



**DEVELOPMENT
CORRIDORS
PARTNERSHIP**

IMPACT ASSESSMENT FOR CORRIDORS: FROM INFRASTRUCTURE TO DEVELOPMENT CORRIDORS

Edited by:
Jonathan Hobbs and Diego Juffe Bignoli
2022

The Development Corridors Partnership

The Development Corridors Partnership (DCP) is a research and capacity development initiative. It is a collaboration between institutions from China, Kenya, Tanzania and the UK. The main objective is to deliver effective research and capacity-building to help improve corridor planning and management. It aims to ensure that development corridor decision-making is based on sound scientific evidence and effective use of available planning tools and procedures, to ensure that risks are

avoided and opportunities exploited. The DCP comprises partners from the University of York, the University of Cambridge, London School of Economics, Sokoine University of Agriculture, the University of Nairobi, as well as the UN Environment Programme World Conservation Monitoring Centre (UNEP-WCMC), African Conservation Centre, the World Wide Fund for Nature (WWF), the Chinese Academy of Agricultural Sciences and the Chinese Academy of International Trade and Economic Cooperation (CAITEC).

DCP Partners:



For the purposes of this publication, DCP collaboration was extended to experts representing Netherlands Commission for Environmental Assessment, the Centre for Energy, Petroleum and Mineral Law and Policy at the University of Dundee, the University of Queensland, the Columbia Centre on Sustainable Investment, the GOBI

Framework for Sustainable Infrastructure Initiative (comprising the University of Oxford, University of Central Asia and the Independent Research Institute of Mongolia), The Biodiversity Consultancy, the Wildlife Institute of India, the Endangered Wildlife Trust and Ecotecnia Ingenieros Consultores SRL.

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Foreword

In the course of a long and varied working life, I have been privileged to work with, or learn from, a stimulating panoply of individuals who are committed to contributing to the economic, social, and environmental development of all aspects of the United Nations Sustainable Development Goals.

Jon Hobbs and Diego Juffe-Bignoli are, thankfully, two of these individuals. I was delighted to learn that they had come together to produce, for the Development Corridors Partnership, a rich and stimulating collection of research reports, case studies and assessments relating to the array of efforts made under the rubric of 'development corridors'. They were determined to express the conviction that decisions made, primarily by governments, regarding the planning and building of Corridors, really must be informed by an evidence-based understanding of the consequences - positive or negative - of these decisions. And they have succeeded. But Jon Hobbs will never read these words. He was hospitalized after the bulk of the work was complete, and, to the deep sadness and regret of all who knew him, he passed away at the end of September, 2021.

Jon and Diego sought out and recruited a daunting array of researchers, scholars and stakeholders to shed light on the processes currently underlying the world of development corridors today. They certainly succeeded.

The work was initiated before the onset of the COVID-19 pandemic, and as governments turn to the formidable challenge of restoring

economic vitality without further damage to the climate, it becomes even more imperative that impact assessment be understood, embraced and improved. Jon and Diego have shown us the way forward for a journey which absolutely must be embarked upon.

They would be first to recognise that the Development Corridors Partnership as a whole must be commended for showing - in many different ways and places - that, not only is the need for impact assessment clear and present, but so are the skills and commitment of researchers, scholars and stakeholders. These are to be found in an impressive coming together of universities, civil society organizations and business groups, and communities.

All are part of an outstanding initiative, funded by the UK Research and Innovation Council, and managed by the UNEP-WCMC. This initiative has been embraced by some of the best minds that have been turned to the task of ensuring that - while we attempt to bring economic and social benefits to people, in line with the United Nations Sustainable Development Goals - we do not risk significant environmental and social costs, and thus actually undermine long-term development successes.

So, I urge you to read this book, and figure out how you might improve your own contribution to the challenges ahead. Jon and Diego have set out a case. It needs to be taken up, not set aside; acted on, not just talked about. It is in your hands.

John Harker

Chair of the Development Corridors Partnership Independent Advisory Board,
Nova Scotia, Canada.

Dedicated to the memory of Jon Hobbs
who was the architect and driving force of this book

Executive Summary

Driven by increasing globalisation, the development aspirations of nations, and the need to access resources, an infrastructure boom is impacting many regions of our planet. New infrastructure projects are traversing diverse landscapes over hundreds of kilometres, often crossing international borders and penetrating into remote areas previously unaffected by industrialisation and urbanisation. These large-scale projects, mostly spanning several regions in a same country, but often linear and transnational in nature, are generically called corridors. Depending on the nature and objectives, they can be transport, infrastructure, growth, resource or economic corridors.

The rapid development of corridors globally presents environmental planning professionals with numerous challenges. **The primary need is to ensure that decisions about these developments are informed by an evidence-based understanding of their consequences - both positive and negative.** This will enable infrastructure development to meet development needs without adversely impacting ecological systems or human welfare. Improving the quality of infrastructure policies, plans, programmes and projects, by ensuring they include the necessary environmental and social scrutiny, is urgently required now - and will be for the foreseeable future. This challenge is the unifying theme of this publication.

Using insights from Africa, Asia and South America, this sourcebook compiles 24 contributed papers written in 2021, covering many facets of the

opportunities and challenges presented by the rapidly growing number of infrastructure and corridor developments around the world. Prevailing planning practices are reviewed through case studies along with the efficacy of some of the available tools to conduct systematic and comprehensive impact assessments. The latter includes Strategic Environmental Impact Assessment (SEA) and Environmental Impact Assessment (EIA).

As the title suggests the underlying thesis of this publication is that, where they are justified, **there are significant benefits in ensuring that corridors that contain single purpose infrastructure developments (utility, infrastructure or transport) progress through a carefully planned sequential process of diversification and expansion to ensure the maximisation of benefits in full-blown 'development corridors'.** In this book, development corridors are therefore aspirational. They comprise areas identified as priorities for investment to catalyse economic growth and development. They should be developed with multiple stakeholders and social, economic and environmental interests and interdependencies in mind. With the integration of sustainability principles and appropriate environmental and social standards, development corridors could become true '(sustainable) development corridors'. They should be planned to maximise positive opportunities and minimise negative risks. Without this, today's short-term successes will become tomorrow's challenges and long-term human welfare and ecosystem integrity will be undermined.

Overview of contents

This book brings together a wide range of perspectives from experts, researchers, and practitioners around the world with the purpose to foster greater collaboration and increase our global understanding of corridors and their benefits and potential negative impacts. 13 of the 24 chapters are written by independent experts and researchers from Australia, Bolivia, Brazil, China, India, Kenya, Mongolia, South Africa, Tanzania, UK, and the USA. The book also includes 11 chapters containing material gathered by the Development Corridors Partnership, a programme of work led by UN Environment Programme World Conservation Monitoring Centre (UNEP-WCMC) and funded by the UK Government via their Global Challenges Research Fund.

The collection of papers in this sourcebook is divided into five sections. First an introductory section where we introduce some key terms and definitions that underpin this work ([Chapter 1](#)). We then explore some key principles and aspirations of corridors such as delivering the Sustainable Development Goals ([Chapter 2](#)), ensuring theory and practice align ([Chapter 3](#)), ensuring financial sustainability ([Chapter 4](#)), properly assessing environmental sensitivity ([Chapter 5](#)) respecting human

rights ([Chapter 6](#)), or maximising, co-benefits ([Chapter 7](#)).

In the next three sections, we present 15 case studies from three continents: Africa, Asia, and Latin America. These case studies explore key challenges and lessons learned from specific planned, ongoing, and already implemented developments. They are presented as individual stories that readers can explore.

The final and fifth section aims to summarise lessons learned from a 4-year research and capacity building programme specifically aiming to understand the key challenges and opportunities around corridors and that has been the major driving force of this work: The Development Corridors Partnership project (DCP). DCP is a collaborative partnership across UK, Kenya, Tanzania and China, funded by the UK Research and Innovation Global Challenges Research Fund (see [Chapter 23](#)).

The book finishes with an overview of the lessons learned from the contributed papers included in this book and develops ten principles for corridor planning and delivering a meaningful and comprehensive impact assessment ([Chapter 24](#)), which we summarise here as ten key messages.

Key messages

1

Corridors must seek to achieve positive sustainability outcomes:

The mindset underwriting environmental planning of most infrastructure developments has been to mitigate negative impacts. The planning of few existing corridors is based on their role in supporting a sustainability vision for a country or region in which they are situated. Corridor developments must therefore be based on sustainability principles and support progress towards national, regional and international sustainable development goals. A true development corridor will seek to do good, as well as to mitigate negative impacts.

2

Integrated and inter-disciplinary approaches are needed:

Corridor developments are extensive, complex, multifaceted features traversing many landscapes. They can bring about significant transformational change to physical, economic, social, and cultural systems, and serve as interconnecting features. Yet engagement in corridor planning is often constrained by limited disciplinary and institutional involvement, with projects often superimposed upon communities. Corridor developments need diverse expertise and experience in their planning and management, including local stakeholder knowledge, avoiding disciplinary, institutional, or sectoral silos, that can result in policy conflicts, contradictions, and inconsistencies.

3

Corridor proponents should clearly demonstrate consideration of alternatives:

Corridor options should not be limited to a preferred proposal favoured by an elite. Corridor developments must consider all feasible alternatives (including maintenance of the status quo and no corridor development) and make the risks and opportunities of each option explicit and transparent through meaningful consultation. An important requirement in all corridor planning is to justify the need for a wide choice of options and an explanation of the potential benefits it will bring and to whom, in comparison with the alternatives. Any necessary trade-offs and how any significant potential negative impacts will be effectively managed, and opportunities created must be explained.

4

Public participation and stakeholder engagement should be at the core of corridor planning:

Corridor planning frequently fails to include meaningful participation of all stakeholders. Corridors can profoundly affect the lives and rights of indigenous peoples and local communities, potentially for generations. A common failing is that the first opportunity for local stakeholders to engage arises only after all strategic decisions have already been made and the only option remaining is for them to react negatively to a fait accompli. The meaningful engagement of all stakeholders is necessary to ensure their role is more than reactive. The way corridors are viewed by different stakeholders must be identified, understood, and addressed. Corridor developments must ensure that all interested and affected people are provided with adequate information about a proposal and have meaningful ways to engage in decision-making processes from the outset of strategic planning.

5

Mainstreaming and tiering are fundamental for corridor success:

Corridor planning requires a tiered assessment process, ensuring that environmental and social issues are considered alongside financial and technical considerations from the start of strategic planning or programme development, right through to project specifics. Conceptual corridor planning is frequently dominated by technical and financial suitability criteria with environmental, social, cultural, and human rights sensitivity issues being considered, at best, as externalities, retrospectively, once issues and problems arise. Strategic planning is important because it is when the full range of options is still open for discussion. It also establishes the parameters that will frame and implement a corridor plan or programme. Environmental and social considerations (and the interactions between them) should be considered early in strategic decision-making alongside (and to inform) technical, financial, and economic considerations.

6

An iterative process is needed:

Corridors exist in dynamic environments and need to be responsive to changing circumstances and priorities. Planning must adjust as circumstances and available information changes. The process should identify, map, and engage all interested and affected stakeholders from the earliest stage of corridor planning and throughout the planning and management of the corridor. New concerns and evidence will likely emerge as a corridor development progresses. Corridor planning frequently places undue emphasis on the production of a report (Environmental Impact Report) and its influence on the decision to proceed. The process may not be so linear in nature. It may involve many adjustments and decisions as new evidence emerges and predictions improve. A good-quality report and recommendations is necessary, but they are dependent upon a comprehensive process of ongoing dialogue and engagement with all stakeholders.

7

Corridors must ensure effective use of available tools:

Many corridor environmental impact assessments fail to meet required international standards. Corridor planning and management should make systematic and adequate use of available impact assessment procedures, methods, techniques, and tools to ensure good-quality decisions. The available procedures discussed in this publication (notably Strategic Environmental Assessment and Environmental Impact Assessment) and their associated methods, tools and techniques should be used when appropriate to help ensure that a systematic process identifies all significant potential benefits and development outcomes, and that they outweigh the costs and risks to affected people and their livelihoods and environments. The objectivity and quality of corridor decisions are dependent upon the effective use of the available tools.

8

Plan corridors with resilience and adaptability in mind:

Prevention will always be better than cure in addressing the negative impacts of corridors, and this should be the priority. However, some circumstances dictate an inevitability of negative impacts. Corridors, therefore, need to be designed to be made resilient to anticipated changes and adaptation measures may be necessary as 'coping' mechanisms or to offset unavoidable impacts, such as the impacts caused by climate change. The suitability of measures will require ongoing monitoring and adaptation as needs arise.

9

Seek impact, influence, and implementation capacity:

The decision to proceed with a corridor is ultimately the responsibility of decision makers. They are usually the representatives of all stakeholders' interests and custodians of their natural resources. Any impact assessment report must provide adequate information to ensure sufficiently good-quality decisions. If they are to be effectively implement the recommendations provided. Attempts to improve the performance of planning and associated assessment processes of corridors must tackle the ways in which outcomes are shaped by political contexts and institutional capacities. Approaches to working on assessment processes should integrate political economy analyses and institutional capacity assessment from the outset and on an ongoing basis. Resulting insights should inform the design and implementation of interventions intended to improve planning practice.

10

Evolve from Infrastructure to Development Corridors:

The prospects for linear infrastructure projects to evolve into comprehensive development corridors are often left to chance and spontaneity. Infrastructure projects are often developed in isolation and in an incremental way. For infrastructure projects to progress and become true development corridors, the transition must be systematically sequenced into planning from the start. Assessments must include consideration of potential induced, secondary, synergistic, transboundary, and cumulative impacts likely to result from the corridor development. The progression from infrastructure to development corridors must be based on a systematic, comprehensive, and integrated assessment of the potential positive environmental, social and economic opportunities and the rigorous avoidance or management of negative impacts.

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Exploring the Potential of Scenario Planning for More Effective Environmental Assessments: Standard Gauge Railway Development Corridor, Kenya

Jessica P.R. Thorn,^{1,2} Robert A. Marchant,¹ Jonathan Hobbs³

¹York Institute of Tropical Ecosystems, Department of Environment and Geography, University of York, UK.

²African Climate and Development Initiative, University of Cape Town, South Africa.

³Senior Advisor, Development Corridors Partnership, York, UK.

ABSTRACT

In the last 30 years, participatory scenario planning has increasingly been recognized by environmental professionals and researchers as an important planning procedure with Strategic Environmental Assessments (SEAs) to chart plausible, pertinent, alternative futures. Key strengths arise from the fact that scenarios are created using a wide range of participants with different perspectives drawn from multiple sectors and combining dynamic environmental, social and economic trends. Yet scenario planning has rarely been used to assess the potential contribution of large infrastructure developments to achieving national development goals. Moreover, scenario planning is rarely applied in environmental assessments, even though these evaluate the future pros and cons of projects within broader strategies, ensuring they do not undermine sustainable futures. The aim of this paper is to explore the role of participatory scenario planning at the project level and how it can generate wider strategic choices about future alternatives in infrastructure development corridors. Using experiences from applying participatory scenario planning exercises in Kenya along the flagship standard gauge railway (SGR) project, we reviewed the extent to which Environmental Impact Assessments (EIAs) comprehensively identified the likely impacts, mitigation measures and highlight gaps in the process. We analysed the content of all the available EIAs we could access along the SGR phase I and II, specifically the routes from Mombasa to Nairobi, Nairobi to Naivasha, and areas comprising access roads and assigned for offshore sand dredging to supply concrete for the construction of railways, buildings and ports. We also analysed responses from civil society organizations. To contextualize these assessments and understand local perceptions of stakeholders from diverse sectors and the scale at which corridors are impacted, we ran six scenario workshops involving 155 participants, interviewed 110 key informants and had site visits in 2019. Our analysis shows that, generally, EIAs are applied in a reactive sense, while the quality of the

data quantifying impact and mitigation measures did not correspond to international best practice. Focusing on 20 key omissions, we argue that scenario planning and other futures techniques should be applied more widely in environmental assessments to understand people's perceptions of how SGR options would impact their futures. This offers effective and proactive insights about potential land use transformations, synergies and trade-offs, winners and losers. Such an approach may indicate one step in the direction of transforming transport corridors into resilient, futures-oriented development corridors, which are aligned with sustainability visions.

12.1 Introduction

Infrastructure corridors are rarely planned according to a long-term strategic vision of their role in potential sustainable futures or the contexts in which these can be achieved. They focus on their immediate key objectives. That is not to say that they are not often ambitious (and frequently prestigious) components of national development plans, but they are rarely subjected to sufficient scrutiny of how they will influence and be influenced by the broad and dynamic contexts in which they will exist over the long term. Instead, they have a narrow focus on the delivery of specific services. Beyond these primary objectives, projections of their potential role in the sustainable futures are given limited attention.

Procedures such as SEA can assist with this process and in reaching long-term goals – such as the Sustainable Development Goals (SDGs) – and help set universal development targets to which corridors can align (see [Chapter 2](#)). Within SEA processes, scenario planning serves as a tool that can provide a platform for public engagement in consideration of the role of corridor developments in alternative futures. It is, however, an underutilised tool (Hamilton *et al.* 2013). The strategic, governance and broader focus of scenario planning makes it a core part of an SEA processes assessing policy, plans and programmes.

However, EIAs also identify and assess the consequences of proposed developments, albeit at a more specific project level (see [Chapter 1](#)). Scenario planning can be a valuable exercise within project-specific EIAs where consideration of alternative scenarios

is a key requirement. The futures in which a corridor will exist will comprise multiple uncertainties. Many of these may lie outside the remit of a traditional EIA, but it is a useful tool with which to engage all stakeholders and help them gauge the influence that the proposal will have on their lives.

Participation is an essential requirement for any level of environmental assessment, but rarely do these processes engage people in structured scenario analysis to establish a project's role in shaping alternative futures or how it might be affected by projected changes. Unlike forecasts, that extrapolate future situations based on past experiences, scenarios develop plausible, diverse alternative futures (narratives or storylines) concerned with strategic foresight (Thorn *et al.* 2020). Because they address the complexity of possible futures based on a wider range of perspectives, scenarios have the potential to be a useful component of impact assessments, helping to articulate a range of thought-provoking alternatives and gauge how a development may influence (or be influenced by) structural changes in governance, land use, climate, demographics, economics, cultural values and technologies.

While scenario planning has been used for at least 50 years in military and business sector planning, it has only relatively recently been applied to environmental futures, most notably in assessing socioeconomic climate change scenarios (Thorn *et al.* 2020). The scenario-planning process encourages uninhibited brainstorming and lateral thinking,

tempered with sound judgement based on expertise and experience. It blends information that there is some certainty about with plausible but unknown eventualities. The corridor is the key driver of transformation, along with the interests and respective influences of diverse stakeholders engaged in, or impacted by, the corridor. In boundary-setting exercises, time frames are agreed, as are the potential contextual influences and drivers of change; and trends and uncertainties are identified.

A study by Duinker and Greig (2007) showed how scenario planning has utility in defining future developments in anticipation of contextual changes. A further study by Liu *et al.* (2006) indicated that a general agreement exists that scenario planning is a practical and effective way to put environmental models into more beneficial use for long-term decision-making. While both studies make a strong case for the application of scenario planning in EIAs, they do not contextualize and test their application in particular case studies. As far as we are aware, no studies

have explored the integration of the participatory scenario planning and EIAs in the context of a mega-infrastructure corridor in Africa. If it is used at all, it is more likely to be at the policy development stage as a component of a SEA (see [Chapter 18](#) for an example in Asia).

The aim of this paper is to explore the role of participatory scenario planning at the project level (i.e. within EIA processes) and how it can generate strategic choices about a wide range of future alternatives in corridor planning. We use the case of the SGR transport corridor in Kenya, which consists of multiple projects (Table 12.1) based on different phases. Objectives are to: (1) review the extent to which EIAs comprehensively identified potential impacts and postulate how they may influence and be influenced by contextual changes; and (2) consider how can participatory scenario planning can be used to explore the potential to translate infrastructure and transport corridors, among other developments, into comprehensive sustainable development corridors, aligned to sustainability visions shared by all stakeholders.

12.2 Brief history of a flagship infrastructure project shrouded in controversy

Kenya's new SGR project replaces the former narrow gauge lunatic railway built by the British under colonial rule (Miller 1971). Historically, this precursor resulted in significant changes in Kenya, including the development of the capital, Nairobi, which was initially a construction camp and terminus for the railway; as well as inward migration of indentured labour from India. This significantly altered the racial mix of Kenya: a feature that remains in the country today.

The SGR is being built in sections: (1) 609km from Mombasa-Nairobi, with 33 yards or terminals; (2) Nairobi-Naivasha (120km), including 24km of bridges and 7.8km of tunnels; (3) Naivasha-Kisumu (267km); and (4) Kisumu-Malaba (130km) (Fig. 12.1). Construction began in December 2014 and the first phase

of the SGR was opened in May 2017. When completed, the SGR will link landlocked Uganda - and then potentially Rwanda, Burundi and South Sudan - with the Indian Ocean trade routes to the East.

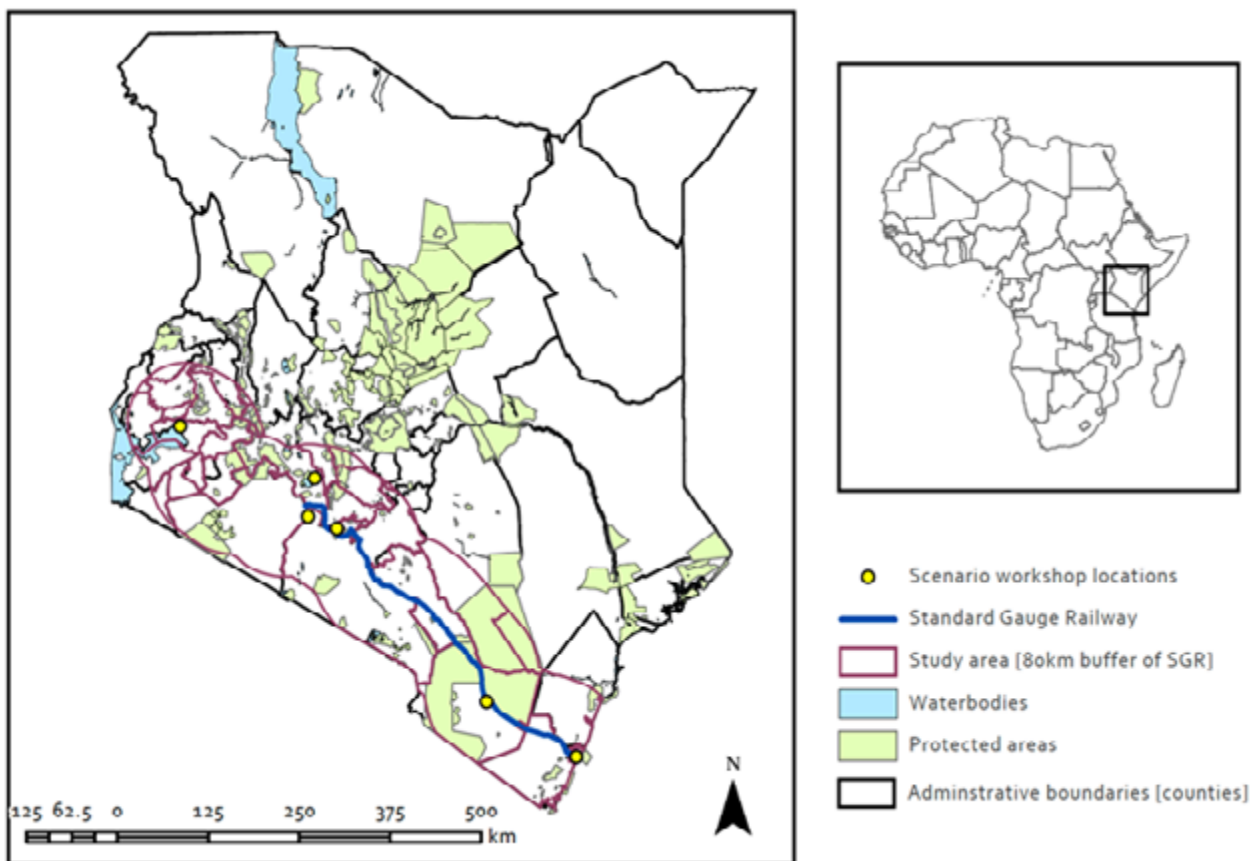
In the last decade, the SGR has been promoted as a significant axis of development for Kenya and the wider East African region (Fig. 12.2). It represents part of Kenya's larger drive to accelerate mega-development, not only in infrastructure, but also mining, oil and gas, energy and commercial agriculture. It also holds the promise to improve regional connectivity and development, efficiencies in freight and passenger transport and alleviate chronic congestion on the highways. Importantly, the project is a symbol of Kenya's ambitions to create a

prosperous and productive economy under its own stewardship. The flagship project falls under Kenya's blueprint Vision 2030 by "deploying world class infrastructure facilities and services for a globally competitive Kenya", making firms more competitive, providing economic incentives to the public sector, and improving attractiveness to foreign investors. It is widely supported as a hallmark of Kenya's expansion and interconnectedness strategy (Ogollah *et al.* 2019, p. 2). Furthermore, the SGR aligns with other goals, such as the Jubilee Government's Big Four development agenda (2018-2022), the County Integrated Development Plans, the Constitution of Kenya

2010, the Physical Planning Act 1996 and the East African Railway Master Plan.

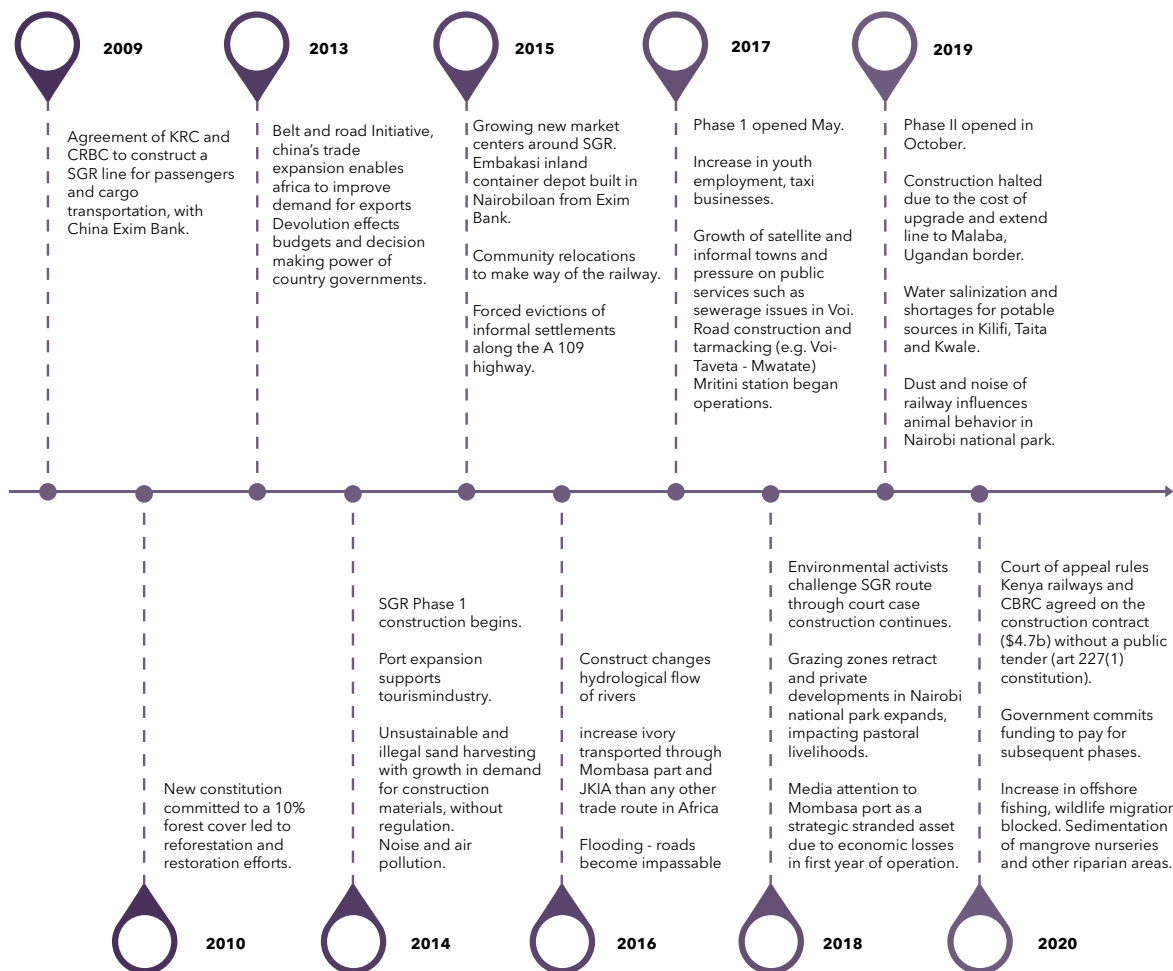
Despite the many benefits, poor planning, token commitments to legally required environmental assessment procedural requirements, limited public participation in such processes, significant environmental damage, particularly to wildlife, fragmentation of protected areas, commercial viability, allegations of impropriety in land allocation processes, suitability of compensation estimates, failure to link existing communities with the rail route, among other factors explored in this chapter (see also Chapters 3 and 11).

Figure 12.1 Map of the standard gauge railway



Phase I of the SGR runs from Mombasa to Nairobi. Phase IIA runs from Nairobi to Narok. Phase IIB runs from Narok to Malaba.

Figure 12.2 Timeline since 2009-2020 of the recent evolution of the SGR, according to scenario workshop participants



Source: China Road and Bridge Corporation.

12.3 Method

12.3.1 Content analysis

We conducted a content analysis of all EIAs accessible for SGR phase I and II (African Waste and Environment Centre 2012; Habitat Planners 2015; Mwaura 2017), specifically looking at Mombasa to Nairobi, and Nairobi to Naivasha Park, as well as areas comprising access roads and areas assigned for offshore aggregate dredging (Table 12.1). We accessed the EIAs through the National Environmental Management Authority platform or through direct requests, University of Nairobi, International Union for the Conservation

of Nature and African Conservation Centre. We also reviewed responses from civil society organizations of EIAs submitted to the National Environmental Management Authority, and reports from ministries, academia, media and multilateral agencies. We were particularly interested in how future scenarios were considered and how local communities were involved in these discussions. Overall, we considered if the EIA process, as applied to the SGR developments, had any influence on decision-making.

Table 12.1 EIAs that were part of the SGR planning process reviewed for this report. None of these EIAs incorporated scenario planning.

Report and location	Consultants	Publication year
Report for Mombasa-Nairobi SGR development Project	African Waste and Environment Centre	2012
Report for the proposed SGR project from Nairobi South railway station-Naivasha industrial park-Enoosupukia, Narok County	Habitat Planners	2016
Report for the construction of Embakasi access road to the railway station in Nairobi Metropolitan Region	Ministry of Transport, Infrastructure, Housing and Urban Development, State Department of Housing and Urban Development	2017
Government of Kenya Makueni County Department of Water, Sanitation, Environment and Climate Change	Preliminary environment and social impact audit report on SGR project Report	2018

12.3.2 Participatory scenario planning workshops

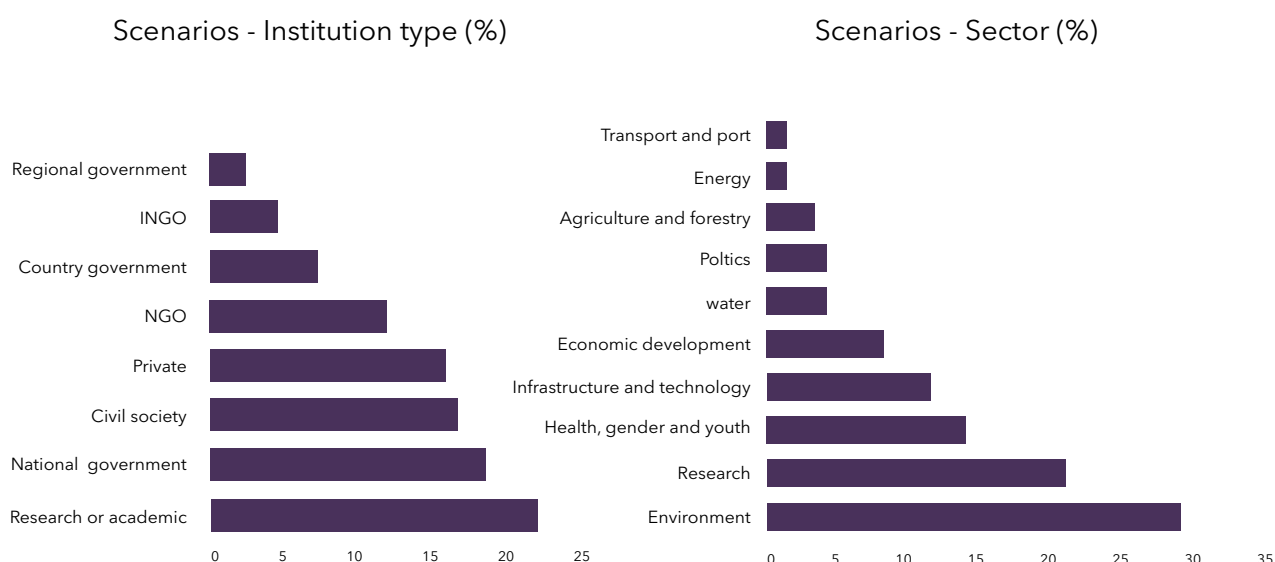
We conducted six participatory scenario planning workshops of three days each, involving 155 participants between March and August 2019 in six counties where the SGR has already been constructed or construction was anticipated (Table 12.2). Participants were selected using purposive sampling to represent a range of diverse perspectives, stratified by gender (68:32), institution type, scale of operation and sectoral representation (Fig. 12.3). We developed three scenarios for two time frames of 2030 and 2063. These future tie points correspond to the SDGs and the African Union Agenda 2063, respectively. The aim of this process was

to develop plausible, diverse visions of the future development, and explore how scenarios could be used to broaden participation, improve EIAs to include sustainability visions, and influence progress to a preferred option. The scenario workshops used the tool 'Kesho' (meaning 'tomorrow' in Swahili) (see Capitani et al. 2016, which provides a detailed discussion of the tool) and has been developed and applied in East Africa since 2014 to explore future land cover changes and how this impacts water, carbon and biodiversity interactions (Capitani et al. 2019), coffee and agroforestry production (Capitani et al. 2018), conservation and pastoral interactions (Kariuki et al. 2021). For a detailed description of the method also see Thorn et al. (2020).

Table 12.2 Participatory scenario planning workshops

No	Location	No.	Date	Main issues identified in the workshops
1	Voi (Kibwezi, Tsavo conservation area, Emali Tok Tok)	36	27-29 March	Wildlife migration collisions, arid region of 200mm rainfall/ya; railway traverses the Kibwezi river; affecting the quantity and quality, some boreholes have been drilled and water pans; Rapid growth and economic centre, feeder roads, impacts on the trucker's industry
2	Nairobi (Nairobi National Park, Ooloolua, Ngong, Kajiado, Twala)	35	1-3 April	Loss in endemic vegetation through the forests (Nairobi National Park, Ooloolua forest, Ngong tunnel); sealed boreholes, community conservancy conflicts
3	Mombasa (Miritini, Matheras wetland, bypass)	37	11-13 April	International connections with export/import markets, tourism, community management; start of the SGR, Mombasa Terminus, construction roads, construction road next to mangrove, bridge through wetlands
4	Narok (Suswa)	19	31 July-2 August	Pastoral livelihood change - new skills arriving at region - land fragmentation, breaking corridor connectivity - human/wildlife conflict; sedentarization of Maasai around railways, rapid growth of urban centres, conflicts over water resources
5	Naivasha (anticipatory)	18	7-9 August	Horticultural and hotelier transitions - sedimentation of lake; construction of dams
6	Kisumu (anticipatory)	18	12-14 August	Regional integration in the East African Block; political positioning in the country

Figure 12.3 Participants from scenario workshops, represented predominantly research (21.9 per cent), national government (18.7 per cent), and civil society (16.8 per cent), and ten sectors – predominantly environment (29.0 per cent), research (21.3 per cent), predominantly health, gender and youth (14.2 per cent)

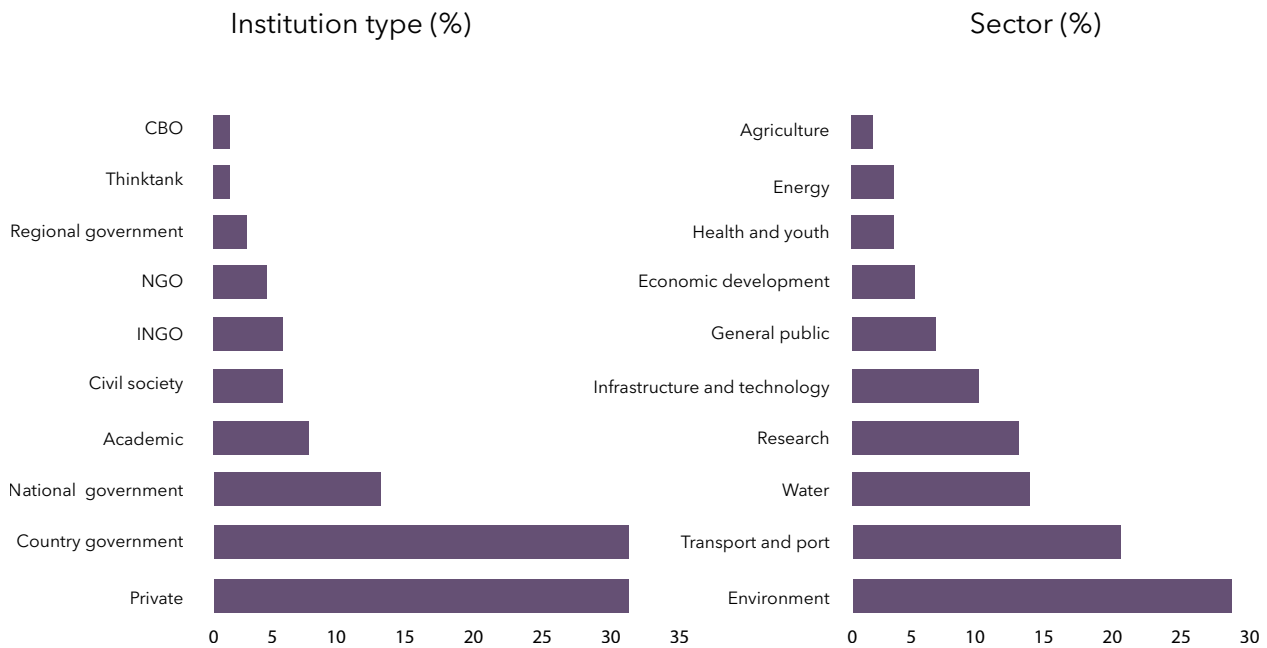


12.3.3 Semi-structured interviews

We conducted 110 semi-structured interviews. Informants represented a diversity of sectors and institutions (Fig. 12.4). Despite requests to have equal gender representation, ultimately the decision on who would represent organizations was that of the informants, and male:female ratio was 78:22. Interviews covered topics of effectiveness of rehabilitation strategies, local resource requirements (e.g. sand harvesting for concrete for railway construction), encroachment into riparian

groves, water resource management; regulatory controls, and permitting; socioeconomic absorption of local employees, impacts on local livelihoods, market access and skill sets; compensation processes, public consultation and participation in planning, design and implementation; and envisioned futures; among others. We explored envisioned futures and how scenario planning can be used to make the EIA more effective.

Figure 12.4 Respondents during interviews represented several sectors, predominantly private industry (31.2 per cent), country government (31.2 per cent), national government (11.7 per cent), academic (6.5 per cent), and nine sectors, including environment (28.4 per cent), transport (19.4 per cent), water (13.4 per cent), research (11.9 per cent), infrastructure and technology (8.9 per cent), among others



12.3.4 Field visits

Third, transect walks were conducted over 14 days of fieldwork in January and February 2019. We covered nine counties of Mombasa, Kibwezi, Taita-Taveta, Nairobi, Naivasha, Nurok, Twala, Isiolo and Samburu. We visited sites to elicit local perspectives on the social

and environmental impacts of the railway, understand to what extent the EIAs recommendations were enforced, and how subsequent phases of the SGR transport corridor could be better planned to maximise development opportunities.

12.4 Results and discussion

Overall, EIAs are generally applied in a reactive sense and their resulting recommendations are poorly enforced, especially if they involve significant changes to preconceived plans. We evaluate these gaps in terms of their environmental, economic and socio-political oversights. For each, we show how scenarios could overcome some of these persistent limitations found, not only in the case of Kenya, but other infrastructure developments across Africa and the world. [Appendix 1](#) provides a full list of 20 key omissions in the EIAs, what was address and what data were omitted to estimate impacts, with mitigation options illuminated from scenarios generated in this study.

12.4.1 How participatory scenario planning can help improve environmental assessments

As mentioned, structured scenario analysis is rarely applied in either EIAs or SEAs, even though both are designed to ensure development does not lead to unintended consequences. When applied in the planning stage, scenarios can make cumulative impacts explicit and help identify what transformational consequences they may have in the future. It helps all stakeholders continually engage in developments throughout project cycle. Through a collaborative process, scenarios can build trust and reduce misinformation,

which is a recurrent challenge that arises in EIAs (see Chapters 3 and 18). Moreover, outcomes can feed into existing planning processes using the language people are familiar with. It also involves the active integration of local inhabitants' voices, knowledge and expectations (Carpenter et al. 2012). Many development projects are constrained by a comprehensive understanding of local dynamics or multiple variables that are critical for a project's success, especially when some of the key actors are from different cultural and linguistic backgrounds. Scenarios can help overcome this limitation by applying a social-ecological systems perspective (Berkes and Folke 1998) considering social, biophysical, policy and economic interactions (Cumming et al. 2013), internal and external multi-layered levels, and nested systems where individual systems and subsystems are integrated into larger systems (Janssen and Andries 2013). When applied in combination with spatially explicit representations of future land use change, scenarios provide a structured way to illuminate potential outcomes of mitigation measures, and who are the winners and losers (Hamilton et al. 2013), and a broad range of long-term contexts. For these reasons, scenarios can help open the relatively restricted nature of EIA participation. To illustrate how scenarios can visualize potential futures, Box 12.1 presents examples of three plausible, diverse scenarios for 2030, developed by stakeholders during a three-day workshop in Nairobi, Kenya.

BOX 12.1 THE SCENARIOS

Scenario 1: the high road

Adaptive and transparent governance means international standards are adhered in planning corridors, resulting in the successful avoidance and mitigation of impacts on biodiversity, ecosystem services, and the livelihoods dependent upon them. National and county governments have sufficient funding, which is managed transparently. Holistic planning is rooted in stakeholder engagement and participation. Spatial frameworks are developed in all countries and are enforced. Effective and open communication across levels of governance, from grassroots to national government (bottom-up and top-down approach), leads to increased ownership

and participation from stakeholders of infrastructure developments. There is policy coherence and collaboration among development partners, governments, non-governmental organizations (NGOs), civil society organizations (CSOs), academic institutions and CBOs. Strict enforcement of and the availability of funding for Environmental and Social Impact Assessment (ESIAs) and Strategic Environmental Assessment (SEAs) controls development within the aspects of the mushrooming of towns, segregation of human and wildlife, blocked waterways and migratory routes. The national government develops evidence-based legislative frameworks, implements the Kenya Vision 2030, and fully adheres to SDG 15 by restoring degraded land. Consistent and resourced monitoring and evaluation programmes oversee the activities of contractors. Climate change mitigation and adaptation strategies are mainstreamed in county integrated development plans, such as renewable energy, climate-smart conservation agriculture and early warning systems.

Scenario 2: the middle road

International standards are given only token application, leading to distrust in decision makers and isolated pockets of biodiversity that maintain reduced tourist revenues. Indigenous communities' needs, values and place-based knowledge are insufficiently considered in development planning, and local skillsets are outcompeted by foreign contractors. Despite land use planning and environmental audits, inadequate implementation leads to encroachment into wetlands, waterway, and key breeding areas. National park managers only consider protected areas, ignoring animal dispersal areas or migratory corridors, resulting in islands of ecological refuge surrounded by industrialization, urbanization and mushrooming informal settlements. Overlapping and conflicting mandates of the Kenya Forestry Service, Kenya Wildlife Service and the National Lands Commission causes delays in decision-making. Although the SGR has successfully reduced the growth of road traffic congestion and accidents, there is also a rise in unemployed truck drivers and owners as well as associated businesses. This perpetuates poverty, food insecurity and poaching. However, compensation uplifts the economies of some communities when citizens negotiate land acquisition compensation prices that reflect market value. Taxi drivers and motorbike operators who provide services to passengers of the SGR also benefit. Communities become more aware and there is a growth in more advocacy, civil activism, and optimism.

Scenario 3: the low road

International standards are ignored in planning corridors, resulting in the loss of ecosystem service benefits, dissection and diminution of ecologically sensitive areas, and loss of tourist revenues and Kenya's status as a leading resource-based tourist destination. A lack of political goodwill and corruption, and inadequate consultation causes a disconnect and mistrust between the government and the citizens. Citizens are excluded from decision-making and remain uninformed regarding the rationale for infrastructure developments. Donors advance their own agendas, and the Kenyan government does not prioritize local rights, leading to a new form of neocolonialization (*ukoloni mambo leo*) and compromised national sovereignty. Kenyan taxpayers' money is spent on the repayment of excessive debt of billions of dollars to foreign governments, with threats of asset capture. Communities lose access to grazing areas, farmland, ancestral lands and natural resources. Prostitution grows and the spread of HIV/AIDS becomes widespread. Overpasses block wildlife movements and there is a huge surge in crop raiding, fishermen's livelihoods are compromised by degraded reefs and community forest associations cannot sustain mangrove nurseries due to watercourse sedimentation. When essential services become inaccessible conflicts arise, leading to civil unrest, and parts of the railway are destroyed. The public resorts to direct action and civil disobedience to overthrow the government.

12.4.2 Adequacy of data or scientific evidence to support assertions

Our content analysis, key informant interviews and workshops revealed that many of the EIAs lacked evidence. For example, in the Nairobi National Park EIA (Habitat Planners 2016) there was no detailed discussion of the impact of the SGR on the distribution and density of birds, reptiles, amphibians, and small-to-medium-sized mammals inside the national park (van der Ree 2016). There was little discussion of the interdependencies of species (e.g. predator prey relationships, dispersal, pollination). There was limited detail on the methods and data used to arrive at conclusions, while in some cases the methods used were not robust. For instance, in the same EIA, road transects were conducted instead of comprehensive longitudinal biodiversity assessments. Technical elements were missing, such as the terms of reference and scoping study (Kenyan United Against Poaching Trust 2018). In other cases, the right to access information (i.e. Article 35 of the Constitution) was not fulfilled. For instance, the feasibility study of the SGR phase II is not in the public domain.

Of particular significance is the case of the Nairobi National Park EIA, which did not have sufficient evidence to assume all wildlife would pass under the railway. First, it used studies reporting wildlife crossings use from the USA, Western Europe or Australia, but no examples from Africa (van der Ree 2016). In these cases, the railway was built before the park was designated (Conservation Alliance 2018). Second, evidence did not include detail of the changes in specific species behaviour. Third, it did not include studies of daily and seasonal wildlife migration. Fourth, it did not consider habitats inside the park, such as the river gorges (Conservation Alliance, 2018). Fifth, there was no detail on design specifications for the proposed underpasses in Nairobi National Park. Finally, the EIA excluded recent key studies (e.g. those showing the primary cause of the decline and extinction of migratory ungulates is due to habitat fragmentation

from fencing, roads, and railways (Harris *et al.* 2009), with additional evidence of these declines becoming obvious in Nairobi National Park (Ogotu *et al.* 2013).

Another example is the case of an illegal EIA license being issued to harvest 800,000m³ of sand for concrete off the coast of Likoni (Mombasa) up to Tiwi (Kwale) along a 0.4-1.0km strip. The purpose was to accommodate the construction of the SGR railway, buildings and port terminal of Port Reitz Cargo terminal in Mombasa. Yet, such abstraction comes against international standards for sea and sand harvesting, which stipulates a minimum distance of 5-10km from the shoreline, because sand was harvested 400m-3km from the shoreline. At the time, Kenyan legislation was unclear as to where sand should be extracted, or the anticipated demand. No offshore or underwater analysis, real-time monitoring of sediment plumes, and how they are affected by the wind, waves, and tides was conducted (Obura 2019). The report did not include the field assessment findings, mitigation measures and what would trigger harvesting activities to be postponed or altered to avoid damage to nearby sensitive reefs (Musyoka 2016). Consequently, a stop order to this was raised twice by the National Environmental Tribunal (Obura 2019).

Scenarios can help to overcome such data limitations by developing stakeholder-informed narratives. After systematic evaluation of the strengths and weaknesses of each scenario, recommendations are then made for strategies to progress towards the preferred scenario. For instance, scenarios could help identify where the railway corridor could disrupt movement of wildlife, even in cases where there are mitigation measures. It would also allow for improved social support of the process and avoid reputational damage.

12.5 Environmental impacts

12.5.1 No consideration of alternative routes bypassing parks and critical ecosystems

One of the main points of contention was the routing of the SGR through the Tsavo Conservation Area and Nairobi National Park. Of the seven proposed routing options from Nairobi, the Kenya Railways Corporation settled on the Modified Savannah Route 4, which ran through the park. In contrast to global best practices in EIA, none considered any option that bypassed the park. Respondents were concerned about impacts on the biodiversity inside and outside the park, and migration in the remaining open dispersal corridors connected to the Tuala Oloosirkon areas, adjacent community lands (Kenyans United Against Poaching Trust 2018). In response, several public campaigns, and protests from pastoralists, conservationists and landless people arose objecting to the routing of the SGR stating the Government of Kenya was taking an “ill-informed and unnecessary risk” (Coastal Oceans Research and Development - Indian Ocean 2019). The EIAs went against the Wildlife Conservation and Management Act of 2013 and the National Spatial Plan 2015-2045. Section 44 of the Act requires no development to occur in a national park without a gazetted management plan, but the last management plan of Nairobi National Park expired in 2010 (Kenyans United Against Poaching Trust 2018). Schedule 6 requires

EIAs to describe endangered and threatened species that could be affected. The EIAs also contravened Section 30 of the Act, which prohibits any activity that is likely to have adverse effects on the environment. Stakeholders were concerned that the SGR set a precedent for other development projects to encroach into protected areas. Considering these factors, civil society organizations raised a legal case against Kenya Railway Corporation against positioning of the railway through the 216 acres of the park.

Similarly, the SGR is routed through a 35km stretch of the Oloolua Forest and drilled a 3.75km tunnel in Ngong hills (25.25ha). Construction in phase I had impacted important biodiversity areas, such as Kibwezi forest, Ngong hills, dryland forests, riverine forests, urban and farm trees, among others. The SGR also passes through Mombasa Wetland Park and close to fishery nurseries of community forest associations (Fig. 12.5). EIAs did not adequately consider impacts on local livelihoods, coastal erosion, mangrove ecosystem functioning, endemic species, watercourse sedimentation, carbon sequestration and air filtration. Rather, three EIA reports stated that the proposed railway passing adjacent the highly valued forests, the impact on the forest will be “negligible since no clearance will be done” (African Waste and Environment Centre 2012). Some of these included sacred coastal forests.

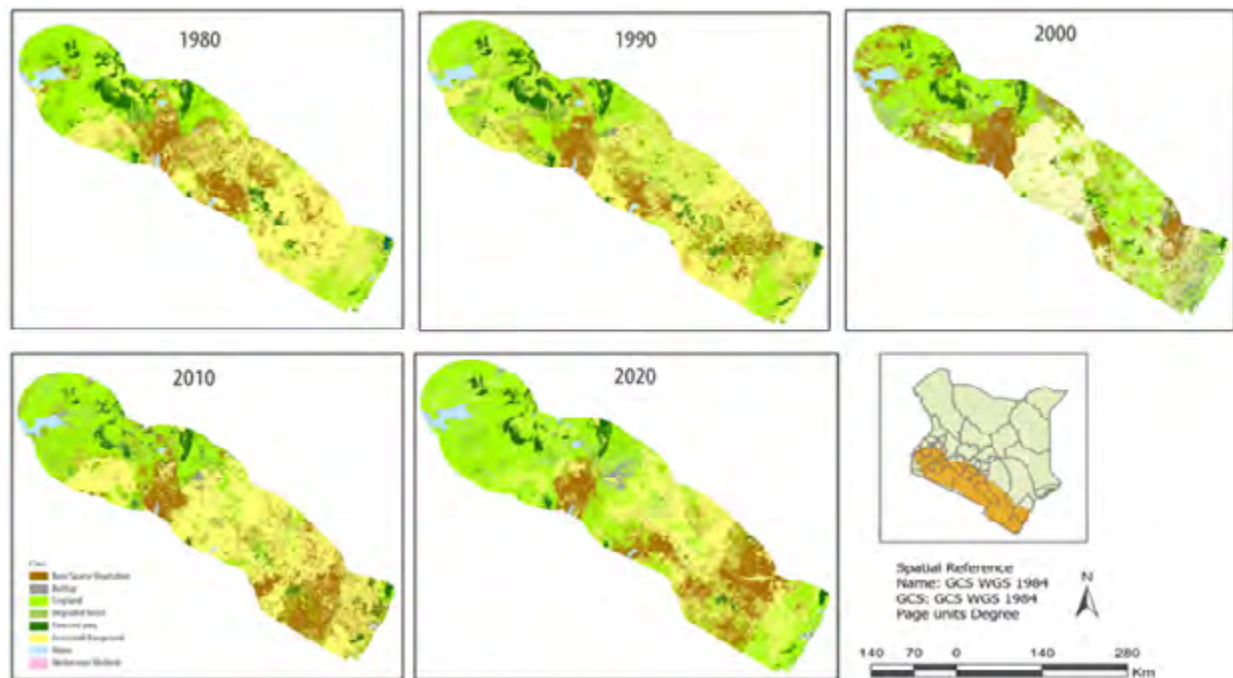
Figure 12.5 Embankment outside Mombasa, where construction impacted the growth of mangroves and other coastal forests (Habitat Planners)



Scenario planning helps to conceptualize alternative futures as part of a strategic planning process, as well as project-specific EIAs. Part of this process involves visualizing alternatives and developing spatially explicit models of how land use may be transformed (Fig. 12.6). Such scenarios provide insights into potential land-use futures and the drivers behind

these land cover changes. For instance, in a workshop in Nairobi, participants highlighted how the SGR could create biodiversity islands surrounded by urbanization and industrialization.

Figure 12.6 Land use land cover change maps of an 80km buffer along the standard gauge railway, showing how infrastructure development impacts surrounding land use cover. Maps are shown in annual increments between 1980-2020



Source: Thorn et al. in prep.

12.5.2 Omission of the issue of human/wildlife conflict

Despite being raised in EIA participatory consultations in Ongata Rongai and Tuala (Kajiado), the issue of human/wildlife conflict was overlooked, with the only mitigation measures proposed being improved security, installing fencing and anti-collision nets to control elephant, giraffe and buffalo crossings, raising the track to 40m with viaducts and bridges, and building underpasses. Light deterrents, or compensation mechanisms were not considered. Subsequently, monitoring of collared elephants in 2016-2017 by Save the Elephants and Kenya Wildlife Service has shown the restriction of movement of elephants on one side of the railway, suggesting they do

use the nine wildlife passages that have been installed to connect Tsavo East and West Conservation Areas (Okita-Ouma et al. 2017). In 2019, there was a rise in compensation claims in Taita Taveta county, where elephants were destroying crops along the railway. In 2019-2020, 494 people died from human wildlife conflicts across Kenya, which earmarked US\$ 5.4 million in claims to the regional government (Xinhua 2019) (Fig. 12.7).

Scenarios help stakeholders to think about the bigger picture in both time and space, contextualizing specific project proposals and envisioning their role in longer-term futures. Scenarios also help to explore situations where conflicts could escalate in the future. We found, for example, stakeholders in our workshops in Suswa, Nairobi and Voi

foresaw the knock-on effects development could have not only on human wildlife conflict (e.g. severed migratory routes, impaired ecological functioning), but also poaching (e.g. increased access to illicit markets) (Laurance et al. 2008; Laurance et al. 2015a; Laurance et al. 2015b). Employing a systemic perspective, they argued a need to maintain good governance, avoid land grabbing adjacent to the railway and better manage

land conversion and subdivisions. Scenarios further emphasized the need to reduce inequality and support alternative livelihoods so farmers and pastoralists would not solely depend on one season of crops or one herd. By having a great diversity of land use options, communities could reduce losses, while improving intercultural interactions between tribal groups to with limited resources and land.

Figure 12.7 Elephants killed on Mombasa Road not adapting to the SGR embankment



Source: Kenyans United Against Poaching Trust 2018

12.5.3 EIAs did not apply the precautionary principle when there was uncertainty

The precautionary principle is useful when there is inconclusive evidence and public controversy over appropriate activities and full extent of risks of a development, which often demand hard and fast decisions. In the case of the SGR, where the desired level of protection is undefined and the risk of harm cannot easily be quantified, the principle is appropriate. But it was not applied, and so various actors appealed to the National Environmental Management Authority, calling for the precautionary principle to be applied to avoid irreversible damage to the habitat, flora, and

fauna (Conservation Alliance 2018; Kenyans United Against Poaching Trust, 2018).

In a world of uncertainties, scenario planning helps to design alternative options in view of multiple possible futures (e.g. climate change, land use change, behavioural change). Understanding uncertainty requires a close analysis of: (a) the sources of uncertainty; (b) the magnitudes of these uncertainties and how they propagate from one phase of the SGRs construction to another; and (c) measures to communicate these uncertainties to decision

makers. All three of these elements of uncertainty are required for contractors, investors, engineers and other actors working in the development corridor to establish clarity, credibility and transparency (Liu 2006).

12.5.4 Insufficient consideration of long-term expansion and land use change

Expansion of the SGR in the coming decades will likely require additional railway lines, bridges or tracks. It could take up considerable land surrounding the railway, whether in national parks, settlements or other zoned land uses. It could also increase in congestion due to trucks taking containers from the internal container depot

in Syokimau, Embakasi, to Machakos, as well as private commuter traffic and Nairobi (van der Ree 2016). Yet, in the absence of a railway master plan and a national spatial planning framework, the fact that the location was not suitable for a transit railway station was overlooked, since it is an end-station, hemmed in between high-value assets of the city.

Here, spatially explicit scenarios could the Nairobi Metropolitan Area proposed development plans, human settlement patterns and how the SGR would likely blend into the surrounding area. Scenarios can overcome the fact that current EIAs do not consider the equitable sharing of costs and benefits of future generations and in different parts of the landscape.

12.6 Economic impacts

12.6.1 Insufficient consideration of redundancies or impacts on non-skilled livelihoods

EIAs reported many economic benefits to key industries (e.g. taxi businesses, tourism industry, commuters, shipping agents; [Appendix 1](#)). However, the impacts of construction and operation of the SGR on certain livelihoods were not fully considered. For instance, redundancies were likely to happen due to the closure of businesses, resulting in job losses for loaders, drivers, mechanics, roadside businesses, clearing agents and other warehousing businesses. Ogallah *et al.* (2019) estimated national job losses in long-distance trucking industry would be 1,008; in container freight stations it would be 4,340; and in local transport it would be 2,963. Hotel accommodations could be closed due to fewer bus passengers and truck drivers along Mombasa-Nairobi Highway. Farmers could be affected by the dust from construction and blasting (Fig. 12.3) (Government of Kenya 2018). Dive operators and fishermen could be affected by the dredging of sand on the reefs of the

coastline. In addition, local hiring should be a central component of ensuring social licensing from contractors, and local buy-in and legitimacy. Although the China Road and Bridge Corporation said they would employ local skills, the company had no obligation to buy from local private companies, nor did they have a concrete plan to build capacity.

Scenarios can help bring to fore diverse interests through the process of multistakeholder workshops and help achieve consensus on preferred futures and discuss measures needed to progress towards them. Scenario planning can also illuminate the potential dangers of inaction and importance of securing local livelihoods.

12.6.2 Revenue to local and national government and indebtedness

Much attention has been paid to the Kenyan debt that will be incurred from investments loans.

The approximate estimated construction cost was US\$ 3.8 billion, with around 90 per cent financed by the China Exim Bank and the remaining 10 per cent by the Government of Kenya. Critics argued that Chinese lending generates substantial economic gains, higher debt burdens, weaker debt affordability and weaker external positions (Rogovic quoted in IOL Business Report 2018; Cardomy, Taylor and Zajontz *et al.* 2021). At the time of this report (May 2021), the Government of Kenya was unable to pay monthly loans of US\$ 1 million for 21 months, and so the Chinese government did not issue the loan for the final stage of funding in 2020.

Scenario narratives indicated concern, given the historic context of colonialization, that development corridors such as the SGR could present a situation where foreign countries give loans with stringent conditions that could run the risk of loss of territory, resources, sovereignty and control of decision-making. Respondents highlighted potential risks associated with recent the rise of foreign private infrastructure contractors in Kenya would lead to less gen-

eration of revenue from the SGR construction being fed back into the local economy (Sanghi and Johnson 2016).

12.6.3 Cost-benefit analyses did not include environmental and ecosystem service costs

Route option analyses did not include any elements of ecosystem service valuation. No cost comparison analysis was given to value to protected area land or the broader impacts on ecosystem services the Nairobi National Park provides (Kenyans United Against Poaching Trust 2018). It did not consider the routing of the would also have repercussions on the reputation of Kenya as a wildlife tourist destination, with impacts on the gross domestic product, considering Nairobi National Park has the highest visitation rate of all parks in Kenya (Conservation Alliance 2018). Scenario analysis can be issued in this context to look at the ecosystem service impacts, to assess the relative cost in all routes.

12.7 Social impacts

12.7.1 Selective and rushed participatory public consultations

Effective stakeholder engagement is arguably one of the most challenging elements of EIA processes, and one of most cited issues identified in scenario workshops and interviews. In the case of the SGR, EIA consultations were too narrow in terms of their duration, how they were conducted and constituents of who was involved. For instance, the consultation process took 1.5 years, using methods such as media, community meetings (*barazas*), roadshows and

plays. However, opponents argued that engagement for the construction was selective. For instance, the SGR Port Reitz Cargo terminal EIA consultation used a local representative to select participants, which respondents felt ran the risk of elite capture. The Kenyans United Against Poaching Trust (2018) stated some key stakeholders were excluded from EIA consultations altogether, such as pastoral communities living adjacent to Nairobi National Park, which contravened the Environmental Management and Coordination Act of 1999.

In phase IIA, the Conservation Alliance (2018) argued the EIA consultation process conduct-

ed by Habitat Planners consultancy was rushed and there was not enough time to conduct the EIA. Information was not provided beforehand for participants to interpret and understand the route. Moreover, consultations only focused on sections of the phase IIA, rather than the entire route. For instance, in the selection of the Modified Savannah Route 4, the public was not briefed on the range of potential routes, but only the Bomas route, which would impact on large areas of inhabited land.

Engagements were considered briefings, not consultations, because there was no forum to ask questions, as stated: “(We) were simply lectured as if the route was a done deal” (Kenya United Against Poaching Trust 2018, p. 2). Ogalah *et al.* (2019) suggested “structured stakeholder engagement (did) not assess the possible downsides as result of action” (see section 3.3). Some opponents to the Nairobi National Park routing stated that “the public consultation sessions were mainly to create awareness and critical views of those who attended the meeting were not considered” (Conservation Alliance 2018, p. 7). For example, in the EIA reports, content was excluded from the outcomes of two meetings with conservation NGOs held at the Ministry of Environment and Natural Resources, which rejected the proposed route through Nairobi National Park. On the other hand, some consultations that occurred from 22 September 2016 to 12 October 2016, which

were in contempt of a court order issued by the National Environment Tribunal for the phase IIA EIA, were nevertheless included in the EIA.

This clearly indicates procedural inconsistencies in the evidence presented within the EIA, leading to a series of public protests (Fig. 12.8). Overall, there appeared to be inadequate communication and sensitization from community liaison officers of the Kenya Railway Corporation being responsible for very large populations they were unable to reach. The degree of acceptability of stakeholders, transparency and inclusivity was low according to the participants in workshops, communities, local businesses and NGOs interviewed for this research.

Scenario analysis can support effective communication from grassroots to the institutional level (bottom-up and top-down approach) and increasing ownership and participation from stakeholders of infrastructure developments. Scenarios promote engagement which could ultimately lead to more policy coherence and more efficient, effective decision making and better ecological outcomes (e.g. between Kenya Forestry Service, Kenya Wildlife Service, Ministry of Lands and National Lands Commission). Scenarios, furthermore, help to improve coordination across institutions and stakeholders to utilize local governance structures already in place and improve incentives for local participation and information sharing.

Figure 12.8 Public protests the routing of the railway through Nairobi National Park took place across the country, from the coast (as shown in Mombasa above) to inland



Source: Coastal Oceans Research and Development – Indian Ocean East Africa 2016.

12.7.2 Lack of mitigation measures for sexually transmitted diseases and teenage pregnancy

Workshop participants regularly indicated that the SGR could spread sexually transmitted diseases (STDs), including HIV/AIDS, along the route. EIAs contradict one another on this matter: where one EIA reported the SGR could expose workers and surrounding communities to sexually transmitted diseases, while another EIA said it would reduce the spread. Mitigation measures included awareness raising in construction camps and market centres, voluntary counselling, testing for construction workers and surrounding communities, encouraging the use of contraceptives to construction staff. Reports did not discuss the spread of HIV from construction workers. In one EIA, this was described as “sexual immorality”, which assumes abstinence is the appropriate response, which has proven ineffective in controlling the spread of STDs (McGrath 2003). While the potential risk of a rise in prostitution was reported in the phase IIA report, no mitigation strategies were proposed. The issue of teenage pregnancy was ignored in all EIAs, even though it came up as a frequent concern in the workshops.

Scenarios apply a systems approach, which helps to consider factors that may be outside of the facilitator’s discipline. We found, for instance, that workshop participants envisioned futures where there is widespread family planning education, particularly surrounding schools. They highlighted the need to develop a code of contractors for the use of child labour or sexual workers, and collaboration with health and other departments at county level. They also called for more community health workers and new upgraded health clinics close to railways.

12.7.3 Inadequate compensation

Some respondents (e.g. in Kitui-Meru) were satisfied with their relocation compensation

for the land acquisition of the SGR. They felt the price was fair relative to the value of the land, it “uplifted livelihoods”, and led to the growth of areas such as Voi, Mtito Andei and Emali. Others (e.g. beach management committee and community forest user groups in Mombasa, or pastoralists in Taita Taveta) argued that locals did not receive full compensation for losses. Staff of regional offices in Kibwezi of the Kenyan Forestry Research Institute, whose tree research plots were destroyed to make way for the railway indicated they were not consulted, although this may have occurred at headquarter levels and they received inadequate compensation. Other damages were reported in our research, such as flyovers blocking people from accessing their personal land, schools, market centres and water points, and destroyed water pipes, among others (Fig. 12.9), (Government of Kenya 2018). In addition, compensation did not consider the impact of relocation on the social ties. That is, forced relocation severs social capital, that is, the resources that are embedded in social networks, which can be particularly important in situations of vulnerability where they are used in cost-saving measures, as a form of social insurance or to supplement livelihoods. Respondents were concerned about the erosion of indigenous and other cultural identities, as people move away from rural homestead. The Nairobi National Park EIA did not include a complete Resettlement Action Plan prior to construction, including an estimation of the number of people living adjacent to the railway to be affected by each alternative, mitigation measures, and costs for implementation (Kenya United Against Poaching Trust 2019). Although the Kenya Railway Corporation contracted two consultancies (Ecoplan Management and Earthscope Survey Services) to prepare the Resettlement Action Plan for phase IIA, the EIA was not provided prior to construction, which is illegal. This caused substantial conflict with the surrounding communities.

Scenarios can practically develop strategies and partnerships to overcome such unintended consequences. For instance, our scenario workshops emphasised the importance of the Ministry of Culture working with the National

Lands Commission to actively promote local languages and maintain cultural heritage. Scenarios also emphasized the importance of providing training to local communities, so

windfall profits are not squandered. Interviewees emphasized that compensation prices should be negotiable and reflect local market value, following an independent assessment.

Figure 12.9 (a) Cracks in Kathekani Secondary school from construction; (b) collapse of SGR embankment due to heavy rains in Makeni. Construction blocked several rivers, formed gullies, increased flooding and destroyed roads from rising surface runoff (e.g. Kawese River in Makeni county, Darajani water pan in Mito Andei, Kibwezi East, Emali town, Mang'elele wetland, Kiboko spring); (c) Mang'elele quarry sites left unrehabilitated; (d) farmlands lost from the dumping of waste, and mango and banana trees and beehives severely affected by dust at the Mang'elele quarry site area.



Source: Kenyans United Against Poaching Trust 2018; Government of Kenya 2018.

12.7.4 Timing of the release of EIAs and construction was mismatched and relied on outdated laws

Despite being a compulsory requirement for all development projects before they can proceed, construction activities took place before EIA licenses were issued, contravening the Environmental Management and Conservation Act 1999. Specifically, Kenya Railway Corporation and China Road and Bridge Corporation began construction at the Ngong Tunnel commenced in May/June 2016, but the EIA for phase IIA was released at the end of October 2016.

The same situation took place in Nairobi National Park, where the route was finalized, and construction had started without conducting an EIA. This led the National Environment Tribunal issuing a stop order to prohibit any activities related to phase IIA from being conducted until the matter was heard in court. However, on 20 October, the construction of the phase IIA began, despite this order being in place (CORDIO 2019). A response by opponents of this stated: "This begs the question

whether the EIA was a simple afterthought to justify actions already taken” (Kenyan United Against Poaching Trust 2018, p. 2).

A third example was in Mombasa, where the South Coast Residents Association, National Environmental Civil Society Alliance of Kenya with the natural resource network appealed against a license NEMA/EIA/PRS/1581, which was issued to China Road and Bridge Corporation by National Environmental Management Authority twice: in May 2015 and February 2017. They argued the EIA was illegal because the National Environmental Management Authority went ahead with issuing a license to China Road and Bridge Corporation to harvest the sand in Likoni without undertaking an EIA. The timing of the EIA came in too late to alter ongoing project implementation. It also went against Article 69 of the Constitution of Kenya 2010 in respect of the environment and public participation in the management and conservation of the environment. In an unprecedented ruling, the court ordered that an underwater survey be conducted to identify the species and the ecosystems that might be affected and how

this would be mitigated (Environmental Justice Atlas 2017). At the time of the report, authors were not certain whether this survey had been conducted.

Beyond inappropriate timing, other EIAs relied on some repealed laws, such as the Forests Act of 2012, which was repealed by the Forest Conservation and Management Act of 2016. EIAs also relied on the East African Railways Master Plan, which has not been updated since 2009.

To overcome these challenges, scenarios are useful for getting on board the relevant expertise to ensure plausible impacts are anticipated and mapped out. Our workshops indicated the need to improve governance oversight mechanisms and the influence of civil society. Without transparency and enforced legal frameworks, other sectors of society would be adversely impacted, such as education and health, or poor substandard infrastructure projects and ecological harm. A scenarios approach allows the safe exploration of these alternatives.

12.8 Conclusions: scenarios as tool for strategy development in EIAs and SEAs

Using the case of the SGR development corridor in Kenya, this paper reviewed the extent to which EIAs comprehensively identified the likely impacts, mitigation measures and how participatory scenario planning could be used to overcome common omissions in EIAs, and SEAs more broadly. Clearly, the current application and engagement in the EIA process is not fit for purpose. Part of this challenge comes from the speed of all phases of infrastructure developments such as the SGR, where construction and ambition is operating at a high pace to tight timetables. The application of participatory scenario planning and the ensuing divergent land use futures can play an important role in EIAs and SEAs in identifying pathways to transition from a linear transport corridor, into a much more wholesome, futures-oriented development corridor aligned to longer sustainability visions. Scenario planning has the potential to

look at ways that infrastructure corridors can be truly defined as development corridors by exploiting their multifaceted opportunities. We therefore recommend that scenarios are applied more widely for strategy development in both EIAs and SEAs for development corridors in Africa and indeed, worldwide.

Yet, limitations remain. Currently, we have little evidence on how effective participatory scenario planning insights have been in changing people’s decision-making processes. Moreover, few actors operating in the infrastructure value chain routinely use participatory scenario planning (e.g. government agencies issuing tenders, private companies or banks) so there is a need to scale understandings of why and how to apply scenario typologies (Thorn *et al.* 2020). Although participatory scenario planning can take at least a few months to be done well, individuals

only need to engage in this for a few days to explore the divergent options. Yet, even a few days can limit the number of high-ranking officials who become involved in the process. Finally, bringing together a diversity of stakeholders with competing interests can trigger conflicts, and facilitators need to be trained to manage inherent power dynamics (Oteros-Rozas *et al.* 2015).

Therefore, although more research is needed, evidence is mounting that adopting a scenario planning within environmental assessments can ensure decision space is opened to allow maximum benefit to reach a wider selection of the population and avoid unintended consequences of the current operation. Considering the benefits of scenario planning in terms of potential insights and avoiding consequences of poor futures planning, it is relatively low-cost. While the

use of scenarios in phases I and II in Kenya of the SGR would be late, we encourage the application of scenario analysis as early in the design process as possible, as the SGR is extended to Uganda, Rwanda and beyond, or indeed other similar linear infrastructure investments (e.g. ports, roads). This more active planned approach to investigating the consequence of linear infrastructure will go a long way to realizing wider sustainable development goals through Vision 2030, especially goals 9 (industry innovation and infrastructure), 11 (sustainable cities), 12 (responsible production and consumption) and 15 (life on land), as well as 3, 4, 8 and 13. This potential will depend on how willing governments, developers and financiers are to embrace participatory scenario planning procedures and act on findings.

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Appendix 1. Key omissions in EIAs and mitigation pathways suggested in scenario workshops and key informant interviews

Results suggest major evidence showing that the EIAs are based on incorrect or insufficient information

No	Key omission	What was addressed	No data to estimate impacts	Mitigations identified in scenarios	Sources
1	Size and severity of the effect zone of the SGR was under-represented	- vegetation lost below the viaducts	- total area of usable habitat and species lost - impacts on different land uses (e.g., grassland, shrubland) - impacts on different topography, water availability, vegetation growth due to shading, invasive species - edge effect inadequately estimated to impact only one direction - changes in animal behaviour, with most animals staying to the southern side of SGR	- bundle infrastructure in same corridor	Van der Ree <i>et al.</i> 2016; Laurance 2015; Laurance <i>et al.</i> 2015a; 2015b

2	No detailed consideration of future greenhouse gas and other emissions	<ul style="list-style-type: none"> - reduced emissions associated with large vehicular movement - combustive product emissions (nitrogen oxides, particulate matter, carbon dioxide) - exhaust and fugitive emissions 	<ul style="list-style-type: none"> - long term emissions of GHG v. diesel engines - embedded carbon costs including construction materials - dust emissions levels on mangroves - detail of pollution of gas and smoke on vegetation 	<ul style="list-style-type: none"> - need to address national issues in intermittent electricity supply - adhere to Air Quality Regulations of 2008 - need for fuel efficiency and management 	Kipyegon et al. 2019
3	Vague descriptions of how railway infrastructure can withstand climate change	<ul style="list-style-type: none"> - build large bridges with a flood frequency between 1/100-1/300 event/ years - install drainage channels - design culverts to withstand severe storms and shoreline corrosion 	<ul style="list-style-type: none"> - No consideration of climate change adaptation - Embakasi Access Report made no mention of climate change - For example, in phase I there were some cases of collapsed embankments in Makeni county 	<ul style="list-style-type: none"> - gully rehabilitation - water harvesting structures - coastal storm surge barriers - nature-based solutions - behavioural change 	Habitat Planners 2019
4	Lack of detail about construction activities	<ul style="list-style-type: none"> - noise from the operation of the railway - an explosive and blasting management plan 	<ul style="list-style-type: none"> - generation of noise during construction activities (e.g., campsites, quarries, crushing plants and batching plants) - did not specify local materials would be sourced and by 2015, China Road and Bridge Corporation had imported most materials from China 	<ul style="list-style-type: none"> - maintaining close communication with surrounding communities to restrict disruptions - watering roads - minimising vibrations 	Sanghi and Johnson 2016; KUAPO Trust 2018
5	Lack of detail about waste management	<ul style="list-style-type: none"> - vague descriptions of mitigation measures to manage pollution, effluent treatment, and waste oil facilities 	<ul style="list-style-type: none"> - lack of information of location, processes, disposal and managing contaminated soils and waste oils from SGR 	<ul style="list-style-type: none"> - rehabilitate quarry sites - use waste to generate biogas - monitoring pollution - ensure waste management responds to population growth 	Sanghi and Johnson 2016; KUAPO Trust 2018

6	Railway embankments inappropriately located and too low	<ul style="list-style-type: none"> - embankments - building underpasses 	<ul style="list-style-type: none"> - inappropriately located in Emali and elsewhere cut through water, livestock markets and traditional homesteads, breaking up family land - diminished the dispersal wildlife living in Mbagathi Riverine Dispersal Corridor - road collisions along embankments of elephants and giraffes increased along Mombasa highway not adapting behaviour by moving under underpasses but avoid them 	<ul style="list-style-type: none"> - systems view identifies that the costs will cause external losses - install more underpasses and overpasses - more in depth study prior to identifying locations of underpasses 	Okita-Ouma <i>et al.</i> 2016; Okita-Ouma <i>et al.</i> 2017; Koskei <i>et al.</i> , 2018; KUAPO Trust 2017
7	Illegal offshore sand dredging for SGR Port Reitz Cargo terminal construction from shoreline	<ul style="list-style-type: none"> - sand harvesting of 19-50m or 400m-3km from the shoreline along a 0.4-1km strip (800,000 m³) 	<ul style="list-style-type: none"> - impact on livelihoods of deep-sea and shallow fishermen, divers, wildlife managers, and hoteliers' livelihoods - impact tourism industry from removal of beach sand - marine contamination of heavy metals from the mud dumped off Likoni (Mombasa) up to Tiwi (Kwale) - impact of coastal dredging on fragile reefs, beaches, tidal hydrology, benthic and bottom marine ecology 	<ul style="list-style-type: none"> - restoration and rehabilitation measures of degraded coastal sites and ecosystems - adhere to international standards of sand harvesting which is between 5-10 km from the shoreline 	Musyoka 2016; EJA 2017; Obura 2019
8	Routing through 35 km stretch of the Oloolua Forest and the drilling of a 3.75km tunnel in Ngong hills (25.25ha)	<ul style="list-style-type: none"> - impacts of communities, water quality and flow, forest structure, composition, and diversity, traffic - potential benefits of the movement of farm forestry products, by reducing travel time to markets - restoring soil structure and reducing compaction 	<ul style="list-style-type: none"> - mixes the terms afforestation and reforestation (or uses the terms interchangeably) - does not specify the need to use indigenous (except in the case of Ngong) - does not specify the need to use drought tolerant species - no proposals for biodiversity or carbon offsetting where natural irreplaceable features could not be restored once affected by development 	<ul style="list-style-type: none"> - avoiding clearance and disturbance - enforce Forest Act of 2005, Environmental Management and Coordination Act 1999, Forests: OP/ BP 4.36 - apply mitigation hierarchy of avoid, minimise, mitigate and offset 	KUAPO Trust 2017; CORDIO 2020; Conservation Alliance 2018

9	<p>Limited consideration of impacts on critical mangroves ecosystems</p>	<ul style="list-style-type: none"> - impacts on indigenous and sacred forests and their importance for coastal protection, riparian stabilization, religious value, non-timber forest products, water regulation, and habitat connectivity - culverts constructed so seawater could continue to flow normally to mangrove areas 	<ul style="list-style-type: none"> - mangrove growth, birds and other species was adversely impacted by dust deposition from construction - impact on transportation of materials along subsidiary roads constructed close to mangrove nurseries and river sedimentation - impacts on coastal erosion, mangrove ecosystem functioning, carbon sequestration and air filtration 	<ul style="list-style-type: none"> - involvement of beach management units - awareness raising - nursery construction 	<p>Kipyegon <i>et al.</i> 2019</p>
10	<p>Omission of human wildlife conflict</p>	<ul style="list-style-type: none"> - railway fenced all along route - security improved especially adjacent to protected areas - anti-collision nets installed to control the crossing of wildlife (especially elephants, giraffes, and buffalos) - raising the track to 40m with viaducts and bridges 	<ul style="list-style-type: none"> - escalated conflict in pastoral communities living next to Nairobi National Park, Tsavo National Park and in Suswa - rise in compensation claims after the SGR was built - rise in human, wildlife and livestock deaths associated with human wildlife conflict - poaching 	<ul style="list-style-type: none"> - light deterrents - mechanisms to fund compensation claims - alternative livelihoods and insurance mechanisms and reduce inequality - improve intercultural interactions - good governance, avoid land grabbing adjacent to the railway, and reduce encroachment - establish long term habitat management and monitoring plans 	<p>Okita-Ouma <i>et al.</i> 2017; Xinhua 2019</p>
11	<p>No consideration of alternative routes outside protected areas or critical habitats</p>	<ul style="list-style-type: none"> - seven routes within the national park 	<ul style="list-style-type: none"> - routing inside Nairobi National Park - routing through migration route of Tsavo Conservation Area - repercussions on brand image of Kenya as a wildlife destination - impacts on dispersal corridors 	<ul style="list-style-type: none"> - working with local communities to establish woodlots - create a mitigation fund for the benefit of local communities which have lost critical ecosystems 	<p>KUAPO Trust 2017; CORDIO 2020; Conservation Alliance 2018</p>

12	EIAs did not apply the precautionary principle	NA	-precautionary principle was not applied, and so various actors appealed to National Environmental Management Authority calling for the precautionary principle to be applied to avoid irreversible damage	-scenarios address uncertainty - scenarios help to design alternative options in view of multiple possible futures	Conservation Alliance 2018; KUAPO Trust 2017
13	Insufficient consideration of long term expansion of the SGR and land use change	-an end-station, hemmed in between high value assets of the city, was not suitable for a transit railway station	- how land use change, the Nairobi Metropolitan Area proposed development plans, human settlement patterns and how the SGR would likely blend into the surrounding	- consider the equitable sharing of benefits of future generations who could bear the cost of this investment - decision makers use spatially explicit land use models	KUAPO Trust 2017
14	Insufficient consideration of redundancies or impacts on other non-skilled livelihoods	- strategic execution team put in place to monitor pre-emptively adverse impacts - business opportunities for small-scale traders such as food vendors around construction sites - taxi businesses and tourism benefits from more passenger capacity, reduced commuting costs, local/international activities - shipping agencies benefit from ferrying cargo directly from the Mombasa Port to the Nairobi Inland Container Depot	-redundancies from closure of businesses, job losses for loaders, drivers, mechanics, roadside businesses, clearing and freight agents, shop attendants, warehousing businesses in container freight - accommodations could be closed due to less bus passengers and truck drivers along Mombasa-Nairobi Highway - farmers could be affected from the dust from construction	- secure local livelihoods - consider local content and skills - buy from local private companies - China Road and Bridge Corporation has a concrete plan to build capacity	Ogallah <i>et al.</i> 2019

15	Cost benefit analyses did not include environmental and ecosystem service costs	- NA	<ul style="list-style-type: none"> - route option in Phase IIA did not include any elements of ecosystem service valuation - no cost comparison analysis to value to protected area land or the broader impacts on ecosystem services the Nairobi National Park provides - potential impact on national park visitation numbers potentially detracting from their experience with repercussions on the revenue of the park 	<ul style="list-style-type: none"> - Scenario analysis can be issued this context to look at the ecosystem service impacts - to assess the relative cost in all routes - land use development plans and zoning for the built environment protecting national parks 	KUAPO Trust 2017
16	Excessive indebtedness	- scheduled debt process	<ul style="list-style-type: none"> - scenarios to pay back the return on investment and debt - public perceptions on the acceptability of national debt and potential threats to national sovereignty and asset capture 	<ul style="list-style-type: none"> - conduct a sound economic analysis of scenarios of the revenue generated into the next 20 years 	IOL Business Report 2018; Cardomy <i>et al.</i> 2021
17	Unclear compensation processes	<ul style="list-style-type: none"> - compensation for land acquisition - community representatives - grievance redress system 	<ul style="list-style-type: none"> - unclear process of compensation process - consideration of the impact of land acquisition on local social ties, indigenous cultural identity, and language - Nairobi National Park EIA complete Resettlement Action Plan prior to construction, including an estimation of the number of people living adjacent to the railway to be affected by each alternative, mitigation measures, and costs for implementation 	<ul style="list-style-type: none"> - Ministry of Culture works with the National Lands Commission to actively promote local languages and culture - provide training to local communities so windfall profits are not squandered - compensation prices should be negotiable and reflect market value 	Government of Kenya 2020; KUAPO Trust, 2018

18	Selective and rushed participatory consultations	<ul style="list-style-type: none"> - community engagement officer - engagements over 1.5 years with community meetings, media, and other fora 	<ul style="list-style-type: none"> - perspectives various stakeholders (e.g., community forest user groups, pastoralists) not engaged - ratio to community liaison officers and populations is low - information was not provided beforehand for participants to interpret and understand the route - critical feedback from conservation NGOs excluded 	<ul style="list-style-type: none"> - provide information beforehand for participants to interpret and understand the route - effective communication from grassroots to institutional level - increased ownership and participation from stakeholders 	Conservation Alliance 2018; KUAPO Trust 2017
19	Lack of mitigation measures for sexually transmitted diseases	<ul style="list-style-type: none"> - voluntary counselling - testing workers and surrounding communities - encouraging construction staff to use contraceptives - Kenya Railway Corporation refurbished health care centre in Voi and elsewhere - education bursaries 	<ul style="list-style-type: none"> - likely spread of HIV from construction workers - no measures to manage the rise in prostitution - no mention of the rise in teenage pregnancy 	<ul style="list-style-type: none"> - family planning education especially in surrounding schools, and health clinics - develop a code of contractors for the use of child labour or sexual workers - raise awareness in schools of pregnancy and contraception - collaboration with health and other departments at county level 	McGrath 2003
20	Timing of the release of EIAs mismatched to the timing of construction	<ul style="list-style-type: none"> - civil society use of the court to appeal against the issuing of licenses 	<ul style="list-style-type: none"> - EIA license release after construction of Ngong Tunnel - EIA license release after construction of Nairobi National Park construction began - The timing of the EIA came in too late to alter on-going project in Likoni sand harvesting 	<ul style="list-style-type: none"> - EIA be issued before construction begins to be able to alter actions taken - improve governance oversight mechanisms and the influence of civil society - scenarios are useful for getting in board the relevant expertise to ensure plausible impacts are anticipated 	CORDIO 2019