposal	-1

We found that as the consultation progressed, while the experts continued to discuss the issues, the focus on water, planning, marine issues, traffic issues, health and education remained consistent throughout. Less emphasis was placed on air pollution although this remained linked to traffic and to health issues. One notable 'loss' from the top 20 was 'area of open space' and although it gained several comments the ranking was much lower in the second round. This is an example whereby an issue which many feel should be captured in the urban planning context[6] can be reinstated, provided that this is done in a transparent and accountable way.

Step 4 Causal (Risk) Pathways

During the development of the DPSIR conceptual models (step 2), all risks are captured as a risk pathway or causal chain of events. For example, the risk that polluted industry emissions might adversely affect air quality in the future through a number of pathways including i) ageing and poorly maintained industrial infrastructure leaving untreated discharges, ii) illegal discharges resulting from inadequate discharge licensing system and regulation, iii) growing populations requiring more industrial facilities resulting in greater net emission volumes.

This system-wide understanding is captured in step 4: to enhance the growing synergies between the bodies of expert team knowledge, a second expert workshop is held to present, collate and consolidate the synthesis and shared understanding of the dynamics of the human and natural environment of the study area. A series of decision- or 'event-trees' is developed using commercially available software[7], based on the frameworks of the 15 conceptual models and modified by consensus during the workshop. These event trees allow key interrelationships to be made visible and hence to be clearly taken into account in both the environmental management planning and review cycle and in wider policy-making. In the example (figure 5) it is clear that increased demand for services caused by population growth has a causal effect on 12 different "states" of environment: some are direct (primary), such as waste production or demand for food, other effects are through associated pressures, i.e. secondary or tertiary. This visualisation then helps the policy-maker to focus interventions at different pressure levels to improve environmental state parameters and associated benefits.

6 See e.g. Mwenda and Gilba, 2012.

7 www.treeplan.com accessed 4th Feb, 2015.

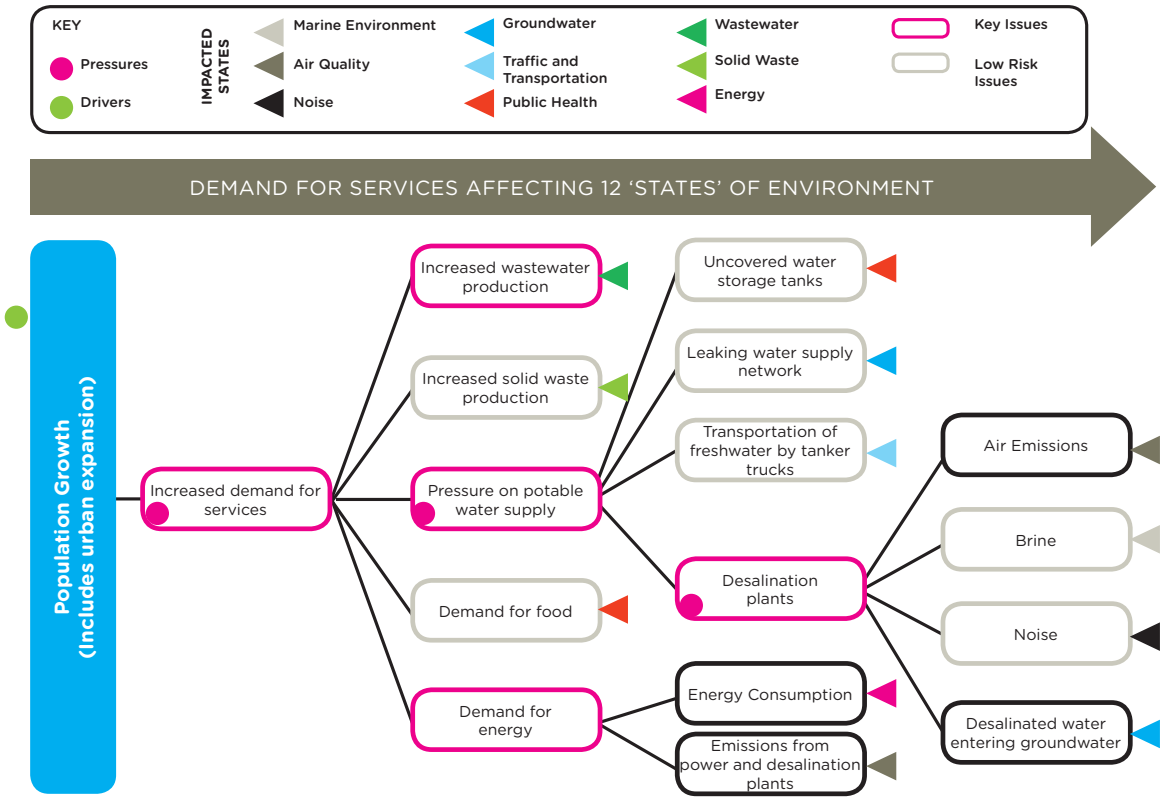

Figure 5: Example branch from Event trees – causality and effect flows

Such event trees are particularly useful for analysing sequential decision-making problems under conditions of uncertainty. The tree can include various controllable alternatives (e.g. decisions to increase or decrease a particular variable, such as number of desalination plants), as well as uncontrollable uncertainties, and can be developed to include sensitivity analysis. However the information still depends on the quality of input data to be effective (and valid).

In our study, four key drivers emerged from this process:

- Population and economic growth
- Institutional and legislative framework
- Climate change
- Education

These drivers are the overarching socioeconomic forces exerting pressures on the state of the environment. This finding concords with the framework of the GEO-5 analysis (UNEP 2012) which identifies two major drivers on the continuum – population and economic development – that influence cross-cutting dynamic patterns and generate complex systemic interactions.

Step 5: Indicative Environmental and Social Baseline Scorecards

The 20 key issues from step 3 are taken forwards into Step 5 to develop a set of preliminary baseline 'scorecards' and associated indicators. The Delphi consultation can be further extended into a third round to arrive at an agreed suite of reliable indicators of the state of the human and natural environment. The decision to take this step hinges on the level of maturity in the urban administration and the decision to undertake this additional step would necessarily take account of local capacities. The alternative is to delay this final iteration until the future implementation of the findings of the SoERA as part of the local urban management process.

In any case, the final step addresses the needs (a) to build stakeholder understanding and engagement and (b) to reinforce the capacity of the authorities to make effective urban management and development decisions. As has been amply shown elsewhere, the likelihood of success in this is enhanced by effective communication of the research findings to the decision-making and broader stakeholder audience (e.g. Allen & Kilvington 2002, Phillipson et al 2012).

Summative 'scorecards' are used to communicate the issues identified through steps 1-4 into a form readily understood by decision makers and the public (Figure 6). These are derived from a combination of (i) the baseline assessment in DPSIR terms and (ii) expert inputs from the modified Delphi process.

State			Trend					Confidence in Data		
			↑ ↓	↑ ↓	↑ ↓		O			
Good	Of Concern	Very Poor	Favourable increase / decrease	Of concern increase / decrease	Unfavourable increase / decrease	Stable - no change		High	Medium	Low

Figure 6: Baseline Scorecard categories

In the simplest case. the reported state of the environmental and social conditions are ascribed a categorical score of 'poor', 'of concern' or 'good' in relation to available benchmarks – e.g. WHO water quality standards[8] - and, in their absence, a measure of 'desirability' of the condition.

The presentation uses colour-coding as a visual communication tool. In our case, in addition to describing the state, it was also possible (data permitting) to describe the trend in some of the conditions. Here a description of the change as 'favourable', 'of concern', or 'unfavourable' was made, together with an indication of the direction of the change on the basis of available past data. In a very few cases it was also possible to ascribe a forecast measure of the change.

In all instances, care must be taken to remain within the bounds of the available knowledge and underlying data acquired during steps 1-4. Where important data is absent, this gap should be recorded as 'unknown' and duly shown in the scorecard. Since the SoERA Report is ideally to become a public document, this provides important impetus to future investment and research in those areas lacking important information.

The level of confidence attributed to the score is also declared, to accommodate the variable quality of the underlying data. This is based on the interaction between on the 'level of agreement/ consensus' between the technical authors and peer reviewers, and the 'amount of evidence

8 http://www.who.int/water_sanitation_health/dwq/guidelines/en/.

available' as referenced in the baseline reports (step 1). Figure 7 shows the matrix used to arrive at the scorecard colour coding.

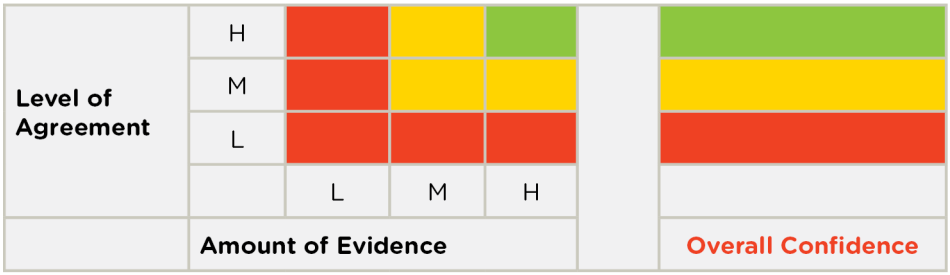

Figure 7: Confidence assessment matrix

Additional explanatory comments can be included in the scorecard. Of course, levels of confidence may go up or down as new data and model outputs become available, or through changes in the understanding of the science, and these should be reflected in subsequent iterations as the scorecards are reviewed, updated and benchmarked on a regular (annual, biennial) basis. They will contribute to the development of a set of key or 'headline' indicators to monitor and report changes in the conditions affecting the urban environment.

Final Report

The final State of Environment Rapid Assessment Report presents a synthesis of: the baseline status and trends, identifies the causal pathways and event trees, key (headline) indicators and summative scorecards. It presents a series of key recommendations for next steps including actions focused on immediate benefits to environmental and social management, as well as more strategic developments in education, capacity building and legislative or administrative change. The format of the Report somewhat depends on the requirement of the beneficiary (e.g. regulatory authority) and key stakeholders. It needs to communicate the outputs from the 5 steps and could be presented in any combination of media (e.g. interactive web format, electronic reports, GIS database, and mobile app) as well as the traditional hard copy report.

In the immediate term, then, the SoERA Report provides:

- the basis for ongoing Environmental and Social Reporting
- the basis and impetus for ongoing monitoring of environmental and social conditions
- a benchmark for investment decisions in monitoring
- the basis for effective environmental and social policy-making.

In the longer term, the SoERA Report will:

- provide the baseline for a quantitative assessment of the economic costs of environmental degradation[9]
- be the benchmark for ongoing environmental and social management planning
- underscore the process of financial investment in improvements in the urban human and natural environment.

9 See e.g. World Bank, 2010.

3. Discussion

The SoERA process can accommodate highly variable quality and quantity of baseline data. This does not mean that the assessment is based on poor quality data – rather, the effect of variable data quality is mitigated by engaging an iterative process of inclusion of qualitative 'expert' opinion informed by the existing information, benchmark global experience and local conditions.

The SoERA provides a system-wide understanding of the urban environment and its interrelationships with the social context. It cuts through sectoral and administrative constraints, identifies key issues and highlights causal relationships. The SoERA report informs future management actions and policy decisions. The SoERA achieves this through eight key attributes (Table 2 below):

Table 2: Key attributes and associated benefits of the SoERA approach

Attributes	**Benefits**
Comprehensive and structured, cuts across sectors and disciplines, benchmarks state and trends against relevant criteria where appropriate	Gives confidence to act Provides basis for economic assessment, e.g. Cost of Environmental Degradation (COED) Provides the basis for effective Environmental and Social Management
Quick (12-18 months) and cost-effective	Readily implementable
Makes use of wide range of data, good and poor quality, but with rigour and transparency	Cost effective, ensures that existing data is not wasted
Examines complex environmental and social causalities and highlights priority issues	Enables cost effective and focused policymaking based on key sectoral and cross-cutting issues
Captures both environmental and social state, trends, future challenges and needs	Enables focused and equitable policymaking
It is a report of the environmental and social issues in non-technical language where possible	Facilitates broad public information and stakeholder discourse. Provides the basis for regular, meaningful and transparent State of the Environment Reporting at local, national and international levels
Uses indicators to outline the state of the human and natural environment	Facilitates development and communication of meaningful environmental and social management plans
Through gap identification and analysis, provides a baseline for ongoing assessment of the status and challenges facing of the regulatory and institutional context	Encourages and facilitates monitoring by government, stakeholders and the public

In some cases, ongoing data collection and monitoring may be recommended in order to reinforce, complement, monitor and fine tune any future management actions.

The SoERA approach therefore reflects the GEO 5 Conclusions[10] on the manageability of seemingly intractable urban management issues:

- need to focus on causes, rather than effects
- the relationship between human well-being and environmental sustainability is synergistic
- indirect interventions can go a long way
- direct interventions can be targeted at many different entry points
- unintended consequences matter
- even intractable drivers can be reframed
- surveillance and monitoring get results.

The SoERA works within the bounds of available data and information. As such, it is technically pragmatic - implementable in the face of variable quantity and quality of baseline data. This variability is mitigated by the iterative and transparent nature of the rapid assessment process. This underlines the SoERA's core utility as a tool for initiating and developing progressive and coherent environmental planning and management systems. The SoERA can be undertaken under widely varying conditions of both baseline data and local administrative capacities.

At the same time, the SoERA approach is valid and robust when viewed from a scientific perspective. During the identification of key indicators in any subsequent iteration, the key issues agreed during the technical expert consultations will be aligned with priority themes identified for the aspirations of a future sustainable city. Clear distinction is then made between indicators of state and those of pressures, drawing the analysis back to the DPSIR framework to inform three questions (Pinter et al. 1999):

- What is happening to the environment and why (Pressure and State)?
- What is the consequence of the changed environment (Impact)?
- If appropriate, what is being done about it and how effective is it (Response)?

To fully reflect the state of the environment in the urban context, this process could engage widely with relevant local expert and non-expert stakeholders in the final Delphi consultation (e.g. Yang 2014). However, the open engagement of local groups in these consultations can be limited by prevailing political, social and demographic conditions. The SoERA approach adapts to allow changes in stakeholder input over time as the process – and the civil society context - matures.

The findings of the SoERA can be fine-tuned through revision and benchmarking of the scorecards, to provide a long-term management planning roadmap for decision makers. The scorecards provide a set of visual tools to understand and communicate the status and trends, to educate communities and to guide management and decision making towards the creation of a sustainable urban future.

10. Fifth Global Environment Outlook GEO5 report. 2012. Chapter 1: State and Trends of the Environment

In the face of pressures for rapid urban development, the mixed-method approach we have used addresses the need for practical guidance to decision-makers to be based on evidence, but often at least cost and in a strictly constrained timeframe. The SoERA combination of indicators with an examination of causalities also begins to address growing critiques of the ways in which indicators have tended to be presented as lists, without taking into account interactions between them (e.g. Wolfslehner and Vacik 2011). Others have taken a similar pragmatic view: Gomez-Navarro (2009) emphasized the need for "new approach to prioritize urban planning projects according to their environmental pressure in an efficient and reliable way", pointing to a combination of three procedures: (i) use of environmental pressure indicators, (ii) use of a network approach to aggregate the indicators and (iii) interpretation of expert information during the decision-making process."

More recently, Turcu (2013) suggests that five complementary methods can be used when selecting indicators, combining at least two methods and using the following:

1. Existing data, selecting indicators based on data convenience or availability;

2. Normative assumptions, basing indicators on (expert's) explicit or implicit assumptions about what people should (or do) value;

3. Public consensus, whereby indicators draw on 'existing lists' reflecting legitimate citizen consensus;

4. Participatory processes, selecting indicators on the basis of ongoing purposive (expert and citizen) participatory exercises; and

5. Empirical evidence, drawing on empirical accounts of people's values and experiences.

We agree with O'Connor (2006) in recognising that "[s]ocial and environmental dimensions of evaluation analysis are always interlinked, because there are always asymmetries of need and of access to environmental benefits (and of exposure to harms or risks) between different classes of stakeholders". In such circumstances, more information by itself does not necessarily equal 'better' and particularly does not lead to better answers to the question of "what should be done?" We propose that the SoERA process – by combining quantitative baseline data, stakeholder and expert opinion, and scorecard assessment, is the foundation for "a deliberative political process [which] is very fundamentally necessary as the process of exploring and building a future together" (O'Connor 2006), whatever the point of departure.

The SoERA Report drives such a deliberative process by stimulating all four necessary changes in urban development planning and implementation of effective environmental management, i.e.:

1. Improved and regular environmental and social reporting

2. More consistent and relevant monitoring of environmental and social conditions

3. Effective environmental and social policy-making and planning

4. Coherent environmental and social management.

Because of its collaborative and integrative approach, the SoERA should also act as a catalyst for more extensive development, as set out in Table 3.

Table 3: SoERA as a catalyst for development

Development domain	**SoERA as a catalyst for change through…**
Education	Improvements to public awareness through dissemination of the information held in the scorecards. Mainstreaming of environmental understanding into public consciousness and institutional action is fundamental for long-term sustainability and prosperity.
Legislative and institutional strengthening	Reinforcement of existing legislations and the capacity to enforce current and proposed procedures and processes, encouraged by engagement with the SoERA process
Capacity building	Technical training specific to institutional roles and responsibilities to support strengthening of the legislative and institutional framework. Mainstreaming of environmental and social understanding into institutional action is reinforced by ongoing environmental and social reporting via the SoERA mechanism.
Integrative land use planning	Full consideration of the environmental and social implications of land use plans and zoning (e.g. infrastructure, housing, industry, energy, urban green space, cultural heritage) via a hierarchy of strategic (policy-programme) and local (project) perspectives.
Systems thinking	Development of locally-appropriate solutions using cross-sectoral and interdisciplinary knowledge and expertise. SoERA consolidates the synthesis and shared understanding of the dynamics of the human and natural environment in any location, revealing key interrelationships to be taken into account in the urban management planning and review cycle. Taken together with effective capacity building this underpins resilient and progressive urban planning and management.

4. Conclusions

There is no shortage of initiatives to support urban development and climate change resilience in developing countries. However, these rely in large part on ready availability of robust baseline information on the environmental and social status and trends. In practice this is often simply not the case, leaving a key challenge facing developing cities around the world, namely how to manage and interpret an uncoordinated array of environmental and social data in an integrated, technically valid and cost-effective way. The SoERA provides an economical and adaptable mechanism to address this challenge.

The SoERA was developed in a practical urban context to be flexible, transferable and adaptable to changes in the technical, economic and political conditions. It establishes the baseline environmental and related social conditions in an urban environment prior to decisions on renewed investment in urban planning. It has the added benefit of supporting and motivating political support, institutional development and capacity building as well as offering the potential to enhance environmental and social awareness and education. Refinements to the data gathering systems should be targeted to inform future iterations as part of the ongoing management and reporting cycle. Together with effective capacity building, this provides the foundations for reliable, efficient and progressive environmental planning and sustainable management of urban systems.

In conclusion, we believe that in the context of rapid urban development in the face of administrative, technical and financial resource scarcity, as in most sub-Saharan and many other developing countries, there is a pressing and overriding need for a tool which effectively, efficiently and engagingly communicates the local environmental, economic and social issues and provides signposts for their improvement. We argue that even in the apparent absence of long-term monitoring data, a SoERA report can and should be compiled. Engaging with the SoERA itself helps establish the relevant competencies and governance framework, and begins the process of focussing efforts, finance and training on key priority areas with minimal investment, low recurrent cost and maximum sustainable development benefit.

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