

An International Strategy for Sustainable Linear Infrastructure: Stakeholder Engagement

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AUTHORS

- Anders Sjölund, Swedish Transport Administration, Borlänge, Sweden.
- Andreas Seiler, Swedish University of Agricultural Sciences, Grimsö Wildlife Research Station, Sweden.
- Antonio Mira, University of Evora, Portugal.
- Carme Rosell, Minuartia, Barcelona, Spain.
- Cristian Remus (Cristi) Papp, Wildlife and Landscape National Manager, WWF Danube Carpathian Programme Romania, Bucharest, Romania.
- Elke Hahn, Federal Ministry of Transportation, Innovation and Technology, Vienna, Austria.
- Fiona Mathews, Professor of Environmental Biology, University of Sussex, NERC Knowledge Exchange Fellow, Chair of the Mammal Society, University of Sussex, Falmer, UK.
- Fraser Shilling, Road Ecology Centre, University of California, Davis, USA.
- Hans Bekker, Retired (Department Public Works; Dutch Ministry for Transport and Water Management), Netherlands.
- Hildegard Meyer, Project Manager, WWF Central and Eastern Europe, Vienna, Austria.
- Jose Rafael Garrido López, Environmental and Water Agency, Regional Government of Andalucía, Spain.
- Juliana Moreno Pina, Environmental Analyst, Licensing Department at the São Paulo State Environmental Agency – CETESB, São Paulo, Brasil
- Kate Newman, WWF-USA, Washington, US.
- Kishaylin Chetty, Biodiversity Center of Excellence, Environmental Management, Sustainability Division, Eskom, Johannesburg, South Africa.
- Lazaros Georgiadis, Biologist – Environmental Consultant, Florina, Greece.
- Lourens Leeuwner, Wildlife and Energy Programme, Endangered Wildlife Trust, Johannesburg, South Africa.
- Margarete Trocmé, Federal Roads Office (FEDRO), Federal Department of the Environment, Transport, Energy and Communications (DETEC) Switzerland.
- Marita Böttcher, Federal Agency for Nature Conservation (BfN), Leipzig, Germany.
- Radu Mott, Association Zarant, Brasov, Romania.
- Rob Ament, Center for Large Landscape Conservation, (IUCN/CCSG/TWG), Montana, US
- Rodney Van der Ree, Ecology and Infrastructure International Pty Ltd, Melbourne, Australia.
- Sandro Bertolino, Department of Life Sciences and Systems Biology, University of Turin Torino, Italy.
- Sarah Chiles, Ewaso Lions and Grevy's Zebra Trust, Kenya.
- Tony Sangwine, Highways England, Bristol, UK.
- Vaclav Hlavac, Nature Conservation Agency, Prague, Czech Republic.
- Wendy Collinson, Wildlife and Transport Programme, Endangered Wildlife Trust, Johannesburg, South Africa.
- Xiaochun Qin, Associate Professor, Department of Road and Railway Engineering, Faculty of Civil Engineering, Beijing Jiaotong University, Beijing, China.
- Yannick Autret, Ministry of Ecology, Sustainable development and Energy, Paris, France.
- Yun Wang, Research Center for Environment Protection and Water and Soil Conservation, China Academy of Transportation Sciences, Beijing, China.

ABBREVIATIONS

ACLIE:	African Conference for Linear Infrastructure and Ecology
ADB:	Asian Development Bank
AIIB:	Asian Infrastructure Investment Bank
ANET:	Australasian Network on Ecology and Transportation
AVC:	Animal Vehicle Collision
CBD:	Convention for Biological Diversity
CEDR:	Conference of European Directors of Roads
CIBIV:	Congreso Iberoamericano de Biodiversidad e Infraestructura Viaria (Latin American Congress of Biodiversity and Road Infrastructure)
COP:	Conference of Parties
EBRD:	European Bank for Reconstruction & Development
EIA:	Environmental Impact Assessment
EIB:	European Investment Bank
EU:	European Union
GIB:	Global Infrastructure Basel
ICOET:	International Conference on Ecology and Transportation
IDB:	International Development Bank
IENE:	Infrastructure and Ecology Network Europe
IGELI:	International Guidance for Ecologically-Friendly Linear Infrastructure
IUCN:	International Union for Conservation of Nature
LI:	Linear Infrastructure
LTI:	Linear Transport Infrastructure
NGO:	Non-Governmental Organization
OECD:	Organization for Economic Co-operation and Development
PIARC:	Permanent International Association of Road Congresses (the World Road Association)
PIANC:	Permanent International Association of Navigation Congresses (The World Association for Waterborne Transport Infrastructure)
SEA:	Strategic Environmental Assessment
UN:	United Nations
USA:	United States of America
WWF:	World Wildlife Fund
....:

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(source: Global Biodiversity Outlook 4, 2014)

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FOREWORD

“An International Strategy for Sustainable Linear Infrastructure; Stakeholder Engagement” provides an introduction to linear infrastructure and sustainability; it is, about connecting people with wildlife in a global framework of dynamic, economic development during a period of global concern for biodiversity loss and the climate change. Transportation authorities, energy companies, water boards and other public service provider organisations that deal with planning, construction, operating, use and maintenance of linear infrastructure and civil works are providing remarkable, and often high services for society. We expect safe, reliable and efficient services for general day-to-day living, performing our work duties, enjoying comfortable and safe housing, as well as the protection against natural impacts, such as flooding and avalanches. Civil engineers, bookkeepers, decision makers and politicians are all a part of this service and process.

Negative impacts to our environment, nature, wildlife and the landscape are becoming more apparent, as our expectations and needs of the key service providers increase – but at what cost to biodiversity? The drivers for healthy abiotic and biotic wildlife are infected by our needs, but avoiding and mitigating of such effects are proven possible.

Two examples:

- ✓ In some cases, road verges and embankments of infrastructure can serve as refuges for specific species of flowers and insects but are often neglected when a road is designed and built. Through better design and maintenance of these refuges, we can increase the value of such spots over many hundreds of thousands of kilometers around the world.*
- ✓ Watercourses are crucial for numerous wildlife species either as a refuge or sustenance; however, often road salter these water courses resulting in instability for the surrounding ecosystem. Positioning and design of bridges and culverts for watercourses is therefore important for the water management, not only for the stability and safeness of roads but also for the connection between species reliant on wet habitats.*

These examples from nature should be part of an inclusive-thinking process during the planning, design and maintenance stages of linear infrastructure – particularly with regard civil engineering aspects. Not only is this important, but it can assist in the transition to a more sustainable infrastructure. This means that nature and nature-based solutions are acritical component of the overall design of infrastructure; similarly, civil engineering helps to protect, minimise and stimulate nature and natural processes and can be a plus for biodiversity. Each of the two disciplines is not able to survive without the other.

*Hans Bekker
Eco-engineer
Former program manager Department Public Works
Dutch Ministry Transport and Water Management
The Netherlands*

INTRODUCTION

1.1 Why this Strategy

Linear Transport Infrastructure (LTI; which includes roads, rail, power lines, pipelines, canals, and fencing) provides crucial services for people's mobility needs and the transportation of goods, as well as being necessary for the well-being and prosperity of societies. Nevertheless, beside intensive agricultural land-use and urban expansion, LTI is a major cause of fragmentation of natural ecosystems and biodiversity decline worldwide (*Canters et al 1997, Trochme et al 2002; Forman et al 2003; Sherwood et al 2003; Van der Ree et al 2015*). Inevitable habitat loss and the negative direct impacts can extend for kilometres on either side of the structures and can continue to impact ecosystems for years, affecting their services across the landscape. Beside these hidden (and often long-lasting) impacts, the most obvious (and visual) impact of many LTIs is human safety, particularly when a collision with an animal occurs (i.e. an animal vehicle collision, AVC); this can have further demographic consequences for wildlife, through the barrier effect. Other Linear Infrastructure (LI), such as power lines are one of the major causes of unnatural deaths for birds worldwide due to electrocution; this is especially in landscapes without tall trees and cliffs, where towers and poles are attractive perches and roost sites. Both low to medium voltage distribution lines and medium to high voltage transmission lines present a near invisible flight barrier at various flight heights and collisions with conductors and shield wires are well documented.

The demand for LTI such as roads, railways, navigable channels, waterways, power lines and pipelines, has increased globally, while the loss to biodiversity accelerates; this creates conflict between economic development and nature conservation. For example, the indicative quantity of demands on global road construction is enormous; currently there are 64 million km of paved roads on the planet (enough for 83 round-trips to the moon), with an additional 25 million km planned for construction by 2050. An alarming 90% of these will be in non-OECD countries (*Dulac 2013*).

Approximately 80% of the Earth's terrestrial surface remains roadless, although this area is fragmented into ~600,000 patches, of which more than half are surfaces that cover less than 1 km² with only 7% covering areas larger than 100 km². Consequently, global protection of ecologically valuable roadless areas is inadequate (*IENE 2014, Ibisch et al 2016*), and this is further compounded by lack of investment in preventing AVCs, especially when transport corridors intersect ecological corridors without the appropriate mitigation measures. Moreover, high-speed motorways and railways are often fenced and this leads to further fragmentation of wildlife populations through the establishment of insurmountable barriers.

A further example of LTI impacts is power lines, and despite several mitigation options and bird friendly designs being available, power utilities are not always willing to apply these solutions due to cost or other design criteria. In some instances, utilities may ensure that all new infrastructure is constructed in a bird friendly manner however historic, bird-unfriendly infrastructure remains a challenge. Contrary to popular belief, placing power lines underground is significantly more costly than above ground installations and poses a major safety and maintenance challenge to utilities. The only viable solution is the mitigation and

retrofitting of current above ground infrastructure as well as ensuring that all new electrical infrastructure is installed with avian impacts in mind.

LTI, as a main cause of habitat fragmentation, has both primary and secondary effects on nature (Iuell et al 2003; Van der Ree et al 2015) as described in Table 1. Additionally roads and rail have been singled out as generating intense natural selection pressures that have important consequences for population conservation, through altering the landscape and the genetic flow, as well as the overall evolutionary processes of certain species (Brady et al 2017; Chapron et al 2019). Of greater concern, much of these infrastructures will occur within and around areas currently managed for biodiversity and ecosystem service values, thereby undermining past, current and future conservation investments. Recognizing the importance of ecological connectivity a defragmentation approach has already started to implemented in Western Europe (IENE 2018) like the 15 years national defragmentation project of the Netherlands¹.

Table 1: Primary and secondary effects on nature due to LTI (based on Iuell et al 2003)

Primary effects on nature due to LTI	
1	Loss of wildlife habitats as considerable surface areas are occupied LTI structures. Parallel supportive infrastructure (such as operation facilities, logistics etc.) further create a wider zone of occupation in natural areas.
2	Barrier effects for both local and migratory species populations negatively influence their natural movements. This increases genetic isolation, and can be a contributory factor for extinction of Endangered species.
3	Faunal casualties resulting from collisions between transport and wildlife (AVC). This has multiple costs, primarily to humans (for example, damage to vehicle, medical treatment, closure of road, etc.) as well as impacts on animal populations.
4	Noise disturbance and air pollution resulting from LTI and its associated users can influence zones on a wider scale than the land they occupy.
5	The ecological function and the value of verges (i.e. the edges of LTI development), is often rarely considered (IENE 2016). These microhabitats are important refuges for numerous flora and fauna species; however, they can be ecological traps and be causes for roadkill, or also harvest and aid the spread of alien, invasive plant species.
Secondary effects on nature due to LTI	
1	Resulting changes in the landscape are often not addressed with the development of an LTI; for example with a new road, urbanisation, human settlements, local access roads are often secondary developments. These are major land use changes.
2	LTI, whilst improving access and improved livelihoods, often create disturbance to areas previously inaccessible. Hunting, poaching and tourism are all examples of access to otherwise undisturbed wildlife habitats.
3	Negative landscape ecology perspectives in longer time and larger geographical scale as permanent linear intervention in important natural landscapes.

¹ <https://www.mjpo.nl/english/>

In a climate change framework, water management will become more critical than it is currently, and ensuring appropriate water levels in both navigable channels and natural aquatic systems close to LTIs is a challenge. Achieving a balance between the planning, construction and maintenance of resilient and safe LTI, and efficient water management should therefore be an important global demand of future generations.

Addressing these conflicts is especially important for developing countries where species richness is usually greater and more diverse than more developed countries; developing countries face intense pressure and demand for economic development, with little measures to mitigate the negative impacts. For example, the building and re-opening of roads crossing preserved areas in South America, for example, the Brazilian Amazon², Iguassu National Park³ and Peruvian Amazon⁴. By comparison, in developed countries a dense network of LTI and biodiversity requires extensive and comprehensive ecological mitigation.

In order to achieve the Aichi Biodiversity Target 5:

By 2020, the rate of loss of all natural habitats and degradation and fragmentation is significantly reduced”,

reducing habitat loss, fragmentation and degradation has become an urgent issue and a challenge to be tackled worldwide. At the same time, mainstreaming biodiversity in energy, mining and infrastructure development, has been a major goal in the framework of the CBD to achieve Aichi Biodiversity Targets (*Convention on Biological Diversity 2018*).

According to the evaluation of Target 5 on habitat loss, in the Global Biodiversity Outlook 4⁵, the summary of the progress towards achieving the target, the habitats’ degradation and fragmentation reduction is still in negative trends (see 3rd diagram in Figure 1). Furthermore, the Global Biodiversity Outlook 4, states that actions to enhance progress towards Target 5 (and other targets), if more widely applied are connected with:

- Identifying at the national level the direct and indirect causes of habitat loss with the greatest impact on biodiversity, to inform policies and measures to reduce loss;
- Developing a clear legal or policy framework for land use or spatial planning that reflects national biodiversity objectives (Target 2); and,
- Aligning existing incentives to national objectives for land use and spatial planning, and, the use of further incentives to reduce habitat loss, degradation and fragmentation, including as appropriate, payments for ecosystem services and REDD⁶ mechanisms (Target 3);

Despite the clear reference to “fragmentation” as a concern with a negative trend towards finding effective solutions, there is still no connection between concrete development activities and general references to LTI.

² <https://www.theguardian.com/environment/2018/oct/09/brazils-bolsonaro-would-unleash-a-war-on-the-environment>

³ <https://www.wwf.org.uk/updates/soy-highway-threatens-world-heritage-site>

⁴ <https://news.mongabay.com/2019/08/new-road-risks-pandoras-box-of-disruption-in-worlds-most-biodiverse-national-park-commentary/>

⁵ <https://www.cbd.int/gbo4/>

⁶ *Reducing emissions from deforestation and forest degradation

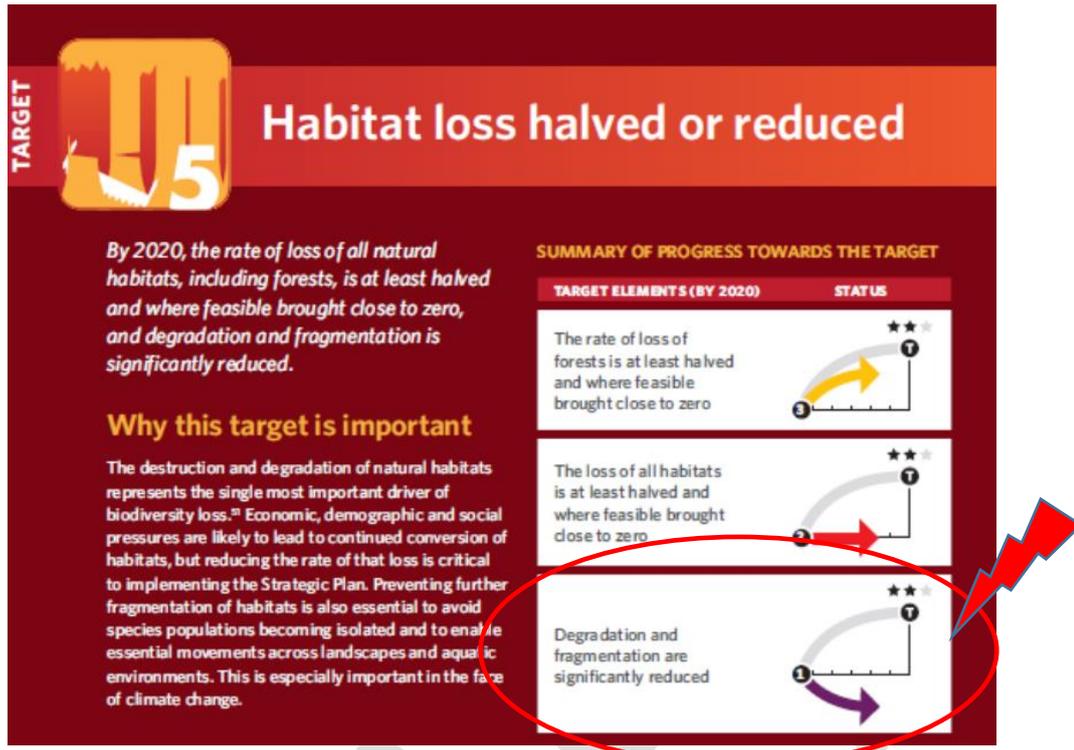


Figure 1: Summary of the progress towards achieving the target 5 of CBD Aichi Targets (source: Global Biodiversity Outlook 4, 2014)

This *International Strategy for Sustainable Linear Infrastructure; Stakeholder Engagement*, hereafter called the Strategy, addresses the important players and their vital role in launching proactive policies, establishing appropriate, legal frameworks, supporting better LTI planning, promoting multi-sector cooperation and encouraging innovative science-based solutions on resilient LTI. The main deliverables of the Strategy include:

1. The aims, the principles and an overall framework of groups that must be involved as key stakeholders; and,
2. An outline action plan that includes concrete direction of actions towards achieving concrete outputs in the next decade (2020-2030).

The main approach of the Strategy is the “joining forces” of different target groups at all levels of LTI development; these include the main stakeholders such as the policy makers, agencies/authorities working in construction, operations and maintenance of LTI, as well as government ministerial staff, and/or private or public LTI companies.

1.2 Who we are

We are an international coalition formed from a variety of organisations and sectors. We are primarily representatives from the global LTI conferences and conservation organisations (namely, IENE, ICOET, ANET, ACLIE, WWF, IUCN, ...), but not limited to this arena. Our team is drawn from global experts in ecology and LTI with the aim to work towards finding a ‘win-win’ solution for LTI and ecology; this will be achieved through an increase in ecological connectivity during LTI development as well as consideration for avoiding and/or reducing fragmentation of populations and habitats as much as possible.

Our Strategy builds upon previous cooperative efforts to develop the guidelines: International Guidance for Ecologically-Friendly Linear Infrastructure (IGELI). These guidelines and collaboration first commenced at ICOET 2015 (Raleigh, North Carolina, USA) with discussions continuing at further workshops held at IENE (Eindhoven, Holland 2018), ICOET (Salt lake City, USA, 2017), IUCN (Hawaii, USA, 2016) and ACLIE (Kruger National Park, South Africa, 2019).

A workshop held at ACLIE 2019 in Kruger National Park, South Africa (*Georgiadis et al. 2019*) initiated plans to develop the Strategy. Co-ordinated by IENE, an international working group was established with a view towards promoting the Strategy at the CBD COP 15 in Beijing (October 2020), as well as ICOET (Sacramento, USA, September 2019). Participants at the ACLIE workshop agreed to develop an international roadmap that would identify and engage different stakeholders as basic players on mainstreaming biodiversity on sustainable LTI development by integrating the environmental, social and economic components.

Further outcomes of the workshop also summarised the Decision 14/3 on mainstreaming of biodiversity in the energy and mining, infrastructure, manufacturing and processing sectors⁷ (CBD/COP/DEC/14/3/30 November 2018) of 14th COP CBD (Sharm El Sheikh, Egypt, Nov 2018) (*Convention on Biological Diversity 2018*).

METHODOLOGY

The Strategy was developed in four stages following four questions, which are outlined in more detail below:

1. **How** to develop our Strategy? (**step 1: Bibliography search**)
2. **What** will be the objectives of the Strategy? (**step 2: Determining the framework of the aim and objectives of the Strategy**)
3. **Who** will be engaged and **why**? (**step 3: Identification of the relevant stakeholders**)
4. **How and when** the players should be engaged? (**step 4: The Action Plan**)

Step 1: Bibliography search

Following a comprehensive search of the available bibliography and of several online sources, the development of the Strategy considered the relevant actions required to engage stakeholders in projects and plans connected with biodiversity, nature conservation, business and LTI development (*AccountAbility 2015, BSR 2019, Cariani in ENAIP Veneto CERlecon project – CE119, Durham et al 2014, Jeffery 2009, GIB 2017, International Finance Corporation of the World Bank 2017, Krick et al 2005, Leal and Brandli 2016, MacNicol et al 2014*).

Step 2: Determining the framework of the aim and objectives of the Strategy:

The overall framework of the development of the Strategy and the setting of strategic objectives for the relevant stakeholders' engagement, is based on the final report and the recommendations of the IGELI project (*Georgiadis et al 2018a*) and includes:

- A. Description of the aim of the Strategy;

⁷ <https://www.cbd.int/decisions/cop/?m>

- B. Defining the sustainable LTI;
- C. Establishing the basic principles of sustainable LTI; and,
- D. Defining the objectives for sustainable development of LTI.

Step 3: Identification and description of the stakeholders

The identification of the stakeholders as the most important players (who) that must be involved and their role (why) is implemented through three stages:

- A. Scoping and mapping of the important stakeholders;
- B. Assessing, analysing and prioritizing the stakeholders; and,
- C. Understanding and defining the roles of the stakeholders.

Step 4: The Action Plan (How the engagement will be achieved)

Following the objectives of the Strategy, the Action Plan for Stakeholder Engagement is presented in four tables (see Table 4: An Action Plan for stakeholder engagement for the development of Sustainable LTI) for each of the following administrative levels:

1. The policy and strategic level.
2. The level of planning and environmental impact assessment.
3. The implementation and management level.
4. The multiple level of education, awareness, consultation and communication.

The tables of the Action plan include:

- A. The identified stakeholders.
- B. The actions needed according to their role as important players for the development of sustainable LTI.
- C. The time frame for a decade in two periods of 5 years.
- D. The outputs of the actions.

THE AIM AND OBJECTIVES OF THE STRATEGY

3.1 The aim of the Strategy

The aim of the Strategy is to define a roadmap on effective engagement of all the different stakeholders as important and crucial players in developing sustainable LTI globally that addresses the following:

- Launching proactive policies at international, cross-border and national level;
- Establishing appropriate legal frameworks at international, regional and national level;
- Securing sufficient funding;
- Supporting better planning and establishing proactive approaches;
- Promoting multi-sector cooperation;
- Involvement of the civil society and public; and,
- Encouraging innovative science-based solutions on resilient LTI.

3.2 Defining the Sustainable LTI

The sustainability of LTI is based on the definition of “Environmentally friendly transport” described in the Carpathian Convention⁸ with a few proposed additions. Sustainable LTI can be defined as LT that:

- Limits negative impacts on land use, landscapes and ecosystems, and is constructed in such a way that minimises animal roadkill;
- Ensures ecological connectivity while limiting fragmentation of the natural environment;
- Limits pollution, noise production, emissions and waste within the planet’s ability to absorb them towards minimising its impact on global climate change;
- Is safe, adaptable and resilient to climate change;
- Uses renewable resources at, or below, their rates of generation;
- Uses non-renewable resources at, or below, the rates of development of renewable substitutes;
- Respects the local societies and their cultures in the areas intersected by its alignment; and,
- Make people feel safe and happy enjoying the aesthetic experience of beautiful sceneries integrated LTI into landscapes as much as possible.

3.3 Establishing the Basic Principles of Sustainable LTI

In the framework of the adoption of the basic principles of sustainable LTI a first comparison in the framework of the IGELI report included the three frames of the principles of the Carpathian Convention, IENE principles (*Georgiadis et al 2018b*⁹). It further included the principles of the International Forum on Sustainable Infrastructure (Ha Noi principles¹⁰).

The result of this comparison shows:

1. Most of the principles are the same or very similar; and,
2. The principles of Carpathian Convention are included at a high-level political text and therefore they are recognised officially by the Convention’s signed countries.

Based on the above the proposed International Principles for Sustainable LTI are outlined in Table 2 below:

⁸ <http://www.carpathianconvention.org/text-of-the-convention.html>

⁹ <http://www.iene.info/igeli/>

¹⁰ Ha Noi Principles of International Forum on Sustainable Infrastructure: Integrating Climate Resilience and Natural Capital into Transport Infrastructure Planning and Design. Ha Noi, Viet Nam 17-18 May 2017, <http://www.gms-eoc.org/uploads/resources/1192/attachment/27.Next-Steps.pdf>

Table 2: International Principles for Sustainable LTI

International Principles for Sustainable LTI	
1	Strong policy and legal framework: Establishment and strengthening of a policy and legal framework for sustainable LTI development that is achievable with safeguarding landscape connectivity as a primary concern at any project scale.
2	Strategic Planning: Any major LTI project should be planned and developed guaranteeing ecological fluxes and well-connected wildlife populations before any implementation and funding decision. The “Mitigation Hierarchy” of ‘Avoidance – Mitigation – Compensation’ should also be implemented.
3	Ecosystem approach: LTI projects should ensure healthy ecosystem functioning and include the value of Natural Capital and ecosystems services. Projects should recognise that humans, with their cultural diversity, are an integral component of ecosystems ¹¹ .
4	Any case, a unique case: Each LTI project is site and species specific and therefore unique. Mitigation should be based on scientific and local knowledge without “copy and paste” from other projects.
5	Multi-disciplinary and cross-sector cooperation: Establishment of multi-disciplinary cooperation amongst different professionals (such as engineers, policy makers, economists, ecologists and environmentalists) as well as cross-ministerial agencies (such as, nature conservation, transportation; finances, etc.) to ensure integration and coordination.
6	Civil society involvement: Involvement of civil society in the planning phase of LTI projects.
7	Polluter pays principle: Implementation of the “polluter pays principle”, after clarifying the ethical and transparency concerns; this should include concrete mitigation measures from the onset of the LTI planning phase, until the tendering and contracting, and finally to the building and operating phases.
8	Long life effective maintenance: Inclusion of maintenance of mitigation measures in the budget of the ordinary program for maintenance of the LTI under operation.
9	Resilience to climate change: LTI should be planned or adapted with consideration for their resilience to climate change and ability to respond to climate extreme events. This is especially the case for transport infrastructure, where responses to stronger and intense precipitation with larger bridges and culverts servicing both hydraulic and ecological connectivity purposes is a critical requirement.
10	Adaptable infrastructure habitats: Habitats related to LTI should be planned and managed in a manner that fulfils their potential as positive biodiversity refuges and ecological corridors.
11	Environmental supervision: Inclusion of environmental supervision that monitors the effectiveness of LTI features and the habitat and wildlife populations in all phases of programmes, plans and projects from Strategic Environmental Assessment, Environmental Impact Assessment and design to full operation.
12	Culture of learning: Establishment of a culture of learning to develop and support continuous evaluation and exchange of knowledge and experience between the interested, relevant and authorised organisations and state services.

3.4 Defining the Strategic objectives

In the framework of the IGELI projects and based on the development of the international discussion on the global needs of environmentally sustainable LTI, two groups of concept tools

¹¹ <https://www.cbd.int/ecosystem/>

defined a basic framework of objectives that recognised the negative impacts of fragmentation as well as supporting ecological connectivity:

The concept tools identified as causes of fragmentation and a requirement for shaping ecological connectivity (described in Table 3) include:

1. **Genetic isolation** as the **main problem**;
2. **Habitat fragmentation** and land degradation as the **main cause**;
3. **Ecological and landscape connectivity** as the **main aim**;
4. **Green and Grey Infrastructure** as the **main crossing point and conflict areas**;
5. **Sustainability** as the **main objective**; and,
6. **Avoidance and Mitigation** as the **main solutions**¹².

¹² The mitigation hierarchy include avoidance – mitigation – compensation as the basic three options, but, especially when avoidance is selected to avoid the intersect an important/protected area by an LTI, then mitigation (and compensation where is necessary) is the next choice to support the cohesion of their area with other important/protected areas as network under the “threat” of the fragmentation of this LTI.

Table 3: Basic concepts for ecological connectivity

	Logical framework concepts	Ecological connectivity concepts	Description
1	Main problems	<i>Genetic isolation and loss of bio-engineering functions</i>	Under the framework of the biodiversity loss, species extinction and ecosystem approach and taking into account that genetic flow is essential for the species survival and their evolution, the main environmental problems related with the development of LTI are the genetic isolation and the loss of bio-engineering functions which can cause significant changes in habitats, that makes it impossible that the original community of species can persist.
2	Main cause of the problems	<i>Habitat fragmentation</i>	The lack of genetic communication is caused by the habitat fragmentation (terrestrial or aquatic) while additional and crucial problem is the direct animals' mortality on LTI.
3	Main aim	<i>Securing the ecological connectivity</i>	The main aim is to secure the ecological connectivity in important natural areas, as species' basic habitats or ecological corridors when they are intersected by LTI.
4	Main objective	<i>Sustainability</i>	Sustainability has to be achieved in three different perspectives: Social, Environmental and Economic.
5	Main crossing point and conflict areas	<i>Green and Grey infrastructure</i>	Adopting the concepts of Green Infrastructures, the Natural Capital and the Ecosystem Services the main "crossing points" are conflict points that Grey (technical/linear/transportation) infrastructures cross through Green Infrastructures/natural areas.
6	Main solution	<i>The hierarchy of the priorities of Avoidance - Mitigation – Compensation</i>	The achievement of sustainable coexistence of Green and Grey Infrastructure needs to focus of resolving problems with specific measures following the hierarchy of priorities of Avoidance - Mitigation – Compensation.

The second group includes concepts of strategic logical framework suggesting the need to determine:

1. The general aim/goal;
2. The concrete targets;
3. The objectives;
4. Concept Tools on sustainable LTI;
5. The Audience - stakeholders;
6. Principles to be followed;
7. Technical tools (for example, handbooks, guidelines, standards etc.);
8. An Action Plan with (for example, activities, timetable, outputs); and,
9. The following up process.

From the above concepts more analysis is needed regarding the term 'sustainability' as described for the development of LTI in chapter 3.2. Sustainability is a basic objective in several policy texts and international conventions and as it can have different meanings to people with different backgrounds, it can be approached in three different perspectives: Social, Environmental and Economic.

Sustainability on environmental aspects in the framework of development of LTI needs to be focused and defined on achieving the aim of Biodiversity Conservation and Ecological Connectivity included in the overall environmental impact (for example, CO₂ emission and climate change factors, soil erosion, etc.) in balance with economic growth and the social perspectives including population growth and viability as well as the culture and way of life of indigenous local people. Especially in developing countries, keeping this balance is essential because they are characterised both as:

- "Emerging countries" for economic and social development as they have special social value as they host significantly unique local indigenous human societies; and,
- "Environmentally vulnerable countries" as they have increased and high level of environmental and biodiversity values.

IDENTIFICATION OF THE IMPORTANT PLAYERS

Stage 1: Scoping and mapping of stakeholders

One of the first steps in planning a project is the identification of stakeholders and understanding what a stakeholder is. Loosely defined, a stakeholder is a person or group of people who can affect or be affected by a given project. Stakeholders can be individuals working on a project, groups of people or organisations, or even segments of a population.

There are many ways to identify stakeholders for a project; however, it should be done in a methodical and logical way to ensure that stakeholders are not easily omitted. This may be done by looking at stakeholders organisationally, geographically, or by involvement with various project phases or outcomes.

Candidate stakeholders for our strategy were divided into four categories (as outlined in step 4 of the Methodology in chapter 2:

- 1) Governance and strategy;
- 2) Planning;
- 3) Implementation and operation; and'
- 4) Consultation, education and communication.

This categorisation is based on the experience of the Harmon Project (EU Interreg programmes, Danube Carpathian Programme, SEED Money Facility) during the development of the “*Stay of Play Report on the harmonization of green-grey infrastructure development in Austria, Bulgaria, Czech Republic and Romania*” (Mot et al. 2019).

Stage 2: Assessing, analysing and prioritizing stakeholders

An outcome of identifying stakeholders should be a project stakeholder register, whereby names, contact information, titles, organisations, and other pertinent information of all stakeholders is captured. This register will form part of the Stakeholder Management, whereby each stakeholder’s representation is analysed. This includes:

1. The credibility connected with the perceived quality and validity of the stakeholder’s engagement;
2. The relevance connected with the usefulness of the engagement process and its outcomes;
3. The legitimacy connected with the perceived fairness and balance of the stakeholder engagement process, particularly important in cases where conflicts may occur; and,
4. The responsibility on achieving sustainability on LTI development.

Stage 3. Understanding the roles of the Stakeholders

Once all stakeholder information has been captured to a register, strategies for Stakeholder Management are developed; these should be geared toward maintaining support from those who are in favour of the project while winning over those opposed or at least mitigating the risks they may present. These can loosely be identified as four stakeholder types:

1. Informative: Stakeholders who have little interest and there is less need to consider them in much detail or to engage with them. However, it is important to assist them in understanding the problems and promoting potential solutions;
2. Consultancy role: Stakeholders with high interest, low influence but they are supportive;
3. Involved: Stakeholders that work partially or directly with interested third parties and it is, therefore, necessary to ensure their concerns and aspirations are understood, considered and, where appropriate, incorporated into decision making; and,
4. Fundamentally collaborated: Stakeholders who work in partnership in relevant aspects in all phases of a LTI development process from the decision-making and planning stages through to the implementation, operation and maintenance phases of a project.

THE ACTION PLAN (how the engagement will be achieved)

1. 5.1 The stakeholders, their role, actions and the outputs.

Towards achieving the Aichi goals and reversing the negative trends of habitat degradation and fragmentation reduction, the Action Plan describes:

1. All the stakeholders and their actions and inputs that can contribute to the recognition of the problems;
2. Strategic decisions that secures political sustainability; and,
3. Plans to implement the sustainable development of LTI at a local, regional level.

The Action Plan for the implementation of the Strategy is described in Table 4 with four distinct levels of governance for stakeholder type, namely:

- A. Policy and Strategy
- B. Planning and Environmental Impact Assessment
- C. Implementation and Management
- D. Level of Education, Awareness, Consultation and Communication

These levels of governance are further split into four administrative levels:

1. International;
2. Continental/Regional;
3. National; and,
4. Local (including states, counties, regions and/or provinces).

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Table 4: An Action Plan for stakeholder engagement for the development of Sustainable LTI

A. POLICY AND STRATEGY LEVEL

#	STAKEHOLDER	ACTION	Timeframe		OUTPUT
			2020-2025	2025-2030	
International					
1	International Conventions: <ul style="list-style-type: none"> • Convention on Biological Diversity • Bonn Convention • Climate Change Convention • Sustainable Development Goals • Belt and Road Forum for International Cooperation 	<ul style="list-style-type: none"> • Promote the recognition of fragmentation as a global threat to biodiversity; • Mainstream ecological connectivity as a common goal in all environmental and sustainable development policies, specifically LTI development and spatial planning. 	X		<ul style="list-style-type: none"> • Amendments to the conventions and decisions for common international goals for mainstreaming biodiversity on LTI development; • Established cohesion of ecological connectivity with transportation that is both functional and safe. • The Chinese government has issued two important documents, namely “Guidance on Promoting Green Belt and Road” and “The Belt and Road Ecological and Environmental Cooperation Plan”.
2	UN	<ul style="list-style-type: none"> • Support for international and national strategies for sustainable LTI. • Establish a ‘common language’ for sustainable development for politicians, investors, financiers, engineers, environmentalists as well as members of the public; • Promote a multidisciplinary and cross-sector approach. 	X		<ul style="list-style-type: none"> • Recommendations provided to global regional organisations, national governments, investors and LTI planners, constructors and operators. • Guidelines, standards and best practices are endorsed by relevant stakeholders.
3	G20	<ul style="list-style-type: none"> • Adopt policies on sustainable development of LTI and transportation of people, foods, goods (materials and products), energy and services. 	X		<ul style="list-style-type: none"> • Policies are adopted on sustainable development of LTI and transportation of people, foods, goods (materials and products), energy and services. • “Strong legal frameworks” which support sustainable LTI development are in place.
4	International banks <ul style="list-style-type: none"> • World Bank • Investment banks • International regional banks • European Investment Bank (EIB) • European Bank for Reconstruction & Development (EBRD) • African Development Bank • Asian Development Bank (ADB) • Asian Infrastructure Investment Bank (AIIB) • International Development Bank (IDB)¹³ • ... 	<ul style="list-style-type: none"> • Support of the “Polluter’s Pay Principle” as part of an ethical framework towards sustainability of infrastructure investments. • Budget support of mitigation measures in the planning stage of an LTI project. • Support for LTI-biodiversity research projects following the principle of ‘Environmental Supervision’ in a pre-compensate approach. 	X	X	<ul style="list-style-type: none"> • Established international standards for financing sustainable LTI investments are adopted trilaterally (i.e. civil, environmental and economic). • New knowledge systems for ecology and LTI are embraced as a “Culture of Learning” particularly in developing countries. This can include: <ul style="list-style-type: none"> ➤ Endangered and new species presence and local conservation status. ➤ Effective mitigation measures and innovate solutions adapted for local ecology and LTI development.

¹³ Responsible for Regions as Latin American and Caribbean

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#	STAKEHOLDER	ACTION	Timeframe		OUTPUT
			2020-2025	2025-2030	
5	<p>International Organizations for infrastructure development</p> <ul style="list-style-type: none"> • PIARC • PIANC • International Organization for Railways? Power Lines? Energy Transportation Lines? • Global Infrastructure Basel (GIB) 	<ul style="list-style-type: none"> • Mainstream biodiversity and ecological connectivity in environmental and sustainable development policies and strategies, thereby adopting the “Ecosystem approach” principle. 	X	X	<ul style="list-style-type: none"> • International guidelines and standards are adopted on planning, construction, operation and monitoring of LTI development supporting the coherence of both transport and ecological corridors are established.
6	<p>International Organizations on Nature Conservation</p> <ul style="list-style-type: none"> • IUCN • WWF-International <p>Continental networks on infrastructure and ecology with international activities:</p> <ul style="list-style-type: none"> • ICOET • IENE • ANET • ACLIE • CIBIV 	<p>Each organization/network is encouraged to:</p> <ul style="list-style-type: none"> • Support consultation and policy production on: <ul style="list-style-type: none"> ➢ Promoting the “global thinking to local acting”. ➢ Translating “local needs to global concerns”; • Cooperate and take initiatives with common actions and synergies; and, • Exchange scientific knowledge and promote effective practical solutions for LTI ecology. 	X	X	<ul style="list-style-type: none"> • Concrete schemes of multidisciplinary and cross-sector cooperation are developed. • International guidelines and standards are adopted on planning, construction, operation and monitoring of LTI development supporting the coherence of both transport and ecological corridors are established. • Global regional organisations and national governments are advised and guided of new policy and decision-making. • LTI and ecology publications, reports and recommendations are available for all stakeholders. • Conferences and workshops on LTI and ecology and infrastructure are promoted as platforms of knowledge-exchange, sharing best practices and networking opportunities.
Continental/Regional					
7	<p>Conventions or initiatives in Global Regional scale:</p> <ul style="list-style-type: none"> • Bern Convention in Europe • European Landscape Convention • Boao Forum for Asia¹⁴ • Initiative 20x20 in Latin American and Caribbean countries¹⁵ • ... Conventions in Africa • ...Conventions in Australia • ... 	<ul style="list-style-type: none"> • Recognition of fragmentation as a global threat for biodiversity and mainstreaming ecological connectivity as a common goal in all environmental and sustainable development policies and mainly on LTI development and Spatial Planning. 	X	X	<ul style="list-style-type: none"> • Amendments of the Conventions and Decision for common international goals on ecological connectivity, mainstreaming biodiversity on LTI development and the cohesion of the protected areas in national and trans-border level.
8	<p>Intergovernmental Regional “Unions”:</p> <ul style="list-style-type: none"> • EU • African Union • Organization of American States 	<ul style="list-style-type: none"> • Recognition of fragmentation as a global threat for biodiversity and mainstreaming ecological connectivity as a common goal in all environmental and sustainable development policies and mainly on LTI development and Spatial Planning. 	X	X	<ul style="list-style-type: none"> • Decisions (in form of Strategies, Policies, Directives or Regulations) and concrete guidance tools to implement effectively in practice the development of sustainable LTI

¹⁴ <http://english.boaoforum.org/en/index.html>

¹⁵ <https://initiative20x20.org/about>

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#	STAKEHOLDER	ACTION	Timeframe		OUTPUT
			2020-2025	2025-2030	
	<ul style="list-style-type: none"> • Union of South American Nations • Arab League • The Shanghai Cooperation Organisation • Asia-Pacific Economic Cooperation • ... 	<ul style="list-style-type: none"> • Promoting the Green Infrastructure policy in all development sectors towards investing on the natural capital and perpetuate the natural resources sources for the future generations. • Providing appropriate funding for including design, planning, constructing, operating and maintenance of LTI in the most sustainable way and securing the functional ecological connectivity. 			<ul style="list-style-type: none"> • Provision of efficient and appropriate funds without “environmental discounts”.
9	Local bio-regional trans-border level Conventions and agreements: <ul style="list-style-type: none"> • Carpathian Convention • Alps Convention • ... 	<ul style="list-style-type: none"> • Recognition of fragmentation as a global threat for biodiversity and mainstreaming ecological connectivity as a common goal in all environmental and sustainable development policies and mainly on LTI development and Spatial Planning. 	X	X	<ul style="list-style-type: none"> • Amendments of the Conventions and Decision for common international goals on ecological connectivity, mainstreaming biodiversity on LTI development and the cohesion of the protected areas in national and trans-border level.
10	Continental Organizations for infrastructure development <ul style="list-style-type: none"> • CEDR in Europe • Organizations for Railways? • Organizations for Power Lines? • Organization for Energy Transportation Lines? • ... 	<ul style="list-style-type: none"> • Mainstreaming biodiversity and ecological connectivity in all their environmental and sustainable development policies and strategies. 	X	X	<ul style="list-style-type: none"> • Established International guidelines, standards and forms on planning, construction, operation and monitoring of sustainable LTI development supporting the coherence of both transportation and ecological corridors.
National					
11	Governments and Ministries	<ul style="list-style-type: none"> • Adopt and enforce international policies for LTI and ecology at national and local trans-border levels. 	X	X	<ul style="list-style-type: none"> • National sectoral policies and strategies are developed. • Concrete legal frameworks, national master plans and programmes are established. • National platforms, comprising key experts with multisector backgrounds for systematic policy integration of biodiversity and LTI objectives, are developed.
12	Agencies as: <ul style="list-style-type: none"> • Research Centres and Institutes • Environmental Agencies • Transport and Energy Agencies and Administrations • Water Management Agencies 	<ul style="list-style-type: none"> • Support and facilitate the production of knowledge and innovative solutions for LTI and ecology. • Support and facilitate the development of policies and strategies at a national and regional level. 	X	X	<ul style="list-style-type: none"> • National and regional sectoral policies and strategies are developed. • National and Regional master plans and programmes are developed. • National data bases on ecology and infrastructure are established.
Local					
14	Regions (including counties provinces, states and municipalities)	<ul style="list-style-type: none"> • Adopt and enforce international policies for LTI and ecology at national and local trans-border levels. 	X	X	<ul style="list-style-type: none"> • Regional strategies and master plans are developed. • Local Action Plans implementing the ‘Global Thinking’ into ‘Local Acting’ are established. • Regional data bases on ecology and infrastructure are developed.

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B. THE LEVEL OF PLANNING AND ENVIRONMENTAL IMPACT ASSESSMENT

#	STAKEHOLDER	ACTION	Timeframe		OUTPUT
			2020-2025	2025-2030	
National					
1	Ministries (to include: transport, infrastructure environment, development, economy, spatial planning, energy, agriculture, forestry, tourism, water management)	<ul style="list-style-type: none"> Support for appropriate impact assessments in SEAs and EIAs, including ecological connectivity and the climate vulnerability as fundamental environmental aims considering their cumulative effects on LTI. Establishment of procurement procedures with clear language and standards for securing the functional connectivity of LTI development. Develop sectoral programmes, master plans and projects on sustainable LTI at national and local trans-border levels. 	X	X	<ul style="list-style-type: none"> Sectoral programmes, master plans are established at national and local trans-border levels. SEAs and EIAs recognise fragmentation in their environmental impacts' assessment followed by monitoring until the operation and maintenance. Integrated plans and designs of concrete LTI projects at local levels are produced.
Local					
2	<ul style="list-style-type: none"> Local Regional authorities: <ul style="list-style-type: none"> Regions (or counties and provinces) Municipalities Protected areas authorities Local Regional services for: <ul style="list-style-type: none"> Spatial design Water management Forestry Tourism Energy 	<p>Incorporate ecological connectivity in LTI development into national policies and strategies during:</p> <ul style="list-style-type: none"> Development of regional strategies and master plans; Planning of regional projects at a local level; Development and management of data bases and provision information on biodiversity and spatial design; Environmental impact assessment of SEAs and EIAs including cumulative impacts of multi-presence of existed or planning LTI; Provision of permissions of SEAs and EIAs; and, Implement the principles, special guidelines and standards of Sustainable LTI in practice. 	X	X	<p>LTI deliverables, products and tools which include ecological connectivity in their environmental sustainable approach, such as:</p> <ul style="list-style-type: none"> Regional strategies and master plans for LTI. SEAs and EIAs. Integrated plans and designs of concrete LTI projects in local level.
3	LTI national and private companies: <ul style="list-style-type: none"> Highways constructors and operators Railways constructors and operators Energy production and transportation companies 	<p>Implement during the planning process:</p> <ul style="list-style-type: none"> The knowledge and innovative solutions on "Infrastructure Ecology" and "Ecology Engineering". The national and regional policies, strategies, guidelines and standards. 	X	X	
4	Private and public bodies and professionals: <ul style="list-style-type: none"> Environmental and transport agencies Research centres Institutes Consultancy offices Studies' Offices Researchers, biologists and Environmentalists Land owners Farmers, stockbreeders and agriculture corporations 	<ul style="list-style-type: none"> Implement the principles, special guidelines and standards of Sustainable LTI in practice. Preparation and production of SEAs and EIAs for Ministries and Regions' strategies, plans and sectoral projects. Preparation and production of the development of concrete LTI projects. Develop effective methodologies, collection and use of Green Infrastructure background information and biodiversity data. 	X	X	

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#	STAKEHOLDER	ACTION	Timeframe		OUTPUT
			2020-2025	2025-2030	
	<ul style="list-style-type: none"> Tourism companies and corporations Hunters 	<ul style="list-style-type: none"> Implementation of the first phase of environment monitoring before the construction of a LTI. Participation in open consultation and the development of a dialogue with the land users. 			
5	Civil society's representatives of local communities, the general public and NGOs.	Participation in open consultation and the development of a dialogue with the civil society and the public.	X	X	

C. IMPLEMENTATION AND MANAGEMENT LEVEL

#	STAKEHOLDER	ACTION	Timeframe		OUTPUT
			2020-2025	2025-2030	
Local					
1	<ul style="list-style-type: none"> Land owners 	Construct, operate and maintain sustainable LTIs.	X	X	<ul style="list-style-type: none"> LTI projects are integrated with minimum impact on ecological connectivity and biodiversity.
2	LTI public and private companies: <ul style="list-style-type: none"> Highways constructors and operators Railways constructors and operators Energy production and transition companies LTI industry's companies 	Implement during the planning process: <ul style="list-style-type: none"> The knowledge and innovative solutions on "LTI Ecology" and "Ecology Engineering". The national and regional policies, strategies, guidelines and standards. 			
3	<ul style="list-style-type: none"> Researches, institutes and organizations (public or NGOs) Private and public bodies and professionals 	Implement monitoring projects for the environmental impacts of construction and operation of LTI.	X	X	
4	Representatives of Civil society, the public and NGOs	Represent civil society and contribute towards effective environmental monitoring implementation.	X	X	
5	Supervising public authorities and services	Supervise and provide permissions for the overall development of the construction, final operation and maintenance of the LTI based on the results of the monitoring projects.	X	X	

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D. LEVEL OF EDUCATION, AWARENESS, CONSULTATION AND COMMUNICATION

#	STAKEHOLDER	OUTPUTS	Timeframe		OUTPUTS
			2020-2025	2025-2030	
Local					
1	Universities and research institutions in synergies with LTI construction and operation companies	<ul style="list-style-type: none"> • Increase and promote the scientific knowledge. • Improve the effective methodologies on measuring landscape and habitats' fragmentation • Contribute to innovative and science based solutions in practice. • Implement the "culture of learning" principle. • Foster the new professionals for the future. 	X	X	<ul style="list-style-type: none"> • LTI projects are integrated with minimum impact on ecological connectivity and biodiversity.
2	<ul style="list-style-type: none"> • Environmental agencies • LTI agencies and administrations • LTI public and private companies • Research centres • Institutes • Suppliers/business partners 	<ul style="list-style-type: none"> • Consult on developing policies and strategies in national and regional level. • Influence the sustainability of the final decisions. 	X	X	
3	Schools and Environmental Education Centres	<ul style="list-style-type: none"> • Education of the future's citizens. • Capacity-building of existing and future special target groups of the four administrative level of the Strategy. 	X	X	
4	Protected areas information and awareness centres	Support and increase the public awareness level.	X	X	
5	Civil society's representatives: <ul style="list-style-type: none"> • The public • Local communities • Drivers • Passengers • Energy users • NGOs 	Support the overall bottom up process on decision making and public involved.	X	X	
6	<ul style="list-style-type: none"> • Media • Professionals on communication • Opinion leaders 	<ul style="list-style-type: none"> • Promotion of public awareness and information • Fostering political press and influence of the public on sustainable development. 	X	X	

5.2 Implementation and funding the Strategy.

For the implementation of the Action Plan for international sustainable development of LTI, a framework of initiatives should be undertaken (Figure 2), commencing at a higher, international level which filters down to a local level. It is imperative that experience and knowledge gained at local levels provide feedback of operations to the international levels. This will aid and support improving strategic planning as part of the follow up process.



Figure 2: A flowchart outlining the initiatives that should be followed to guide implementing the Plan of Action

Funding of the Action Plan can be achieved through:

1. Public and governmental funds that are already available for policy making (especially in response to critical present and future challenges). These funds can support the Action Plan until the production of policy and strategic level outputs.
2. Public/and or private development funds (such as banks and/or private investors), connected with the planning, construction and operation of LTI and its relative investments. These funds should support the “polluter pay principle” covering all costs (including the costs of the mitigation and compensation measures both during the construction and operation and maintenance of the LTI).
3. Public or private funds dedicated for research and innovation.
4. Public or private funds for cooperative development and networking (for example, projects, conferences and workshops).
5. Public and private funds for education, capacity building and public awareness.

Finally, to complete a following up process for the implementation of the Action Plan the creation of an **International Observatory** is proposed **for monitoring the fragmentation status globally** as an important threat for biodiversity loss. This Observatory can be

coordinated by CBD and UN with support of IGELI coalition and organisations from both the Transport and Environment Sectors.

6. EPILOGUE – OUR VISION

...The vision for coherent nature and landscape of our world for 2050....

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