LEARNING
by DOING

The Learning by Doing Project

Policies and Projects Portfolio

2024

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I. Introducction

The Learning by Doing project was an exploratory journey to the identification of societal demand for sustainable development pathways, while at the same time keeping those pathways within the Paris Agreement envelope with respects to emissions and adaptation.

The document includes catalogues of both national and sub national policies and projects. Following the overall thrust of the project, in all cases the policies and projects of both countries and subnational examples would in principle aim to both reduce emission and increasing resilience, while simultaneously enriching lives. Thus, the transition entailed in these policies and projects combination would have to address the demand of the people in specific places (therefore it must be appealing, so it must pursue a positive, good life) while it must be realistically achievable to be politically viable and this is the path LbD continued to explore in 2022. In what follows, this section presents first the general scrum methodology advanced by the project, and the describes how this was advanced first at a country level, and the at a subnational level.

In addition to its open ended character, following an empirical, iterative methodology has allowed the project progressively to improve its understanding of growing nexus between the humanities, policy development, and environment. The novelty of uncovering this nexus is unusual for modern academic divisions and that it seeks to see this nexus, and what it means to lead a good life, in a more integrated way.

In pursuing its objectives, the methodology has evolved within some broad guidelines, with key aspects remaining fairly constant in the last 2 years, varying slightly across countries or regions. It has provided for a wide range of research and modelling approaches to emerge within its general guideline. As designed, LbD methodology advanced through successive iterations, cyclical collaborative meetings whose outputs feed into the planning for the next set of meetings to create a feedback loop, which seeks to facilitate a process of agile learning, to adapt the direction of its activities to emerging findings by teams.

As the project advanced, target groups in each country were defined to allow the project to illustrate local visions of 2 to 1.5° futures, building capacity and helping articulate societal demand for climate action. They also focused in developing projects which may be consonant with this vision. In this vein, the process helped outline a sense of continuity, place, agency and relation with other beings, as well as means for change. In each country, a series of at least 4 iterative Agile/Scrum methodologies partnered country-based stakeholder groups and experts ("country teams") to engage in joint climate activities ("scrums"). Local scrum stakeholders developed visions, technical and convivial options, and policy and financial pathways for a "good life" in 2050, with key sectors moving to net-zero, and resilience for impacts in a 2-1.5°C world. This provided valuable insights into how countries and communities can approach climate action planning and action in a coherent and credible manner, balancing conviviality with technical, economic, and political dimensions of sustainable development.

The project iterative process, their organizations in country teams and scrums, and the use of cross project meetings, resulted in relatively large groups of people effectively interacting with the project and one another. Getting together a group of strategic thinkers from civil society and government to think the challenge of net zero and a good life in specific places was conceived not only as a project activity, but also a key ingredient for the outcome of the project. The project combined 22 in country meetings (scrums), 3 cross project meetings, 3 regional meetings, and 5 outreach meeting as part of the embedded in country methodology; 18 outreach events were included, while other 9 meetings with an multilateral component were advanced. These activities ranged from street festivals to UNFCCC meetings as well as experts' meetings conferences at universities from Guadalajara to Cambridge, and events from Santiago to Beirut. The project activities in all the countries both created capacity and learning opportunities, as well as policy and project proposals in country projects (i.e. "learning by doing"). Participants came from the civil service, the private sector, academia, research and policy, youth and local communities. More than 1000 people participated, slightly more male (522) than female (514), and with almost half of them

through festivals and outreach activities, but all exchanging views on all subjects, rather than isolated participants into self-appointed expertise "silos".

The project activities and the exchanges amongst participants highlighted the benefits of starting pathway development with narratives developed jointly, before analysing their metric implications. This approach ensured the political viability of proposed pathways by providing a shared vision for stakeholders and validating its feasibility through modelling. Pathways remained aligned with the Paris Agreement's goals, including achieving net-zero emissions by "around 2050" or "before 2075."

By framing pathways within local equity contexts, participants within the project showed how localized narratives addressing sectoral aspirations could align with global targets. This strengthened participating countries' positions in negotiations and advanced the role of storytelling in shaping global climate governance.

A. The LbD Project. Policies and Projects

The projects methodology also helped advanced ideas and information for policies and projects. A project portfolio allowed for the strategic sequencing of sectoral actions, with many groups within the project recognizing that some sectors transition faster than others. Policies proposed focused on advancing early movers, such as renewable energy and transport, allowed for immediate benefits while enabling longer-term shifts in harder-to-abate sectors like heavy industry and agriculture.

The sequencing strategy also complemented UNFCCC discussions, particularly within the Global Stocktake process. By illustrating how early action in specific sectors accelerates overall progress toward net-zero goals, the project provided a practical framework for enhancing NDCs. This was especially impactful for developing countries, enabling them to prioritize high-impact actions despite resource constraints, thereby advancing climate goals efficiently and effectively.

The project emphasized the benefits of sub-sectoral collaboration and participative management in localizing public goods. By engaging stakeholders in participative processes, the project showed how development pathways could be tailored to local contexts while fostering cooperation within and across sectors. This approach addressed the "tragedy of the commons," where public goods are often mismanaged. Sub-sectoral collaboration aligned sector-specific goals with broader sustainability objectives, as seen in partnerships between energy, agriculture, and transport sectors. These findings align with Elinor Ostrom's principles for managing common-pool resources, highlighting the importance of localized governance and cross-sectoral cooperation. By operationalizing these principles, the project demonstrated that participative management can enhance sustainability and stakeholder alignment. The project reinforced that sustainable development is not just about policies and technologies but about people and processes, requiring inclusivity, collaboration, and context-specific solutions. These insights were valuable for policymakers, academics, and businesses in advancing effective and equitable sustainable development.

The project conversation significantly influenced climate action planning and policymaking in participating countries. Its methodologies were integrated by participating civil servants (or by alumin who would become policy makers) into national strategies, spanning sectoral initiatives and economy-wide frameworks. Sharing experiences between participants and with third-party countries enabled innovative approaches to common challenges, highlighting the value of collaborative research in shaping global climate action.

B. *Summary of Proposed Domestic Policies/Proposals*

Using the project's innovative methodology, different participating countries moved in this learning process—which invariably resulted in different types of proposals in the different countries. Some of these proposals are intimately linked to, or have been adopted by, central government planning (South Africa, the Dominican Republic). Other participants (Lebanon), because of current circumstances, present their proposals as more forward-looking—although grounded in civil society engagement as part of the LbD methodology.

Under the project, participants registered the following listing of domestic policies proposals and projects, following discussions under the LbD methodology. These covered the four participating countries: Dominican Republic, South Africa, Lebanon and Mexico. In addition, a subnational actions catalogue was produced. This report outlines the key policy and project proposals emerging from this process. The countries catalogues are presented first, followed by the subnational catalogue. A brief description of how the document was produced, is also included.

The Dominican Republic

- Agro-Forestry: 2
- Waste and Circular Economy: 2
- Energy: 2 (though many conditions were discussed)
- Transport: 3
- Tourism: 3

Moreover, in the Dominican Republic, an innovative and cross-cutting concept of participatory management ("co-manejo") was discussed and found useful for considered implementation. Sources for this were found in co-management research regarding protected areas, which practices dovetail with Prof. Elinor Ostrom's theories on the subject, and which are also echoed in some recent European initiatives of co-ownership of renewable energy assets.

South Africa

The South African project discussed the concept of a transition to low-carbon development, and then sectoral pathways for this. Given the complex societal issues in South Africa, engagement was first geared to considerations, before moving to more specific pathways; an in-depth discussion on Transport was the model, and the country's Department of Forestry, Fisheries, and the Environment (DFFE) use the experience of the project to consider policies for sectoral emissions targets for the following sectors:

- Energy
- Transport
- Human Settlements, including buildings, wastewater
- Industry
- Land
- Agriculture
- Environment

This has resulted in plural (17+) project and policy considerations for the middle (2030) and long term (2050). Moreover, a proposal was made by DFFE using explicit elements from LbD to help in public engagement for consultations for long-term development pathways.

Lebanon

Because of current political, economic and social challenges, the project in Lebanon used stakeholder engagement following the LbD methodology towards principally forward-looking policies and proposals. The tactical and strategic policies and projects by the Lebanon project can be listed as follows:

- Transport: 8 policy targets, 10 near-term projects
- Energy: 10 policy targets for Governance, 13 proposals for renewable energy and grid, 15 proposals for business and investment certainty for the sector, and 6 proposals for capacity and innovation-building.
- Agriculture: 6 initiatives for entrepreneurship, 2 initiatives for land conservation, 2 initiatives for water efficiency, 2 initiatives for genetic development, 3 initiatives for sustainable agriculture systems, and 3 initiatives for market reform.
- Waste/Circular: 5 policies/projects.

Mexico

The Mexican project yielded the following domestic proposals and projects, ranging from the broad economy down to particular sectors:

- General Economy: carbon pricing with consulted use of revenues
- Energy: energy efficiency; transport and Low Emission Zones
- Agriculture: capacity-building through education and vocational training
- Industry: support for increased demand for energy efficiency and energy-reduced production methods
- Waste: regulation and incentives on supply and demand side for waste, to incentivise circular economies

Given the historical facility for energy-intensive production in Mexico, the project found a priority in creating capacities for the economy to transition to a more energy efficient paradigm, requiring both push (regulation) and pull (incentives) elements, together with capacity-building and training. These elements were found to be necessary from an early starting point of the transition was to be politically and socially viable in the longer term, as a delay would require traumatic changes to address decarbonisation targets.

Subnational Activities

This work also worked to develop a sub national portfolio of policies and projects, which could be deployed at sub national level, at an increasingly smaller scope. This entailed identifying and assembling a series of interventions that could be advanced at a city, district, neighbourhood, street and house levels. This part of the portfolio was developed through work in the scrums and with teams assembled with experts in cities and universities. Student competitions, and a model to integrate work with universities faculty, and with undergraduate and graduate students and the project. The model took the idea of a good life as developed by the project to advance exchanges with faculties and students. Urban planning and Architecture faculties in Mexico and the UK served as initial examples.

This part of the portfolio also examined different dimensions of well-being as analyzed by various frameworks and indices, and used the division at increasingly smaller scopes as a way to develop these portfolio. This section also served to add perspectives from economics, psychology, and environmental science, so as to argue that well-being cannot be fully achieved without considering ecological sustainability and the health of social relationships. This advocated for a more holistic model of development that both prioritizes the characteristics of the good life in the project, as a way to examine how better to live in specific places within the emissions and impact constraints.

C.   *Methodology: How This Document Was Produced*

This document was a product of the LbD scrum methodology, and is aligned with its "learning by doing" ethos. This methodology advances through meetings described as 'Agile Scrums', to reflect the interdisciplinary mesh of different ideas clashing (in analogy to a rugby scrum) to discover something new. The iterative approach was preferred to ensure the project remained open ended and bottom up, while providing for a certain degree of top down guidance as the project advanced. This emphasis of a bottom up approach was selected so as to allow for those participating to actually learn new things in the process, rather than starting from a predetermined, single minded top down vision. Interdisciplinary dialogues with economists, climate experts, policy specialists, philosophers and theologians on what a good life would look would start the debate. From these more general considerations, country teams would develop general narratives to integrate and draw from this into the cultural and socio-economic contexts.
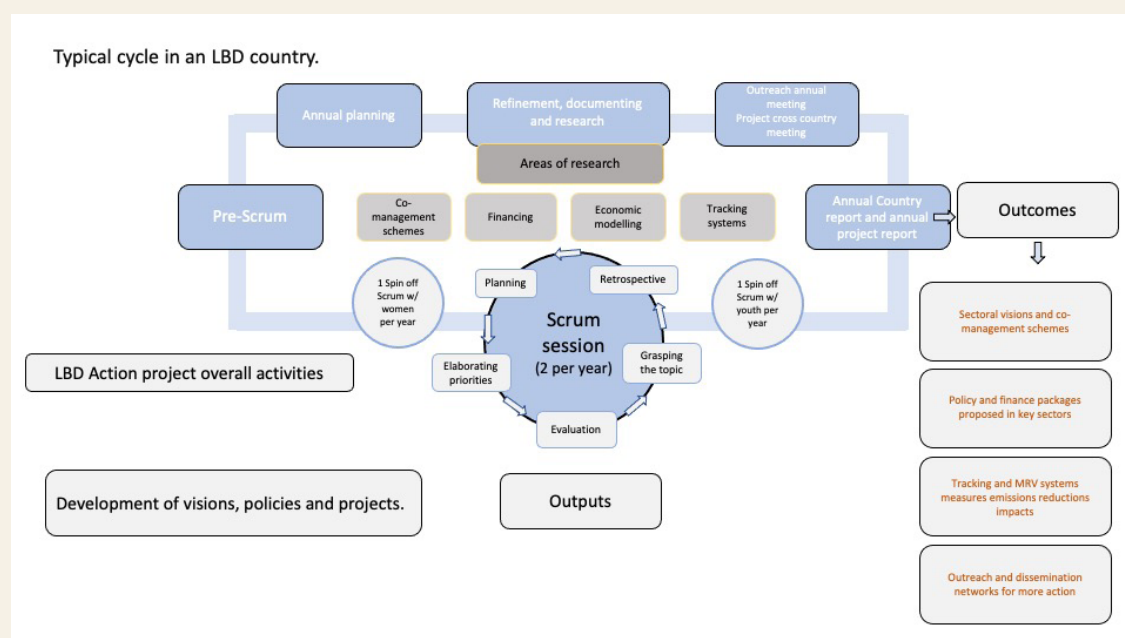
The iterative Agile / Scrum methodology is illustrated in Figure 1.

The idea is also that the scrums would allow stakeholders to work together in cross-sectoral coalitions and participatory-management schemes around particular sectoral aims ("co-management schemes") to pursue and finance low-carbon public services where they live. Country teams would use all these in turn to simultaneously develop visions, technical and convivial options, and policy and financial pathways for a good life in 2050, with key sectors moving to net-zero, and resilience for impacts in a 2-1.5°C world. Country visions were then back-casted to the present as a guide to further develop policy pathways and projects, while country team experts calculate associated carbon budgets and reductions through emissions and cost modelling and tracking systems, in this vein, LbD-specific, appealing, and holistic visions of a good life become a central motive to enhance the speed and scale of transitions by wide range of stakeholders in key sectors.

Country Level Approach

Following these insights, all country scrums produced draft narratives—on a good life broadly in place more generally, and also some specific in various cases. Thus, there were complementary narratives about

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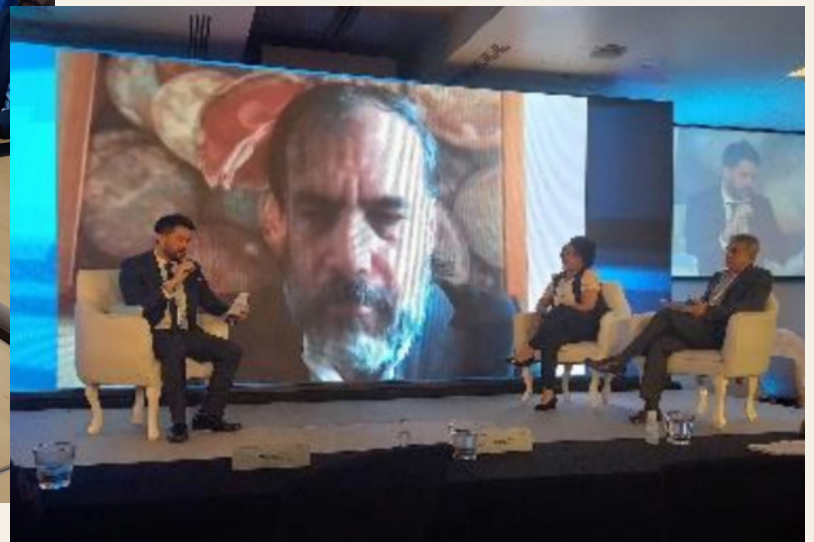
country cases, but also about aspects, such as public affluence, or transport. These project narratives sought to provide a vision of a route and destination; a sense of the good life in specific places in how it was achieved, and associated risks. It also helped outline a sense of continuity, place, agency and relation with nature. These would also be useful to later provide context for sub national visions (more on that below).

The scrums also examined specific routes –policy pathways, both policies and projects– within sectors, and how does these pathways would happen. Scrum members provided input and suggested if and how drafts were to be combined. This enabled the Country leads and the core project team, together with the Knowledge Management team, to both produce final narratives as well as catalogues of policies and measures by countries. These have been released on the LbD web-site.[1]

More broadly, the scrums developed thinking about opportunities for cooperation. These scrums focused primarily at actions and policies at the national scale. A rich set of issues emerged, mindful of what might be innovative beyond the existing national portfolio, and where this indicates opportunities for multilateral cooperation. In the context of a just transition, skills, capacity and knowledge at a systemic and institutional level have been highlighted as crucial to implementation. Indeed, the capacity of poor communities and workers to define their own futures if—and to ensuring that the transition indeed is foundational to ensuring that transitions are just. The good life cannot be a future vision *only*, the pathways of getting to such a future were taken as options which might help inform policy and action, and were advance with a view of being considered part of the developmental path for sectors and communities.
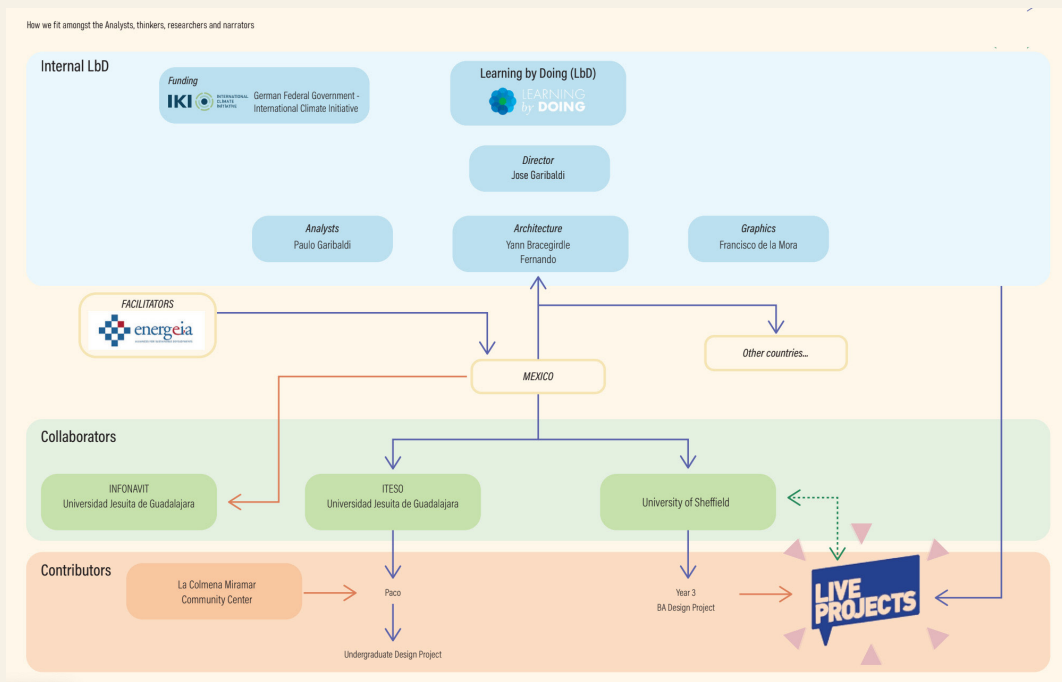
Sub National Level Approach

In addition to the focus of nation-level actions, the team has worked in collaboration with a variety of stakeholders at a subnational level to drive a collaborative design process within a smaller scope. This also helped the project develop a university cooperation scheme, which advanced in cooperation with Architecture and Urban Planning faculties.

In advancing these exchanges, LBD leads presented the project to Faculty and Student bodies in the UK and Mexico. emerging cooperation was presented outlining the principles of the "Learning By Doing" methodology and philosophy. The project worked on this regard with universities both in the UK (University of Sheffield) and Mexico (ITESO University), using these activities as a means to coordinate exchanges and enhance learning between the faculty and student body. These exchanges advanced as response to a brief focused on a shared vision of the 2050 'Good Life' in a specific district in Guadalajara.

When presented to the students, the LbD project leads emphasised co-production with the faculty and student teams. In these exchanges, the LbD team offered expertise in climate research and policy strategies, forming the foundation for climate interventions presented in the final outcomes. The faculty and team also reviewed the country narratives and policy and project portfolios. Through engaging with the country project and policy catalogues, graphic and web design team and wider network in Guadalajara, the university teams both develop sub national and city visions, while gaining valuable insights. This collaboration in turn shaped the visual style of the outputs, facilitated integration into the LbD portfolio, and advanced a cultural and hyperlocalised site context. All this helped enrich the visioning process of the 2050 'Good Life'.

Additionally, the university teams also crafted their own "'Good Life' Workshops" to handover as part of the learning process. Overall, the layers of engagement with various stakeholders has greatly contributed to the final outcomes, shaped heavily by the "Learning By Doing" and the university "Liveness" methodology. The following graph describes the process of the brief development.

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1. https://www.learningbydoingproject.org/south-africa/

How we fit amongst the Analysts, thinkers, researchers and narrators

Stages in the Subnational Approach.

Following the initial meeting between LbD and the University teams, the most important thing was to establish exactly what the brief was and what the goals were for the project. This process was done through brainstorming the key words and phrases from the brief document and the meeting, and by defining the core components of a 'Good Life' as researched by LbD. After presenting the initial brief, the project leads then scoped what it expected the final outputs for this interaction to be, whether this could be produced as a sort of graphical vision (the idea of a tapestry was presented), one which could be taken to be a part of the local vision, and then some indication of how the different sectors (threads) could be presented. An initial brainstorm was advanced in response to the brief, as outlined below.
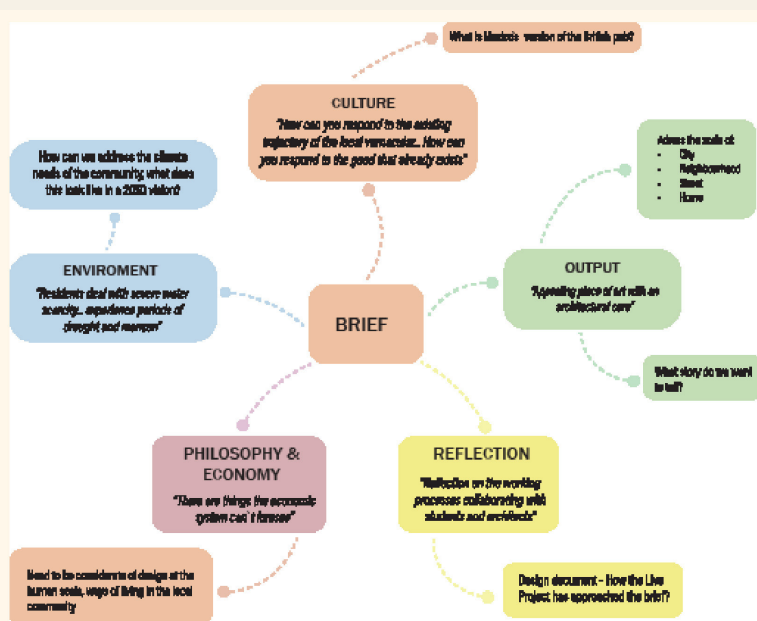
As the brief became more defined, the next steps were define. The possible outputs were defined as soon as possible to maximise the time available to inform, research and produce them. The quote used to underpin the outputs was "an appealing piece of artwork with an architectural core." The output ideas generated aimed to address the scale of the city, neighbourhood, street and home through two main concepts:

- The Tapestry - Holistic wider-scale vision encompassing LbD's climate interventions
- The Threads - Human-scale perspective capturing the social and cultural life in relation to the wider scale climate interventions

Tapestry
The output was presented as an arpillera. An arpillera is a Latin American stitched folk art artwork that depicts everyday life, and was used a medium upon which the visions would be outlined. Following its more integrated approach, the arpillera holistically displays the buildings and wider townplanning within a 'Good Life', displaying the key changes and interventions present in Guadalajara in 2050.

Threads
The 'thread' stitches together key moments from the tapestry that demonstrate contemplation, enjoyment, agency, beauty, creativity, and interrelationality. The purpose of this is to place the viewer in the 'Good Life' scenario that the tapestry has defined.
The photo below seeks to present the expected "Arpillera" model of presentation, and how this could inspire more specific visions and a place and sectors.

ENGAGEMENT: Scoping the potential collaborators and contributors to the Live Project.

To get a thorough understanding of the location and toinform the outputs, the project team took the time to engage as many stakeholders as possible. The ideal engagement for a project such as this would be with people who live locally as they are the subjects of the drawings and would be the most informative. Consultations with local centres and communities in the area where advanced in person (by the Mexico team) and remotely (by the UK one). Over the course of the project, the project team engaged with:

- Architecture Professors at the University of Guadalajara and University of Sheffield.
- Undergraduate students both in Mexico and the UK, and graduate students a the UK.
- Community centre in Guadalajara
- LbD Graphic design team
- Wider discussions with LbD teams.

The graph below provides a view of the overall engagement.
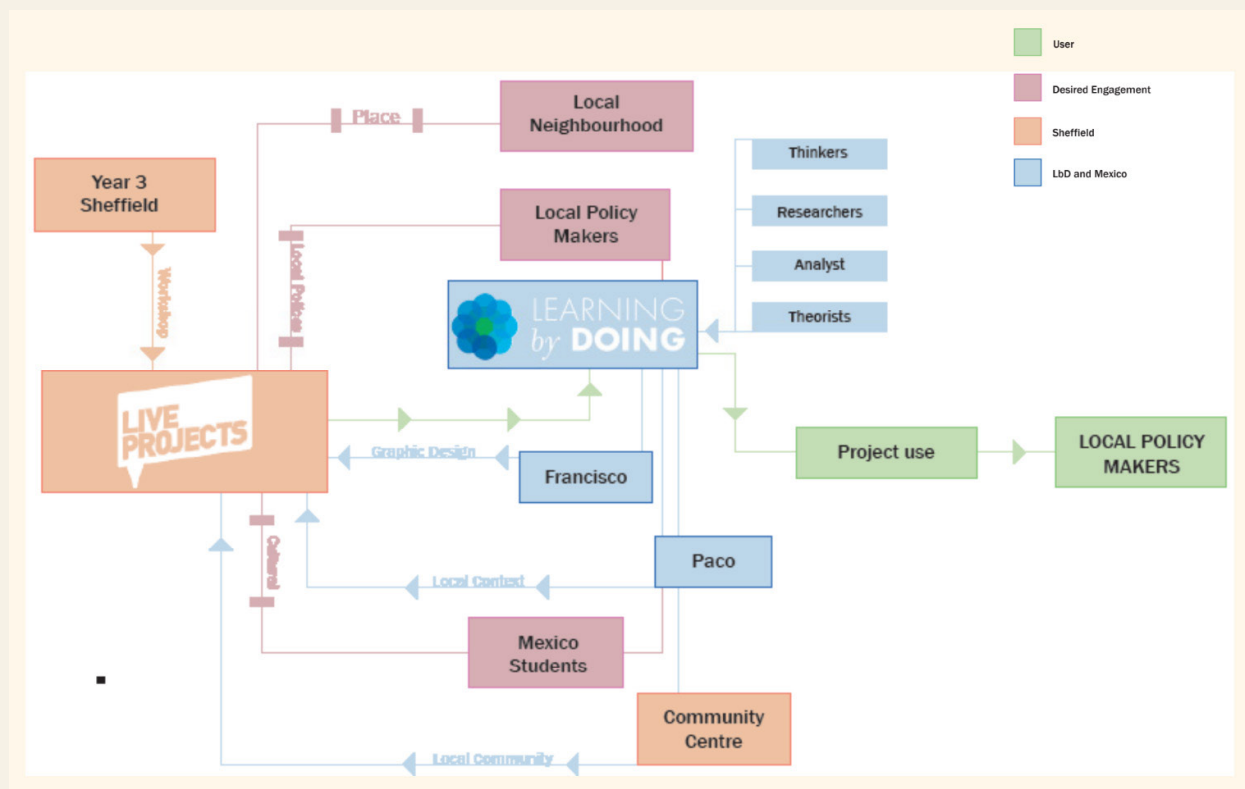
Workshop with Students

After the engagement, workshop sessions were advanced with faculty and students to flesh out non-physical components of the 'Good Life', building on LbD's macro policies and projects, as outlined in the visions document, and the country project and policies catalogue. The engagement with architecture students involved workshopping abstract ideas of a 'Good Life'. The project centred around LbD's definition of a 'Good Life', and the workshop was designed for the design team to engage with the theory behind a 'Good Life'. It was used to establish the feeling of the image and the overall tone of the work, to inform visual style and drawing details. Maintaining the cultural identity of a place is an important part of 'agency'

and so promotes the LbD 'Good Life' values. The LbD lead team provided the presentations outlining the project and its philosophy and ethos, and organised a series of workshop, as well as the resulting outputs from the discussions.

Workshop with the Year 3. Key Abstract Nouns to describe the good life
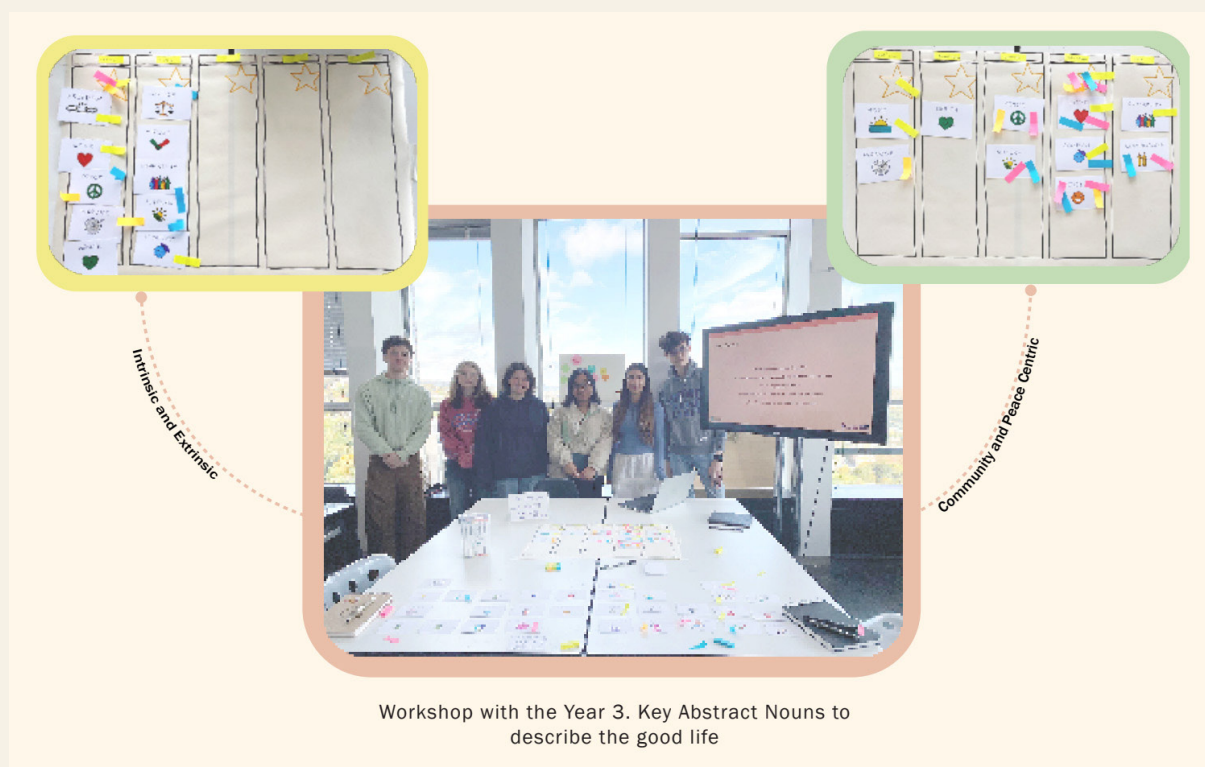
The output of this process at a subnational level resulted in both a catalogue of policies at different levels (city, district, neighbourhood, street, households, presented in this document) as well as a series of graphical visions (tapestries) and threads (sectors) of specific subnational aspects.

The catalogue of measures at a national and subnational levels are presented in this document; the visions, in the separate vision document. In the sections that follow, the catalogue of policies and proyects at a national level are presented first, folowed by a subnational catalogue.

II. The Dominican Republic

The overall context of solutions engagement was developed considering the interaction of human and social development, environmental concerns, and the political and legal context of the Dominican Republic.
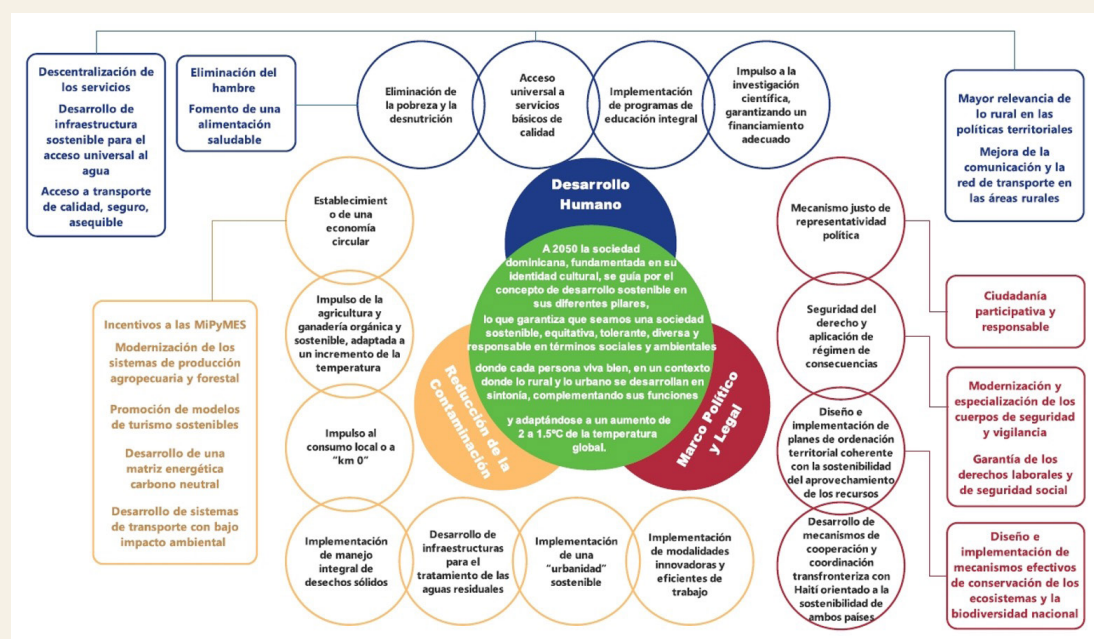
The principal conclusions of the project developed certain priorities in elements that would engender a "good life" in the Dominican Republic, covering a holistic vision of the territory and its resources towards resilience to climate change—both social and structural—which would maintain the typical elements of Dominican culture, including happiness, solidarity, and genuineness, all enriching DR's principal export of cultural tourism.

As such, for this, it is considered essential that interventions take on a process-oriented approach, implementing ongoing support for local groups over time to ensure their empowerment. In this sense, it is crucial to move away from the approach of "providing solutions to communities," while promoting businesses that offer community services as added value.

In the process, education is a priority, requiring the design and implementation of training in both technical aspects and values, integrated at all levels of society through synergistic action among the various actors operating in the territory. Specifically, it is essential for the population to empower themselves on climate issues, understanding their implications on all aspects of life, both individually and collectively.

As a starting point, the discussion revolves around the theme of "water," which brings together all sectors and therefore requires comprehensive management at the watershed level. In this regard, it is considered necessary to reactivate and strengthen watershed authorities.

On the path to sustainable development, it is fundamental to respect the specific characteristics of each territorial context, with a particular focus on cultural and religious aspects that greatly influence a population's life: the inclusion of religious leaders can facilitate the dissemination of sustainable behaviors among people. In this sense, working with family units can be a good starting point.

Key aspects to achieve the goals include developing dynamic planning that aligns with projected climate changes and the continuity of state policies.

Given the relevance and scarcity of water resources in many areas of the country, it is essential to ensure efficient water use by solving the problem of the high losses currently observed in the supply system, both for human consumption and agriculture.

The Dominican population envisions a reconciliation between urban and rural areas, where cities return to green spaces, ensuring quality services for the residents. In this context, public infrastructure will be prioritized, including a green and efficient transportation system that will eliminate the use of polluting means and significantly reduce individual mobility solutions.

The transition to this society requires a shift in the production matrix towards the development of a market for green products and services, based on strategies that combine mitigation and adaptation to climate change.

A. *Agro-Forestry*

It is necessary to overcome the historical conflict between the Ministries of Agriculture and Environment.

The agricultural sector is fundamental to other sectors, including tourism, which is one of the main contributors to the country's economic growth. Specifically, the development of the agricultural sector directly impacts food security and water security. Therefore, it is critical to work on a planning of territorial resource use according to the specific vocation of each territory, based on a comprehensive approach at the watershed level.

The recently approved Territorial Planning Law, Law 368-22, is an important foundation for working on the sustainability of the sector.

There are numerous relevant actors, but history shows that the population has limited spaces for interaction with them, as they are more closely linked to powerful political and economic sectors.

- *Policy/Project: Coherence in sustainable development planning and implementation is necessary between the Ministries of Planning and Environment, especially for then proper implementation of the new Territorial Planning law which seeks to create order in land-use.*

The creation of effective spaces for citizen participation is essential, ensuring the involvement of youth.

Within the framework of the Central American Integration System (SICA), a Regional Agriculture and Coffee Table has been implemented, bringing together both ministries, with the purpose of advancing the design and implementation of a more sustainable agricultural development. This led to the National AFOLU Table, where efforts are being made to define actions to reduce the impact of agriculture on ecosystems. This involves comprehensive work with water boards, farmers, extension technicians, etc.

As part of the Central American Commission for Environment and Development (CCAD), there is a commitment to reforest 30,000 hectares.

Gender bias in agriculture is still prevalent, due to the widely held perception of typically "masculine" roles. This also acts as a barrier to generational succession. In this regard, greater integration of technology could improve women's participation.

- *Policy/Project: The development of an incentive system could promote generational succession, as livelihood opportunities that encourage living in rural areas are essential.*

B. *Waste and Circular Economy*

Waste management, including solid, liquid, and gaseous waste, is a critical issue in the country, which has over 250 garbage dumps and lacks an appropriate sewage and wastewater treatment system.

The approval of the Solid Waste Law, Law 225-20, marked progress in the search for solutions. However, the legal framework needs improvement, as the current regulations have a business-focused approach, emphasizing recycling over circular economy practices. It is essential to promote circular economy practices, prioritizing social aspects in proposed solutions and starting with the elimination of single-use plastics.

An important actor in this process is the Ministry of Industry and Commerce, which should promote policies that create opportunities for small circular economy-based enterprises, as many of these ventures are led by young individuals.

- *Policy/Project: The legal framework for regulatory compliance of solid waste regulations need strengthening, and this must include public considerations, and demand-side (circular economy) considerations—not just top-down regulations.*

International cooperation is another key player that can promote the circular economy.
Efficiency in processes can be enhanced through artificial intelligence.
Examples of options to raise environmental awareness among the population, favoring circular economy solutions and enabling more direct involvement of civil society, include repair workshops, exchange spaces, and creation of centers for items people want to discard for others to reuse.

- *Policy/Project: Free trade zones, which play a significant role in the country's economy, should consider establishing reuse zones.*

Innovative solutions based on artificial intelligence and gamification should be considered.
It is crucial to develop cross-sector solutions that promote waste utilization, such as energy generation from waste.
Education is a key component that should permeate society, fostering a behavioral change among the Dominican population regarding solid waste management.
Effective monitoring and enforcement systems should also be implemented.

C. *Energy*

The energy sector, despite the highly controversial approval of the Electricity Pact, remains a critical sector with significant limitations in generation, transmission, and distribution.

- The national energy matrix is still heavily dependent on imported fossil fuels.
- The sector is dominated by an oligopoly.
- Non-technical losses, exceeding 25% of generated energy, add to technical losses.
- The potential for expanding distributed generation, especially photovoltaic, is limited by the national electrical infrastructure's reception capacity.
- Energy efficiency is in the process of implementation for public air conditioning, but insulation is not being included.

Significant investment is required for improvements in generation, transmission, and distribution systems.

The energy demand from the Transportation sector is not being considered.

The SCORE program has generated interest and aligns with co-management aspects. However, existing network infrastructure is essential. The program's approach can help reduce non-technical losses and motivate towards more sustainable solutions.

- *Policy/Project: Participative management approaches to renewable energy and energy efficiency initiatives can supercharge uptake of these essential technologies and practices at a reduced cost.*

It is important to analyze and implement cross-sector solutions, such as biomass utilization, particularly promoting local solutions that do not require significant transportation investments.

A diagnostic of the country's public and private sectors was conducted through the United Nations Climate Technology Centre and Network (CTCN), resulting in a roadmap for the energy conversion of the agro-industry sector. This roadmap can serve as a good starting point for initiating actions in this subsector.

- *Policy/Project: Public engagement of the roadmap for the energy conversion of the agro-industry sector is initiated, with lessons from LbD, participative management, and bottom-up approaches followed*

The energy sector needs to be reviewed in line with the Revised and Updated Nationally Determined Contribution (NDC) for 2030 and the National Energy Plan 2022-2036 concerning the promotion of renewable energies and emission reduction.

D. *Transport*

Urban mobility requires a change in habits, focusing on culture, security levels, climate, road infrastructure, and its characteristics, among other elements.

In this sense, it is essential to act on one hand through educating and guiding the population and on the other hand through the implementation of subsidies, which would assist in the initial stage and should be gradually reduced.

Public acceptance is a key factor for the transition, which is a challenging but not impossible process. This acceptance arises from an educational process accompanied by an awareness of the concrete benefits associated with the new habit.

- *Policy/Project: Introduce orientation on urban mobility, including micro-mobility, to support opportunities to try new mobility methods, as well as opportunities for secure delivery of goods using innovative distribution systems.*

In the Dominican Republic, a relevant subsector is cargo transportation, for which reform is necessary, taking into account models that benefit both the sector's individuals and the population and territory.

People need to become aware of the impact of domestic vehicles.

Reforming the urban mobility model is necessary, making room for more sustainable modalities, with a feasibility study to choose between alternatives based on their costs and benefits, including the social acceptance component by the population.

One relevant action is establishing hubs at the main entrances of major urban centers, where heavy-duty vehicles would be received, followed by fleets of distribution consisting of electric vehicles.

- *Policy/Project: Consider stepped areas for heavy goods access into metropolitan areas, so that larger, heavy-duty vehicles don't need to wind through the city making several partial deliveries.*

Converting school transportation vehicles could be more easily applicable; therefore, this could be the first subsector to be intervened.

- *Policy/Project: Explore retrofit conversion of vehicles to electricity, giving opportunities for local services and vocational up-skilling.*

E. Tourism

Tourism is one of the main sectors in the Dominican economy. However, the tourism model being implemented has shown its limitations due to the unsustainable use of territorial resources.

The sector has a colonial bias: many foreign entities receive most of the benefits, leaving local areas with environmental externalities and minimal social benefits. This situation leads to various social problems associated with typical tourism demand, creating what can be described as a "factory of misery."

Many companies now understand that scattered activities could harm the sustainability of other sectors and tourism itself. However, a short-term, consumerist approach is still being followed.

While it is acknowledged that tourism could drive demand for sustainable practices and products, there is still a need to focus on the profitability of these businesses.

- *Policy/Project: Instigate a 360° approach to tourism in the context of sustainable development for the whole economy, and not an extractive approach. Tourism can create demand for the necessary low-carbon development products and services necessary for the transition to 2-1.5° emissions and resilience.*

Education will play a crucial role in the process, contributing to generational change and fostering interconnection with other sectors linked to tourism. Academies can play an important role in studying these processes to identify the most suitable solutions.

Before establishing a tourism activity, it is essential to evaluate the carrying capacity of the territorial context to be intervened. Unanswered questions include: Can sustainability be achieved in an all-inclusive tourism exploitation?

- *Policy/Project: Consider and engage on the carrying capacity of tourism in particular area, and plan for the sustenance of the necessary services and infrastructure.*

Once the carrying capacity of an area is defined from the perspective of existing ecosystems, it is necessary to:

- Raise awareness and synergy among different actors at all levels;
- Develop legal instruments to control supply based on established carrying capacity limits;
- Promote inclusion, shifting from a top-down to a bottom-up approach.

The Ministry of Tourism must play a key role in defining policies to move from the current model to a more sustainable and inclusive one. The institution should help create a political and regulatory framework that supports ecotourism solutions and ensures greater participation of vulnerable groups, such as women and youth.

Civil society can have a crucial role through alternative channels that promote territory-linked solutions based on a level playing field. It is necessary to find functional influencers who, at the territorial level, facilitate the development of local demand for sustainable practices.

Therefore, it is imperative to implement tourism activities that respect ecosystems and the communities living in the territory, who are often excluded from benefiting from the activity while bearing most of the impacts.

- *Policy/Project: Create fora for multi-sectoral engagement on the Tourism sector, including supply vectors for services and materials, as well as engaging local communities so they're aware of and can participate in opportunities. This includes upskilling or re-skilling of the local communities to advance value-creation in the local tourism sector—always with a view to the sustainable development of the area.*

Local experiences that integrate different sectors are valuable, such as rural tourism linking agriculture to tourism activities, combining income generation with environmental care to create significant co-benefits, as this economic activity is based on a demand for environmental services that drive greater sustainability.

F. *Innovative and cross-cutting*

The project's course in the Dominican Republic including the cross-pollination of various economic theories with opportunities for local implementation, and also found how these theories were functional in other countries, and so feasible to work through in the Dominican context.

The project developed these through review of public good management thinking, both in abstract academic texts, say following Elinor Ostrom's principles of common pool resource management[1], and cross-referencing to existing initiatives in the region, originally associated with the governance of protected areas.[2]

From these elements, the project explored applications of these principles to real life issues in low-carbon development in the Dominican Republic, and particular reflection was had of the Horizon 2020 SCORE program in Europe,[3] which explored co-ownership of renewable energy resources.

The project postulated to Dominican authorities that part of the energy problem derived from non-technical losses (C.Energy) could be addressed through participatory management of distributed renewable energy sources.

This line of thinking was then explored through iterative thinking at sub-sectoral levels, which developed a number of proposals, including considerations of inter-sectoral demand.

1. Ostrom, E. (2015) Governing the Commons: The Evolution of Institutions for Collective Action. Cambridge: Cambridge University Press (Canto Classics).
2. See https://pdf.usaid.gov/pdf_docs/PNACK094.pdf
3. https://energy-poverty.ec.europa.eu/discover/practices-and-policies-toolkit/publications/score-prosumership-policy-recommendations_en

One example of this approach, discussed during the project, was on the engagement of the tourism sector for the development of demand for new modalities for transport, or for use of recycled materials, such as recycled textiles for curtains or similar room furnishings. The concept is that with time, expertise and logistics for material management could happen, with support from academia, creating a hub for this sort of material recycling within their region—given the gravitas that the Dominican tourism sector holds in the region. As such, the operators would create a common benefit for their own marketing, and the newly created sector could receive measured incentive and investment given the predictable initial demand; there's no reason why the local textile industry would not support this, and indeed, there could be a developed market for import of raw material and export of finished products for the region.

These discussions also overlapped with the metrics that the Dominican Republic has advanced on projects that contribute to its NDC—this was also discussed with the authorities—and the project's iterative and stakeholder-rich methodology, and pathways towards opportunities for stakeholder associated management of the aims of a given initiative for the NDC pathway, were found to be eye-opening. The illustration of the energy initiative, similar in concept to the Horizon 2020 SCORE program mentioned above, was particularly relevant given the challenges for the energy generation program in the Dominican Republic—as the project noted to the authorities, considerations regarding changes in energy for transport have not yet been accounted for.

III.   South Africa

The LbD project in South Africa generated a number of spin-off discussions, each of which developed its own type of proposal considerations. Some of these discussions remained at a high level, such as on discussions of reform to norms regarding rights over land; however, others moved to quite detailed progress, particularly on electricity (which has an ongoing process in South Africa), transport and urban development, and agriculture, as well as a detailed proposal regarding further refinements of sectoral and cross-sectoral development pathways for analysis under the LbD methodology.

Specifically, the project's spin-off discussions, where thematic ways forward were discussed, covered:

- Place-based approaches to development, providing insights into business and location-specific approaches, highlighting the importance of interactions with communities;
- Land issues, which explored for the first time connections with climate change, bundles of rights, and community perspectives to sustainable development;
- Transport issues, which considered insights on different modelling approaches, thinking of transport as a system, as well as a sector; and
- More general "Pathways" discussions, which were considered to be useful for a comprehensive governmental 2050 vision—specifically with a view to the Presidential Climate Commission.

Within the project's purview, the South African Department of Forestry, Fisheries, and the Environment (DFFE), structured consideration of near-term Sectoral Emissions Targets (SETs) for sectors under its responsibility. These SETs would be considered for the period 2025-2030 and are to be allocated in late 2024, and will have a legal basis in the Climate Change Bill (passed by both Houses of Parliament and expected to be signed into law before the national elections). Draft SETs are aligned with the current NDCs, and planning based on the good life approach is expected to inform preparations of the second South African NDC, to be communicated in early 2025. As highlighted by DFFE, these initiatives also included considerations of biodiversity, dealing with indigenous species, wetlands, protected and rehabilitated lands, and wildfire suppression.

Specifically, the SETs reviewed address policies in the following sectors:

- Energy
- Transport
- Human Settlements, including buildings, wastewater
- Industry
- Land
- Agriculture
- Environment

Importantly, targets for these SETs include both quantitative and qualitative targets, to be included in a future policy framework. This philosophy follows closely the tenets and learnings found in the LbD project.

LEARNING *by* **DOING**

A. *Focusing on Transport*

Transport issues are closely tied to the concepts of urban development, which in turn affects social development and behavioural considerations, as well as urban spatial planning and availability of urban social services for health, education, food, and employment. These issues were all considered in the LbD process in its engagement on transport in South Africa. Transport was considered as a system, and received a particular focus, while understanding connections to other systems.

In a particularly detailed spin-off, LbD's methodology was taken up as part of a modelling-heavy initiative, developing sub-sectoral Transport Development Pathways (TDP) proposals to describe a pathway that engaged not only the sector, but sub-sectoral actors, following learnings from the LbD project.

A number of detailed system-approach modelling and optimisation exercises were developed which were taken up in policy considerations, including the feedback and narrative elements, as well as emissions and supply-side considerations. TDPs were informed by narrative storylines, drawn from broader narratives of a good life and public affluence. A survey was undertaken to supplement existing quantitative data.

The proposal included considerations which are hallmarks of the LbD approach, including that the transport sector must firstly deliver a "good life" to its actors in all scenarios, avoiding inflections away from a "good life", and advancing other inflections towards "good life" concepts.

The proposal examined "15 minute" city concepts in terms of spatial arrangements, and resulted in the following TDPs, presented here as scenarios with increasing stringency:

1. Doing nothing—progressing BAU considerations, using population growth as proxies for travel demand, and economic growth as proxy for freight transport demand;
2. Transport in the "good life"—including spatial planning and land use, and "15 minute" city concepts, plus "avoid and shift" measures towards more efficient mobility services;
3. Transport in the "good life" with a clear 1.5˚ target—as above, but including deeper decarbonisation, which influences the "avoid and shift" elements; and
4. Transport in the "good life" with a hard 1.5˚ target by 2050—as above, but with considerations of a deep decarbonisation target for the sector by 2050, or a specific year.

The modeling exercise included considerations of social, environmental, and economic criteria, as well as considerations from primary (i.e. mining, agriculture) and secondary (i.e. Manufacturing, construction) economic sectors.

The proposal further considered optimisations within a Pareto-optimal model, but considering non-quantitative priorities as well. Details of the methodology, survey, scenarios, results and policy implications are contained in a dedicated transport modeling report.[4]

B. *DFFE Integrated programming suported by LbD*

Alongside the LbD project, and later informed by it, DFFE launched a series of proposals for dealing with

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4. Lane-Visser, T., & Vanderschuren, M. (2023). Learning by doing transport modelling: Development of transport storylines for the transition from current modus operandi to a good life. Energeia, CIES and IKI. https://www.learningbydoingproject. org/wp-content/uploads/2024/02/Learning-by-Doing-–-Transport-Modellingwl.pdf

LEARNING *by* **DOING**

- Food systems
- Mobility
- Human settlements
- Land use
- Circular economy

These initiatives would be led by three experts: system dynamics, gender and stakeholder engagement, and environmental, which elements follow the pattern of LbD's scrum process (see further information in the "Development Pathways" section below). Daniela vino.

These items follow considerations of an overall series of SETs relating to the following departments:

Policy Sector	Lead Department/Entity
Energy	Dept. Of Mineral Resources and Energy
Transport	Dept. Of Transport Dept. Of Mineral Resources and Energy
Human Settlement, including buildings, waste water	Dept. Of Human Settlements Dept. Of Public Works Dept. Of Mineral Resources and Energy Dept. Of Water and Sanitation
Industry	Dept. Of Trade, Industry and Commerce Dept. Of Mineral Resources and Energy
Land	Dept. Of Forestry, Fisheries, and Environment SANPARKs
Agriculture	Dept. Of Agriculture, Land Reform and Rural Development
Environment	Dept. Of Forestry, Fisheries and Environment: Biodiversity, Environmental Programmes, Chemicals and Waste, Forestry, Integrated Environmental Management

These elements are on a timeline to develop developmental pathways in a 2024-2025 timeline, following an iterative period of socialisation and pathway development, particularly as the pathway is looking to long-term implications for services and behavioural change, and societal demand for these.

C. *DFFE's Environmental sub-sectors*

With reference to the environmental sector being directly addressed by the Dept. Of Forestry, Fisheries and Environment ("DFFE"), and supported by the LbD process, specific engagement for its SETs is being addressed by the following branches of DFFE, with their associated coverages:

- Biodiversity
    - *   2500 Ha of land for indigenous species
    - *   Designation of 5 Wetlands of international significance
    - *   17.7% area under conservation

- SANPARKs
    * 4,000 Has of land protected
    * 11,060 Has of land rehabilitated
    * 5,100 m3 of wetland rehabilitated

    - Environmental Programmes
        * 100 wetlands rehabilitated (9,603 Has)
        * 90% of wild fires suppressed
        * 30,000 Has of thicket restoration

    - Climate Change and Air Quality
        * Carbon budgets

    - Chemicals and Waste
        * 30% of waste diverted from landfill sites
        * HCFC consumption decreased by 45%

    - Integrated Environmental Management
        * Financial provisioning regulations for the mining sector

    - Forestry
        * 5,400 Has of temporary unplanted areas, planted
        * 15,000 Ha approved for reforestation
        * 200,000 trees planted outside forests footprint
        * Development of a REDD+ strategy

D. *Developmental Pathways for SA aided by LbD*

Following from the LbD process, discrete concept note[5] (the "Concept Note") was developed by DFFE specifically to address development pathways in the context of South Africa's Just Transitions dialogue process between 2017 and 2023, and specifically noting the methodology and inputs to the approach garnered by LbD. The good life approach pioneered in South Africa by LBD, and the TDP example, have been seminal in informing this work. The Concept Note has been associated with DFFE's efforts towards a stakeholder-envisioned integrated socio-economic model for pathways scenarios for allocation of sectoral emission targets (SETs), and serve as a term of reference for the development of SETs, associated with South Africa's reduction of greenhouse gas emissions by 2050.

The methodology of LbD was noted as contributing expressly to the design of the process, with members of LbD participating in a Project Steering Committee continuing to provide their insights and inform DFFE's work on SETs.

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5. x-scrivener-item:///Users/garias/Library/CloudStorage/Dropbox/Projects/IKI%202017/Final%20Report/LbD%20Proj-ect%20Portfolio.scriv?id=B050B970-18ED-403D-838E-946B8932A475

E. *Illustrating the narrative—an LbD application*

LbD's illustrated narrative approach was found by DFFE to facilitate societal dialogue on development pathways. This approach was taken up in a 2024 proposal[6] by DFFE to the Climate Action Africa initiative (Canada) which seeks to support Net-Zero pathway development for the South African LEDS initiative, first using an narrative approach, supported by illustration and art, as pioneered in the LBD project, as a way to engage actors in considerations of socio-economic, and behavioural, reality in a Net-Zero 2050.

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6. See https://www.devex.com/jobs/call-for-proposals-climate-action-africa-1234660

IV. Lebanon

In Lebanon, the project began with a baseline of project themes, which were advanced through scrum interactions with stakeholders from each sector.

- Agriculture

    * Adopting a sustainable and/or organic agriculture system with a specific food-security strategy balancing production and consumption. A sector that addresses several problems and benefit various other socioeconomic issues, such as tourism, health, water availability, biodiversity, education, technology, etc.

- Energy

    * A Decentralized community energy system, with diverse 100% renewable energy (solar, wind, geothermal, etc.) tailored for different uses (house, farm, city, etc.) ; making the sector reliable and secure for a successful economy.

- Finance

    * A sustainable financial structure shifting financial flows towards green investments, through fiscal policies, tax restructuring, innovative financial mechanism, etc. ; adjusting consumption patterns, and inducing behavioral change to achieve the vision goals.

- Waste and Circular Economy

    * Considered with a dual objective of fighting climate change and achieving prosperity for all citizens. Contributing to a good quality of life, through reducing emissions from the material flow in society, reducing pollution, creating jobs, and economic growth, especially through maximizing decentralized community-based composting & recycling, and extended producer responsibility (EPR)

- Transport

    * An effective Transport Demand Management (TDM) strategy aiming at reducing the length, frequency & time of land trips conducted by individuals; and also reducing the use of the private passenger car, by introducing and strengthening diverse, alternative modes of transport (biking, walking, motorcycles, mass public transport, etc.)

- Tourism

    * Branding image of Lebanon "The Land of Diversity", highlighting in addition to its natural assets, the diversity in culture, heritage, biodiversity, history, culinary, etc.

Various challenges were identified in the discussions of possible projects; for example, in discussions regarding the Agriculture sector, issues regarding inheritance rules for the country were found to be

counter-productive to the development of the sector. Moreover, the sector was unattractive to younger people, meaning that the agriculture sector would depopulate over time. This requires a re-thinking of how the sector works and how it can be attractive to new labour, with new opportunities for innovation.

The interaction gave rise to a number of projects which local authorities considered.

However, it must be noted that geopolitical tensions, as well as economic and social disruptions throughout the course of the project provided their own challenges. During 2021, Lebanon's political and economic crisis had intensified to the point where more than 80% of the population were deemed to be below the poverty line. During the summer of 2021, Lebanon suffered from a severe fuel shortage, putting almost a complete halt to transportation, with electricity blackouts lasting 22 hours each day. We must recall that this was the period where the world was coming out of the COVID pandemic. Further social and economic unrest ensued, and subsequently tensions with Israel also intensified.

As such many of the proposals found by the project are focused on internal issues of Lebanon, and, following the difficult political and economic challenges of Lebanon at the time of the project, the proposals developed can be seen as proposals couched from a civil-society standpoint, with support of some internal and multilateral institutions.

A. Transport Initiatives

To be in line with a trajectory of a 1.5- or 2-degree Celsius global temperature increase limit, emissions from the transport sector in Lebanon should reach net-zero emissions by 2050 or shortly after. At the same time, to ensure equity and a good quality of life; efficient, affordable, safe, and accessible transport needs to be available to all people across all geographies. Shifting towards non-motorized and mass public transport, moving away from principally private passenger car mobility, would serve transport objectives required to achieve sustainable development.

Nevertheless, realizing the full potential of non-motorized and mass public transport will not be enough to meet the long-term Paris Climate Agreement goals. This will require also the electrification of the entire sector based on renewable energy technology, which will also have implications on the energy sector.

Lebanon transportation demand is expected to expand significantly by 2050, due to demographic and economic growth. To accommodate that growth, the country needs an integrated, well-planned transportation network that serves the needs of administrative and social services, economic development (industry – agriculture – commercial – tourism), educational establishments, and recreational / entertainment activities.

1. Strategic Aims

An integrated and efficient land transportation system by 2050 should:

- **Enable the achievement of sustainable development.** The transport sector is the circulatory system of the economy, and needs to be as efficient as possible.
- **Allow for a healthier lifestyle.** Adequate transportation infrastructure and services have positive effects on people's lifestyles. Prioritizing non-motorized transportation modes, such as walking and cycling, have health benefits, reduce traffic accidents, and avoid toxic emissions.
- **Provide safe and accessible mobility options.** This is critical for the aim of providing safe, equitable, and reliable mobility within an environment that is sensitive to all users' needs.

- **Socially integrate all Lebanese people.** Transportation is the backbone of society. It can play a key role in how people interact, get together, and engage. It can promote social cohesion and a common identity, elements which are ever more crucial to Lebanese society.
- **Protect and preserve the environment.** Lebanon's transportation sector should be in line with the long-term temperature goals outlined in the Paris Agreement, and achieve net-zero emissions as soon as possible.

In this strategy, the above goals will be translated into two quantitative targets, which are decrease in distance travelled using the private car, and percent electrification of the transport sector. The targets for the transport sector are based on Lebanon's updated INDC, the CVF aspirational target of 100% renewable energy by 2050, and global trends—including trends in the predicted development of internal combustion engines (ICEs), vs. the predicted development of electrically-enabled vehicles, and other zero-emission transport technologies. Lebanon aims to achieve (unconditional) 20% to (conditional) 30% GHG emission reduction compared to BAU by 2030.
Therefore, the 2030 targets for the transport sector in Lebanon are:

1. Decrease the distance travelled using the private car by 10%.
2. EVs achieving 20% market share in terms of annual passenger-car and light-duty vehicles sold.

The 2050 targets for the transport sector are:

1. Decrease the distance travelled using the private car by 50%.
2. EVs achieving 100% market share in terms of annual passenger-car and light-duty vehicles sold.

2. Reforms

There are several solutions for the transportation system, both on a small scale (changes that require low investments) and a larger scale (changes that require big investments). Most start with institutional structures that nurture programs while also supervise and monitor their services and compliances with the aims and trajectory of the implementing policy direction.
The following transformational reforms should be achieved:

- **Sectoral/regulatory reforms:** Sectoral and regulatory reforms provide institutions and policies for the management, and sustainability of the implemented projects.
- **Institutional reforms:** Institutional reforms, including central and regional organising authorities, are necessary for any reliable improvement of the national transport system. An institutional reform would require political consensus from Municipalities, The Ministry of Interior and Municipal Affairs, and the Ministry of Public Works and Transport.
- **Environmental reforms:** Environmental guidelines and policies that inflict reduced, minimal, or no harm upon ecosystems or the environment in relation to the transport sector are still not complete. Despite the availability of laws, decrees, ministerial decisions, and application decrees related to road transport and air pollution since the 1960s, they all require updating, reviewing, approving and/or strengthening for effective implementation and enforcement.
- **Fiscal reforms for alignment and compliance:** Taxation and penalties reforms to increase

the system's overall efficiency and sustainability, with clear reporting to the general public, affecting personal and corporate levels. If it is not implemented, Lebanon will continue relying on national debt to fund its programs and projects.

3. *Tactical Aims*

The following actions should be taken in order to facilitate the implementation of transport reforms and policies aiming to preserve the environment and develop sustainable mobility in Lebanon

1. **Increasing cycling/walking safety and convenience in urban areas.** Road transport in Lebanon consists of motorized vehicles with very rare equipment for non-motorized modes. Ultimately, urban areas (and more specifically areas with high density) should be walkable, open for all modes, and respectful of safety requirements. Reaching this goal will require a combination of technical / infrastructures adjustments and implementation of adequate regulations (including enforcement) in order to adapt the users' behaviours.

2. **Promoting and improving an integrated public transportation service.** Effective and clean public transportation would provide more mobility options for all socio-professional categories through an interconnected transportation system that meets the real needs of people from various Lebanese regions and with varying financial means, while ensuring the reduction of urban transportation travel time. Implementing mobility plans would guarantee safer, faster and easier travels, more reliable travel times with less congestions and a greater choice of travel modes.

3. **Law enforcement, institutional capacity strengthening, and sector capacity building.** Traffic management, control programs, and transportation strategies rely heavily on law enforcement and an adequate institutional framework, which would support safety conditions on road networks, optimize the traffic management system, and maintain serene sharing between all transport modes (motorized, non-motorized, public transport, mass transit, etc.).

4. **Development of a long-term financing mechanism.** Transitioning the transport sector is not possible without an efficient and robust coverage of expenses and risks for investment and operation of transport facilities to support up-front, operational, and maintenance expenses.

5. **Formation of a funding coordination group.** Coordination would promote implementation of sector-wide approaches, while also assisting with monitoring and evaluation of evidence-based policy formulation. It would avoid redundancy in projects' preparation, support the standardization of guidelines and norms (technical, operational, mitigation measures for social and environmental impacts), and optimize governmental resources and capacity building programs.

6. **Promotion of effective public-private partnerships (PPP).** PPPs in national and sub-national levels can be used to optimize risks sharing, which could solve critical transportation problems in both hard (physical) and soft (operational) contexts. However, these solutions need a transparent procedure and an appropriate institutional framework. Community-based transportation systems, such as solar-bike systems, could also flourish under this scheme, creating local jobs and economic opportunities.

7. **Reducing traffic congestion in dense residential and commercial areas.** Traffic congestion hinders economic growth and transport systems. Reducing the dependency on the private passenger car, improved urban planning, traffic law enforcement, etc. are all strategies that will contribute to reducing traffic congestion.

8. **Improving and maintaining road and rail networks.** Although research has shown that increasing the width and length of roads does encourage the use of the private passenger car, there is a need in Lebanon to build new roads and improve/maintain existing ones. The innovative improvement of roads and rail networks can also have role in a TDM strategy, including, the implementation of dedicated bus lanes and railway network development will motivate a higher number of road users to shift to public transport and, therefore, significantly decrease congestions.

4. 2030 Policy Milestones

In order to successfully accomplish the transportation objectives by 2050, some milestones should be set to help the government (with the involvement of the private sector) gradually reach that vision. Therefore, by 2030, the following urgent actions should be taken:

- **2030 Policy Target:** *Planning the development of Lebanon's public land transport sector to reach the above suggested vision and targets by 2050, addressing both climate change and good quality of life for all.*
- **2030 Policy Target:** *Creating contracts for private-sector services and tendering them in a competitive and fair process that allows for community-based solutions and projects.*
- **2030 Policy Target:** *Creating and implementing a program to continuously improve the quality of services provided by the public and private sector on national and sub-national levels.*
- **2030 Policy Target:** *Identifying routes where service is important from a social perspective (poor, isolated, and/or deprived areas), and contracting with the private sector to provide the needed service.*
- **2030 Policy Target:** *Providing a suitable platform for private sector contractors and passenger representatives to participate in the negotiations for the private sector's performance and service improvement.*
- **2030 Policy Target:** *Providing complete and up-to-date information and statistics on the public land transportation network.*
- **2030 Policy Target:** *Developing a plan for the integration of public transport and soft modes to reduce the use of private cars.*
- **2030 Policy Target:** *Developing an EV national strategy.*

5. Major Near-term Programs

Lebanon is not starting from a green field in its approaches to ground transportation—a number of initiatives have been designed and studies, but socio-economic, and geopolitical, pressures have hampered their advancement. These existing initiatives can readily fold into the longer-term programming outlined in previous sections, and would also lead to early emission reduction required to be within the Paris Climate Agreement long-term goals. The major, near term projects and studies available that are relevant to transportation targets of this strategy are:

1. **GB Transit Network – BRT:** Developing the design of a BRT System for the Northern Corridor of Greater Beirut, from Beirut to Tabarja, to decrease congestion and encourage the use of Public Transportation.
2. **Greater Beirut Area Public Bus Network:** A bus network covering the GBA, and its

requirements for adequate services (location of stations and stops, frequencies, required number of buses, etc.).

3. **Supportive Projects GBA & Major Cities:** Facilitation of public transport implementation, road organization and safety.

4. **GBA Metro:** Implementation of a Mass Transit Network that would meet mobility, environmental, social and economic requirements in the GBA.

5. **Tripoli–Syrian Border Railway:** Rehabilitation and reconstruction of the Tripoli – Akkar rail link from the Port of Tripoli to Abboudieh at the northern Lebanese-Syrian Border that connects to the Syrian rail network and, through it, to regional railway networks.

6. **Beirut-Saida-Tyr Railway:** Reconstruction of the Beirut-Saida-Tyr railway with its lines and stations.

7. **Rehabilitation of Specific Roads:** Road maintenance to keep pavement, shoulders, slopes, drainage facilities and other structures.

8. **Périphérique de Beirut (Beirut Ring Road):** For improving the quality of the route that connects the major roads south, east and north of the Beirut area.

9. **Tripoli Eastern Ring Road:** Construction of a 9.4km urban expressway with service roads as a south-north corridor on the east side of Tripoli.

B. *Energy*

The proposals put forward by the project align sustainable development in its energy sector with broader aims to limit the energy sector's contribution to the country's debt, trade imbalance, and greenhouse gas emissions—approximately 40% of Lebanon's national debt is associated with the energy sector alone. Transfers from the national treasury to the national electricity utility company averaged US$ 1.6 billion annually between 2009 and 2019, equivalent to 4% of the GDP, and reaching USD 2.3 billion in 2012. This is principally borne out by fossil-fuel imports, which in 2018 constituted 16.5% of all imports to the country—with their associated emissions, which totalled a 6% average year-on-year increase between 1994 and 2018.[7] Part of the causes of the required subsidies include non-technical losses, including non-billing, non-collection, and electricity theft, estimated at more than 42% in 2022[8].

Weak institutions and important vested interests contribute to the problem, even though the country's peak demand is only 3,600MW, which is low compared to other countries in the region; current generation capacity of 1,600MW has not grown, meaning that as the population has increased, blackouts have been extended, creating grater negative impact to economic development.

The most sensible approach from a national perspective is to increase energy production from renewable sources, however, politically it will not be feasible to halt exploitation of fossil-fuel exploration and development while demand is high. The country's socioeconomic development has been hampered by energy insecurity, and it's an opportunity that renewables must demonstrate capacity to fill, with evident benefits in fulfilling this as early as possible.

A Sustainable energy vision for Lebanon

An optimal, cost-effective approach to renewable energy in Lebanon would move through a transition of solar energy, followed by wind and geothermal generation, and finally, in a limited way hydro, with the associated grid expansion. It's recognised that these elements need aggressive energy efficiency measures, as well as rollout of complementary heating and cooling measures for demand-side management.

7. Lebanon's Fourth Biennial Update Report.
8. MoEW (2022). "Setting Lebanon's Electricity Sector on a Sustainable Growth Path", p.6.

Overall, as a pathway, the following mid- and long-term targets were envisioned by the project:

Mid-term, 2030 Targets—to demonstrate political will:

Sectors are increasingly electrified.
Electricity demand flattens after 2035.
3,055 MW of renewable energy capacity is installed, segregated into:

- 2GW of small and utility scale solar photovoltaics
- 400MW in additional hydropower capacity
- 600MW of wind turbines
- 5MW biogas
- 50MW CSP
- 200MW/400MWh EES

All new buildings are mandated to have solar water heaters and/or solar PV systems if site permits.
Two power plants of combined cycle gas turbines are built. These are the last thermal plants to be implemented.

Long-term, 2050 Targets:

Electricity demand is reduced by 15 per cent compared to 2019 baseline year.
10,050 MW of renewable energy capacity is installed, segregated into:

- 7GW of small and utility scale solar photovoltaics
- 700MW in hydropower capacity
- 2GW of wind turbines
- 2GW of geothermal energy
- 300MW biogas
- 50MW CSP
- 2GW/8GWh EES

Heat pumps dominate the heat generation industry. Ground source heat pumps are installed in large commercial and industrial (C/I) facilities such as hotels.
All water pumps for irrigation and drinking water, and wastewater treatment pumps are mandated to operate on solar PV plus storage systems.
Industries are mandated to operate on hybrid renewable energy plus storage systems, including wind, solar and biogas.
Special economic zones (SEZs) are spread across the country in industrial and rural areas and powered by solar, wind and storage.
Moving forward
The project identified four strategic approaches to deliver transitions for the above mid- and long-term targets:

1. Strengthening the Governance Framework;
   * institutional, legal, regulatory, and procurement frameworks

2. Building a New Electricity Model;
   * electrify, expand, distribute, store, connect

3. Long-term Sustainability and Cost-competitiveness; and
   * value for money in contracts while sourcing multiple technologies

4. Creating Capacity and Economic Value
   * technical and financial capacity, increasing local content and creating economic opportunities

1. Strengthening the Governance Framework

This tier is the most basic level necessary for coherence and sustenance in a transition, but it requires particular attention because of Lebanon's recent history and ongoing crisis.
The elements required are:

a) **securing political will for the transition**—even if it is in stages, there must be signalling to the country's actors of the direction of travel;
   * *Policy/Project: adopt a long-term (2050) vision with interim targets.* This is necessary for concrete signalling.

b) **strengthening and aligning policies**—in the absence of long-term planning or a starting position without reliable electricity provision, any transition planning is difficult. A further, but important challenge is to consider alignment between various sectors of the economy, so as to create non-conflicted signalling on a broader pathway;
   * The LbD process particularly looked at inter-sectoral demand signals to support the movement of sectors to low-carbon development pathways—this implies an evolution of economic development where inter-sectoral demand can support transitions in technologies and practices, so this role isn't defined principally by fiscal support or subsidies.
   * *Policy/Project: adopt functional policies and appropriate monitoring and evaluation.* This will require coordination between ministries.

c) **restructuring related institutions**—this is related to the previous element, as at the ministerial level, competing agendas and conflict of interest between various sources of energy, such as the fossil fuel agenda versus the renewable energy portfolio can deter or slow achievement of the long-term targets. At the utility company level, the transition may disrupt existing business models as energy production becomes more distributed—municipalities and communities may become active players in the energy market.
   * moreover, there may be an erosion of central government fiscal revenues as fossil-fuel use reduces over time.
   * *Policy/Project: Ensure that the renewable energy portfolio is under the correct ministerial umbrella, while ensuring coordination and policy alignment across*

institutions. This is also supports transparency, accountability, and follow-up.
- *Policy/Project: Restructure the existing utility company and amend its revenue model and mode of operation so as to contemplate distributed generation.*
- *Policy/Project: Promote decentralized models at local and municipal levels, along with necessary financing packages, regulatory scheme, and integration platform for decentralized systems, including in agricultural use contexts.*
- *Policy/Project: Create an independent, efficient, and credible regulator.*
- *Policy/Project: Establish a one-stop administrative framework for permitting and administration of clean technology deployment including renewable energy and electric vehicles, as a key enabler for deployment of renewable energy and clean technologies and interconnection.*

d) engaging the private sector—the private sector must buy in to the pathway in order to secure investment.
- *Policy/Project: Adopt Build-Operate-Transfer (BOT) and Build-Own-Operate (BOO) models in accordance with the Public Private Participation ((PPP) law 48:2017 while simplifying and reducing the law processes.*
- *Policy/Project: Adopt a solid and transparent procurement framework under the umbrella of an official procurement entity; publish bids, contracts, and awards.*
- *Policy/Project: Eliminate all types of monopoly, to foster competition, starting with the elimination of the electricity utility's monopoly, and adopt an anti-monopoly law.*

2. *Electrify, Expand, Store, Connect*

Preparing the grid and energy infrastructure for transition to renewable energy requires particular elements, which include changes in investment, operation, and energy connectivity for the country.

1. **Electrifying sectors.** Increasing the electrification rates is essential for a 100% renewable energy system. Changes in interconnection go beyond industrial processes, to transport systems.

   - *Policy/Project: Implement technical and financial modeling aiming to optimize the electrification of sectors, such as transport, etc, and the cost reduction of power systems. The model should account for the expected new load and hourly demand profile and build the new generation profile per resource.*
   - *Policy/Project: Identify the exact resources, installed capacities and locations per technology, and their shares of the energy mix for the years 2030 and 2050 based on the previous policy.*
   - *Policy/Project: Calculate the fuel utilization in the energy mix and expected emissions per kWh at the milestones of year 2030 and 2050.*

2. **Expanding and upgrading the grid.** Modernizing, upgrading, and expanding the grid are crucial for the integration of renewable energy. Additionally, the integration of variable renewable energy sources such as wind and solar poses additional challenges, to both centralised and decentralised generation models.

* _Policy/Project:_ Develop a grid transmission master plan for 2030 onwards, based on the capacities and location per technology identified above.
* _Policy/Project:_ Increase the capacity of the substation at the interconnection with Syria.
* _Policy/Project:_ Establish a renewable energy grid integration unit at the electricity utility.

3. **Energy storage.** Intermittent renewable energy sources require associated energy storage systems (ESS) to ensure electricity availability. Additionally, ESS offers important grid services such as capacity firming, frequency regulation, energy arbitrage opportunities, and others.

* _Policy/Project:_ Identify the required storage capacity per region, technology, and capacity, as per the findings of the model above.
* _Policy/Project:_ Design bankable renewables-plus-storage tenders to integrate energy storage systems ("ESS") early on in the infrastructure and enable simpler financing mechanisms.
* _Policy/Project:_ Enact energy storage targets and regulations defining energy storage as assets of generation, transmission, and distribution, to facilitate legal steps when the public utility is restructured.

4. **Distributed power generation.** By 2050, all available roofs should incorporate solar water heating and/or solar PV systems, as citizens become prosumers.

* _Policy/Project:_ Promote administrative and financial decentralization and develop rural areas to spur economic growth, distribute the load, enabling load centers to be closer to utility-scale renewable energy plants.
* _Policy/Project:_ Incentivize decentralized and small-scale renewable energy power generation, including issuing a decentralized renewable energy law and developing a solar rooftop programme to encourage the deployment of solar PV on rooftops, and mandate new buildings to make provisions for solar water heaters and solar PV.
* _Policy/Project:_ Enable a mechanism and develop a process at the grid operator for virtual power plants.

5. **Energy efficiency and demand-side flexibility.** The increase in energy demand needs to be attenuated in order to manage the required ramp-up in renewable energy production, energy storage, and interconnection. This aids in energy demand, which is also supported by flexibility on the demand side for local power generation.

* _Policy/Project:_ Double down on energy efficiency measures. More important than raising the power generation capacity is reducing the demand.
* _Policy/Project:_ Promote the implementation of ground source heat pumps, especially among large C/I consumers to reduce heating and cooling demand.

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3. *Long-term sustainability and cost-competitiveness*

Investments in transitional capacity for the energy matrix need to have security in their arrangements, and the network needs to deliver value to its stakeholders.

1. **Guaranteeing good value for money.** Energy tariffs will primarily depend on managing to reduce the costs of services in generation, transmission, and distribution—the investment at the supply and transmission side must sustainably deliver value to its customers.
   * *Policy/Project: Build a credit-worthy buyer and consider options for multilateral guarantees such as through Multilateral Investment Guarantee Agency (MIGA), to build creditworthiness and reduce the cost of financing.*
   * *Policy/Project: Implement a quality assurance framework for PV. Ensuring high reliability and performance for solar PV panels and system components would reduce maintenance and replacement costs, and project assurances to uptakes.*

2. **Diversifying sources and technologies against a defined timetable.** The energy transition must prioritise availability and affordability; for this, implementing a wide variety of renewable energy technologies including those that are baseload-capable, such as geothermal, is necessary.

   * *Policy/Project: Diversify the energy mix first towards affordable renewables sources. The focus for the intermediate 2030 target should be on the most affordable, cost-competitive technologies, until the share of other technologies in the global mix increases driving prices further down.*
   * *Policy/Project: Until 2035, switch the use of heavy fuel oil and diesel oil to natural gas. This will reduce the greenhouse gas emissions, and possibly the costs for baseload generation.*
   * *Policy/Project: Securing affordable electricity purchase agreements through the grid interconnection. This will be especially important after 2030 and as the share of renewable energy in the mix grows substantially.*

3. **Developing innovative financing.** Due to high investments costs, building an enabling business investment climate and attracting financing is essential.

   * *Policy/Project: Implement necessary reforms to improve the overall business investment climate and reduce cost of financing. These reforms should start with a financial solution and complete financial and economic overhaul, to reforms in procurement practices, institutions, and enhancing rule of law and accountability.*
   * *Policy/Project: Design bankable projects, so as to reduce the lengthy process of raising the funds from lending institutions.*
   * *Policy/Project: Develop innovative and targeted financial products for clean technologies. Different sectors and power generation models require different incentives and financing mechanisms, including green investment facilities where the private sector can participate. Aid and development agencies should be tapped into for grants, such as for public facilities (e.g. hospitals)*
   * *Policy/Project: Mainstream renewable energy and clean technologies into*

conventional lending by placing key environmental performance indicators for project finance instruments.

4. **Reducing siting and design barriers.** Reducing bottlenecks for implementation of utility-scale renewable energy associated with the identification of locations and mitigation of challenges, reduction of design processes, and grid connections.

   * _Policy/Project:_ *Update zoning and the land registry, to reduce potential land disputes and decrease land acquisition process by developers.*
   * _Policy/Project:_ *Build the internal capacity for the technical design of tenders of various clean technologies.*
   * _Policy/Project:_ *Simplify the process for grid connection offer by grid operator to developers, through the identification of grid connection cost responsibility and categorization, depending on modernization and category levels.*

5. **Engaging citizens and local communities early.** Following identification of renewable energy technologies and capacities per location, it is critical to engage the local community early in the process to mitigate potential disputes.

   * _Policy/Project:_ *Create platforms for community engagement on utility-scale project development. The early engagement of the local community reduces the risk of future disputes.*
   * _Policy/Project:_ *Develop energy funds for communities (which can be used in connection with the above). Funding from this can come from public, multilateral, or private sources (i.e. contribution from utility-scale projects).*

6. **Eliminating potential conflicts with future IPPs.** Ensuring that independent power producer ("IPP") contracts and take or pay clauses for natural gas do not contradict the transition to 100% renewable energy.

   * _Policy/Project:_ *Ensure that long-term contracts and take or pay clauses would not create bottlenecks or contradict the transition to 100% renewable energy. These include the thermal IPPs and natural gas suppliers.*

4. *Build Capacity and Create Value*

There need be a regime of commercial certainty in the energy sector, to support investment and the new business models inherent in the energy transition.

1. **Local capacity.** It's clear that local capacity for new services, and new infrastructure building-and-maintaining, will need to be trained—at professional and vocational levels.

   * _Policy/Project:_ *Build technical capacity for key technologies such as solar PV systems, and electric vehicles and chargers, and for the establishment of carbon market.*
   * _Policy/Project:_ *Promote areas across the energy transition value chain where there could be local content.*

2. **Innovation and entrepreneurship.** New technologies, new practices, and new collaborations need to be developed and nurtured in order to create value locally, and mitigate opposition to the transition.

    *   *Policy/Project: Encourage entrepreneurship through the reduction of costs of starting and closing a business.*
    *   *Policy/Project: Promote innovation in the energy industry. A mix of technologies and third-party entity will be needed to achieve the transition such as aggregators, batteries and panel recycling, etc.. Identify key targeted energy themes for seed funding and acceleration.*

3. **Carbon pricing.** Adopting carbon pricing and credit markets are effective in scaling-up renewable energy deployment. However, cross-sectoral demand for renewable energy is essential as an assurance to the investments.

    *   *Policy/Project: Advance a carbon tax and crediting scheme.*

4. **Developing special economic zones in industrial and rural areas and mandate RE systems.** These zones would not only promote economic growth but coupled with renewable and clean technologies could also achieve reduction in businesses' operating costs. Moreover, they would create demand for the associated renewable energy and connectivity needs, bring an opportunity for innovative energy services, and can help participate in labelling schemes designed to give visibility to industrial output using low-carbon pathways.

    *   *Policy/Project: Issue the necessary regulatory and tax incentives to establish special economic zones distributed across the country in industrial and rural areas and mandate these zones to operate on renewable and clean energy. The impact will be three-fold: 1) economic growth, 2) demand for further deployment of renewables and their infrastructure, 3) reduction of operating costs for businesses and enhanced competitiveness.*

C. *Agriculture*

Reforms for the agriculture sector in Lebanon have been well-known since the civil war (1975-1990). Although the latest agriculture strategy encompasses the whole sector, and has been widely disseminated to national stakeholders, it couldn't cover the unprecedented collapse of the agriculture institutions and production chains since 2019.

To create a performant agriculture sector by 2050 in Lebanon, the following six objectives are necessary:

1. Young skilled entrepreneurs and farmers are leading the sector
2. Agriculture arable land is preserved from fragmentation and change of use
3. Water efficient harvesting and use through innovative techniques are secured
4. Performant and climate smart plant and animal genetic material is valorized
5. Sustainable agriculture production systems are adopted
6. Profitable markets are secured

These findings are addressed in detail as follows, and generally follow a pathway of institutional reform which is delivered with participation of stake-holding production interests.

1. *Young, skilled entrepreneurs in farming*

If the younger generation is not immersed in agribusiness, then the aging farmers could not stay in business, not only due to their retirement, but due to their limited physical capacity to operate, to absorb innovative technologies, practices and strategies, to be proactive and to understand future market needs. The root cause of the reluctance of the youth to engage in agriculture might be related to the limited cost-effectiveness of the business, the climate and market uncertainties, the absence of social safety net, and the difficult nature of the work.
To alter this, the following initiatives are proposed:

- _Policy/Project:_ **Agriculture-specific educational and vocational systems are improved.** This initiative responds to the fact that education in the agricultural sector remains unattractive to youth, as it fails to increase job opportunities, even though the cost of education continues to increase. Courses are often irrelevant to the market, to the profile of their students, or the available infrastructure of the faculties—courses barely cover required specialties, and facilities for students are degrading.
    a. Faculties of agriculture oriented towards specialization in agriculture sub-sectors, based on market demand and university assets
    b. Vocational schools are systematically updated with applied curricula, based on technology improvement and market skills demand

- _Policy/Project:_ **Infrastructure and equipment of educational institutions is modernised.** The development of facilities for students (eg. dorms) is crucial, as well as improvements in teaching human and physical infrastructure.
    c. Experimental fields, laboratories, information technology, artificial intelligence, and precision/digital technologies are introduced and calibrated to the Lebanese context
    d. Academic and technical staff capacity building and training (and recruitment) consider the skills to master innovation technologies

- _Policy/Project:_ **Agricultural R&D concepts are anchored in educational and vocational institutions.** Curricula must demonstrate engagement with market demand, with specialisation prioritised over pure research in national context and needs. Public-private partnerships would reduce the cost of investments in infrastructure and equipment, and an association with farmers in experimentation would integrate local know-how and nature-based solutions.
    e. Public Private Partnerships are established between agriculture input and service provider companies, farmers and research, academic and vocational institutions
    f. Research strategies are aligned to national needs in terms of technology development and the conservation of local know-how (nature-based solutions)

- _Policy/Project:_ **Start-ups and agriculture finance targeting youth and innovation are prioritized.** These would incentivise fresh graduates or master students to develop their own

business, with seed money from international sponsors or a dedicated government rotating fund. Besides technology and innovation, nature-based solutions or climate smart agriculture could also be integrated. This regime could be extended to graduates from vocational schools, or active agriculture cooperatives and farmers or agribusiness associations.

    g.   Start-ups promoted by different platforms with focus on graduate young engineers/technicians and their associations

    h.   Revolving funds and off-shore platforms with tailored financial mechanisms are established for farmers/coops seeking innovation

- *Policy/Project:* ***Awareness campaigns and capacity building targeting young farmers and entrepreneurs are implemented.*** The aim of this approach is to encourage the younger generation to invest and work in a modernized, easier and desired agriculture sector; the concept of entrepreneurship in agriculture would motivate skilled fresh graduate technicians to fill the gap of aging agriculture workers and farmers.

    i.   The concept of entrepreneurship is developed in educational and vocational institutions

    j.   Different media and information dissemination approaches are used to outreach farmers and technicians

- *Policy/Project:* ***Farmers and their groups are strengthened.*** Because existing agriculture holdings are of limited size, higher costs of production must be consolidated into groups and association's strengthening their cooperation. LbD's *comanejo* principles would directly address these issues, as the governance elements of these groupings is important. A farmer registry system would facilitate both market intelligence and innovation opportunities, as well as a transparent social security or subsidy system. Moreover, a normalisation of migrant workers is necessary, on which the sector relies on.

    k.   Agriculture registry system established (all farmers and their associations and their subsequent assets and holdings are registered)

    l.   Mutual funds are updated activated to cover social security for registered members and for health and climate indexed insurance

    m.   A legal framework of foreign workers and farmers considering social security, equity fair agreements for leasing, renting or working is effective

    n.   A legal framework for land tenure should be materialized in order to ensure equity and fairness between agriculture land owners, and the land users

2.   *Agricultural land is preserved from fragmentation and change of use*

Agricultural assets are being eroded, and a performant agricultural system in Lebanon by 2050 requires conservation of fertile land and holdings.

- *Policy/Project:* ***Inheritance laws are revised to limit fragmentation of agriculture lands.*** Existing inheritance laws are affiliated to the religious communities' civil affairs, and thereafter are not equal for all citizens, and do not consider gender equity. Moreover, inheritance customs of all religious groups do not consider the conservation of agriculture holdings, so agriculture holdings could be divided amongst heirs until the land is not worth being exploited for agriculture. Additionally, conflict between heirs over inheritance, the

distribution of heirs within the Lebanese diaspora and in Lebanon, and other constraints, leave more than 30, 000 ha of arable land abandoned, and most of the agriculture holdings below 1ha each—exploitation size is therefore an intrinsic problem leading to a high cost of production, and hinders the improvement of agriculture infrastructure and equipment.

    a. Personal status laws are civic-oriented
    b. Agriculture-designated parcels are prohibited from division below an appropriate fixed surface (i.e. 0.5ha)
    c. Compensation mechanisms for agriculture parcels owners are proposed (and used in financial support mechanisms)

- *Policy/Project:* **Strategic land use planning and subsequent laws and regulations to conserve arable lands are conducted.** Land development should consider the existing master plan of priority agriculture areas. Additional land capability maps provided by the National Remote Sensing Center would allow better design of land use, and preserve fertile lands for agriculture, thereby improving the efficiency, relevance, and impact of infrastructure projects.

    d. Land capability and suitability maps for agriculture produced and acknowledged by the state as agriculture designated zones
    e. Agriculture designated zones protected from change of land use and eligible for different support systems under strategic land use plans are established (with the appropriate financial support mechanism)
    f. Agriculture infrastructure deployed to reach arable lands (irrigation channels, agriculture roads, energy network, drainage, etc.)

3. *Water efficient harvesting and use through innovative techniques are secured*

Water laws, water establishments, infrastructure and on-farm practices remain outdated and far from being cost-effective and efficient.

- *Policy/Project:* **Non-conventional water harvesting technologies are implemented.** Water distribution systems and their management remain outdated, centralized and inefficient, leading to huge losses in quantities and qualities in open channels. Under future climate scenarios, the legal framework for users associations, management and distribution and water harvesting including from treated waste water need to evolve to cope with climate change impacts. The need to reach the farm gate with pressurized water in irrigation schemes depending on surface water is crucial for the establishment of efficient irrigation systems.

    a. Identified technologies for adaptation to climate change in water sector are promoted
    b. Water distribution systems to farm gate are up-scaled and modernized (pressurized, metered and automated)
    c. Water management bodies are decentralized to the lowest efficient level and their legal framework established
    d. Water law updated (water turns revised)

- *Policy/Project:* **Efficient irrigation systems are deployed.** The deployment of efficient irrigation systems is hindered by the lack of proper water distribution systems, water laws (water shares from private springs), and the absence of agriculture crediting systems. In

parallel, drip irrigation or similar systems remain inefficient if they are not linked to climate data, soil characteristics and plant type and development stage.

    e.   Pressurized innovative systems (drip and variants) are deployed (mainly on pressurized distribution systems)

    f.   Technology of precision for scheduling irrigation at the farm level is linked to climate and plant demand

4. *Valorization of resilient plant and animal genetics*

Lebanon needs to balance between native and adapted species, including imported species for production performance and market demand

- *Policy/Project:* **Local breeds genetically improved, multiplied and disseminated to producers**. The seed law and other relevant laws need to be updated and revised in close collaboration between the concerned ministries (MoA, MoE, MoET). Once the legal framework is set up, the technical and operational frameworks follow by the establishment of the necessary infrastructure for the breeding, multiplication, sanitation, quality control, registration, certification and trade are developed through targeted technical projects involving both the public (LARI, MoA), the private (nurseries, traders) and international agencies (ICARDA, ACSAD...). Academic and research institutions are also involved horizontally across the value chain.

    a.   Intellectual property rights are developed, and a national registry for varieties and cultivars is effective.

    b.   Infrastructure and capacity building developed to ensure the conservation, therapy, monitoring and distribution of healthy plant (and animal) material.

    c.   Nurseries (and animal breeding establishments) developed to meet international standards for traceability and sanitary requirements.

    d.   Geographical indexing for local species and know-how is effective.

- *Policy/Project:* **Imported climate smart breeds are promoted.** The registration of important plant and animal material should follow some regulations. Priority should be given to climate-smart products that do not compete with the local breeds, and that are needed to fill the gaps in both local and export markets. This could be reached through incentives related to import taxes, the legal framework for registration at the MoA or other ministries.

    e.   A national registry system for genetic material is established following an effective legal framework.

    f.   Quarantine service infrastructure and staff capacity are improved and effective.

    g.   Incentives to promote climate smart breeds is established.

    h.   Extension service to promote climate smart breeds is effective.

    i.   A decision making tool about the spatial suitability of the imported breeds based on the environmental and physical local conditions is developed.

5. *Sustainable agriculture systems are adopted*

In addition to profitability, sustainable agriculture includes the cost-effectiveness from a resource perspective (land, water, energy) and thereafter which reduces the dependency on fossil energy,

labor force, heavy machinery, and ample consumption of resources in term of space and water. For this purpose, sustainable agriculture systems should be carefully studied before their promotion and inclusion in national strategies. Priority goes for good agriculture practices that target the reduction of GHG emissions, values agriculture residues and wastes, and limits the need for irrigation, space and labour.

- *Policy/Project:* **Sustainable systems are promoted with financial support mechanisms.** Sustainability of the various agriculture systems towards their social acceptance, availability of the technologies in the market, the scale of their application in the national context, the access to finance for their operation and their environmental implications should be conducted at the earliest stages. On a second step, these should be mainstreamed in education, extension service, capacity building, and financial support mechanisms, and replace the current subsidy system.
    a. Sustainable agriculture systems are developed and updated (i.e. organic farming, conservation agriculture, mixed farming, integrated greenhouse production, agroforestry, permaculture, aquaponics, predefined crop rotations, and the use of climate smart breeds...).
    b. Sustainable agriculture systems integrated in education and vocational curricula.
    c. Extension and capacity building on sustainable systems are conducted.
    d. A financial mechanism supporting sustainable agriculture systems is developed.

- *Policy/Project:* **Renewables are promoted for different agriculture practices and post-harvest and processing value chains.** The promotion of renewable energy is essential not only to ensure autonomy, but also to reduce emissions and reduce the cost of production. Many agriculture by-products or wastes could be recycled and re-used to minimize the consumption of resources and energy, and further reduce the cost of production and the dependency on imports.
    e. Hydro-electricity is prioritized for agriculture and agro-industry.
    f. Solar panels and pumps are subsidized for irrigation, and post-harvest practices
    g. Mulch and packaging derived from nylon and plastic are replaced by wood pellets, biomass by-products, carton and paper through an updated legal framework and support system.
    h. Burning and dumping of agriculture residues are replaced by climate and environmental smart practices.
    i. Synthetic fertilizers and pesticides are replaced by green manure, compost, bio-pesticides and other nature based solutions

- *Policy/Project:* **Artificial intelligence, digital services, and other innovative technologies are disseminated.**
    j. Legal, organizational, financial and operational aspects of the necessary enabling environment are established
    k. Incentives and support mechanisms for innovation are developed for upscaling
    l. Dissemination strategies for innovation are developed (fairs, social media, TV, field visits, field schools...)
    m. Capacity building and extension periodically updated to integrate innovation technologies

6. *Access to profitable markets*

Farmers rely mostly on the local market, while exports have been the privilege of few large-scale producers or a minority of farmers capable of meeting the international quality and standards. Despite the increase of local market demand due to demographic trends, traceability and quality are chaotic, resulting in unfairness to many farmers. Exports remains opportunistic to market gaps in the Gulf States or other neighbouring countries, with the absence of any legal entity assisting farmers and traders in developing a market strategy and in improving the governance and traceability of products to meet international standards.

- <u>Policy/Project:</u> **Fair trade and capacity-building for farmers.** Strengthening understanding of market demand and valuation of goods to farmers, preserving value for product quality and incentivising compliance with modern market requirements.
  - a. Regulations securing governance and transparency in market operations are effective
  - b. Traceability (barcoding) system and quality certificates (organic farming, fair trade, geographical indexing, variety copyright…) are implemented
  - c. Farmers and farmers group are oriented towards marketing strategies, techniques, international standards, fair trade and traceability

- <u>Policy/Project:</u> **Strategies for local export markets developed.** This implies major institutional reform oriented towards value chains, by the creation of boards that are built through a public-private partnership. The strategies encompass market demand on both national and international markets, and land capability for competitive products.
  - d. The institutional organisation of production and trade is restructured based on value chains (revival of the board concept for fruits and vegetables, animal production, ornamentals, pulses and cereals, tobacco and others)
  - e. Land capability and suitability for different value chains is linked to a decision tool considering market opportunities and competitiveness (based on yield, market price and cost of production)
  - f. Marketing strategies are diversified and integrated short circuit markets, regional markets, specialised markets and export

- <u>Policy/Project:</u> **International norms for wholesale and retail markets.** National norms and standards are reviewed and updated to meet international norms and local market requirements. The necessary infrastructure to reach these quality standards also need modernisation and support.
  - g. Norms and standards are developed and updated for agriculture and agro-industry products
  - h. Infrastructure for handling, sorting, packaging, cool storage, drying and shipping in gross markets and export points are modernised
  - i. Laboratories for food quality control for import, export or local markets are modernised

D. *Waste/Circular*

Initiatives for Lebanon in terms of materials management look to align both consumption and production towards a more functional relationship towards circularity. Issues considered included:

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- Extended Producer Responsibility – creating legal and/or financial responsibility for manufacturers to deal with end-of-life of their products;
- Reverse Logistics – the processes and marketing required move consumed goods from customers back to manufacturers;
- Industrial Symbiosis – the promotion of collaboration or partnerships between similar or different industries, so that the waste of one becomes the input of another while maintaining the highest value possible;
- Proximity Principle – where the management of materials should prioritise the use of local products and manage them to the smallest geographical circle possible, including waste management;
- Material Recovery Industry – the creation of a new industry operating at every stage of the materials flow process, which industry operates in a decentralised processes, giving opportunities for many SMEs in various regions. Some will require higher education, while others do not, leading to training, up-skilling or re-skilling, and scientific development; and
- Sustainable and Clean Production – domestic production would shift to a higher sustainability standard, with less toxicity and a higher potential for recirculation.

The enabling elements for these aims were found to be the following:

1. **Financing Strategy:** required for infrastructure, corporations, innovative and disruptive circular start-ups, as well as capacity-building for up-skilling and re-skilling, and education from kindergarten to university leading to changes in social practices and behavioural changes;
2. **Reforming Taxes/Tariffs:** a requirement to incentivise changes in practices, alongside education and awareness-raising of circular economy and materials science issues, are tax incentives or rebates for recycled products and increasing tariffs on products with toxic or non-recyclable substances and products—whether locally produced or imported;
3. **Regulating Product Design:** as an example, Lebanon could develop policies to require all soft-drinks, juice, and other refreshment bottles to be identical in shape and material to facilitate reverse logistics—the aim is to facilitate, or funnel, productivity towards intelligent materials management, and to facilitate the development of mid-channel logistics and processing;
4. **Empowering Local Communities:** the decentralised optimal situation for materials management implies that collaboration and new business models will be needed, such as technology platforms powered by entrepreneurs connecting small scale producers and artisans with both local and international buyers—this is an opportunity for bottom-up engagement, which is essential for the decentralisation goal;
5. **Ensuring Social Equity:** strategy shall support vulnerable, marginalised, and poorer communities, including the communities that will manage the flow of materials, as waste and material management require a collective effort;
6. **Changes of Social Behaviour:** policies should feel a palpable sense of pride in using durable circular products, to support the change in consumption and disposal patterns. The role of education will be key (formal but also informal through social media and other communication channels) to change the notion of waste to a resource that we are proud to reuse;
7. **Facilitating a Sharing Economy:** new economic models are essential to be facilitated, such as lease alternatives (for example for electric bikes and cars, or even for the batteries of an electric car), pay-per-usage or subscription-basis options (such as for toys and clothing for

fast-growing children), or for fashion items. The advantage of lease or sharing options is that there's real incentives for the real asset owners (not necessarily the lessees or renters) to maintain and prolong the usage and life of the loaned/leased assets, and to recirculate or recycle its parts at its highest value.

1. *New policies on materials management*

Creating a "re-use" economy
Although "re-use" is not entrenched in Lebanese mentality, the current economic crisis has opened the door to its adoption, as accessibility to imported products has driven opportunity to this economic model—in fashion/clothing and interior design/furniture/accessories businesses, whereby high-quality second-hand goods are being reinvented, upcycled, repaired, refurbished, and made to look highly fashionable, allowing recirculation to pick up.
Newer technologies including AI and 3D design and printing are increasingly opening the door for an approach to circular economies, allowing customisation and intelligent sourcing of components for up cycling or recycling.
New policies to encourage innovation and application, using the markers identified above, can help capitalise human potential, software skills, and creative and artistic talents in a decentralised network of SMEs working with larger production and consumption centres.

- *Policy/Project:* *Develop up-skilling and re-skilling opportunities for innovation in production following a re-use economy.*
- *Policy/Project: Develop import and production coding to align with the development of circular industries and practices.*
- *Policy/Project: Support programs and education to introduce concepts of a shared economy into local communities, green and social enterprises, and general business models.*

Benefitting from international momentum
A circular economy is already a key priority for many donor countries to Lebanon, and for intergovernmental agencies, prioritizing the implementation of SDG 12 on Sustainable Consumption and Production. These elements incentivise networking and collaboration opportunities for best practices and new innovation and technological opportunities, which directly benefit entrepreneurial approaches in the country, and opportunities for external financing.

- *Policy/Project: Advance AI and 3D printing to develop innovation in material management, as well as other technologies to allow tracing product specifications and accurate labelling.*

Sectoral material management plans
The approach would best be implemented through sector-specific programs and support mechanisms. For example, in the agricultural sector, a specific collection stream could be established for agricultural waste to be composted into high quality fertilizers or be used for ethanol for energy production, which cannot be extracted from the municipal waste stream. Collecting agricultural waste during the trimming period is necessary to prevent forest fires and the burning of trimmed waste is the number one cause of forest fires in Lebanon, which is also exacerbated by extended drought periods resulting from climate change. Lebanon suffers from desertification and severe soil erosion, particularly in cropland areas which

means it's necessary and highly valuable to rehabilitate agricultural soil and return to it nutrients by using local composted organic waste. Regenerative agriculture practices could be promoted through training of farmers and giving them access to high-quality local compost and manure, eliminating the need for costly and polluting synthetic fertilizers.

In industrial zones, resource recovery centers could be established for waste sharing. By establishing the right environment for industrial symbiosis, with reliable data and procedures, the waste of one industry could become raw material for another.

New products could emerge, from novel uses of agricultural waste and by-products – for instance from hemp or banana plantations — to manufacture new biodegradable and/or compostable products for packaging, the construction industry, the catering industry to name just a few examples.

- _Policy/Project:_ Develop sector-specific (e.g. agriculture, industry) material management plans, using cross-sectoral and seasonal logistics to create demand for re-use.

V.   **Mexico**

Executive summary

In the Learning by Doing (LbD) (Mexico) project, we focus on identifying and analyzing various prospective scenarios and actions for decarbonizing the Mexican economy, using the Paris Agreement on climate change as a reference, which requires achieving a carbon-neutral economy between 2050 and 2070. As with LbD's analysis of Mexican actions, and as a contrast to LbD in other countries, discussion and analysis worked from a top-down macroeconomic approach first, before engaging in discussions with stakeholders.

Simulations of various prospective scenarios show that the current trajectory of inertial growth is inconsistent with the construction of a carbon-neutral economy. However, they also show that it is feasible to achieve a carbon-neutral economy in Mexico between 2050 and 2070, but this requires implementing fundamental structural transformations in the current mitigation process. Indeed, to reach a carbon-neutral economy by 2050, it is necessary to significantly increase the rates of energy efficiency and decarbonization of the economy, with some sector-specific nuances. For example, there are sectors where a mitigation process is already underway, such as energy and agricultural activities, while in the waste sector, it is necessary to reverse the trend of increasing emissions.

Achieving deep decarbonization of the economy requires supporting structural transformations with specific public policies. For example, to decarbonize the economy, it is necessary to significantly expand the use of electricity across all economic activities, households, and mobility, ensuring that this electricity is generated from renewable energy sources. In agriculture, it is essential to control the expansion of agricultural land, significantly increase yield rates, and create virtuous cycles with forests and ecosystems. Additionally, building waste management and disposal infrastructure is indispensable.

A key policy measure is the implementation of a carbon price that penalizes activities with high carbon content, promotes technological innovation, and provides market signals for investment. It is also crucial to adapt productive practices in these sectors to achieve the necessary shifts toward production and consumption patterns aligned with real decarbonization. These public policies are therefore essential for a climate transition.

Delaying mitigation processes until 2030 would require extremely high rates of energy efficiency improvement and decarbonization from 2031 onward, which are not only unrealistic but also inefficient and likely very costly. Therefore, it is necessary to immediately implement a deep mitigation strategy.

Introduction

Climate change poses an obstacle to development in Mexico (Dell et al., 2014). The impacts of climate change on economic activities, social welfare, and the environment are significant, widespread, and, in some cases, non-linear and irreversible, affecting the long-term growth trajectory of *per capita* Gross Domestic Product (GDP), which in turn influences development prospects (Dell et al., 2014).

Furthermore, the Paris Agreement on climate change aims to stabilize the temperature increase between 1.5°C and 2°C during this century. To achieve this, the global economy must become carbon-neutral between 2050 and 2070, requiring the implementation of various structural transformations in current production and consumption patterns, such as eliminating the production and consumption of fossil fuels (IPCC, 2018; IEA, 2021).

Building a mitigation strategy consistent with achieving a carbon-neutral economy between 2050 and 2070 is an extremely complex task. It requires identifying the scale of mitigation processes by sector that will allow for the decoupling of economic growth from greenhouse gas emissions. This approach enables the preliminary identification of the public policies that need to be implemented and, more broadly, the urgency, scale, feasibility, risks, and limitations of these mitigation processes for the Mexican economy.

This is also in line with a growing body of recent economic literature that seeks to identify, analyze, and assess the physical, public policy, technological, market, legal, and reputational risks associated with this climate transition to a carbon-neutral economy by 2050-2070 (NGFS, 2018; NGFS, 2021). For example, it is important to identify risks related to the loss, closure, or accelerated depreciation of capital (stranded assets) in activities with high carbon content (NGFS, 2021; McGlade & Ekins, 2015). However, this literature on transition risks remains limited for Latin America and the Caribbean and, certainly, for Mexico.

In this context, it is necessary to develop various mitigation scenarios to identify the scale of transformations required to achieve a carbon-neutral economy between 2050 and 2070. The objective of this essay, a result of discussions in Mexico stemming from the Learning by Doing Project, is to identify and analyze various prospective scenarios for decarbonizing the Mexican economy, using the Paris Agreement on climate change as a reference, which requires reaching a carbon-neutral economy between 2050 and 2070. The essay also aims to describe concrete projects aligned with these scenarios.

These scenarios illustrate the main stylized facts involved in achieving a carbon-neutral economy by 2050 in Mexico. The construction of these scenarios seeks to define a long-term goal associated with building a carbon-neutral economy in Mexico and to highlight some exemplary projects aligned with this goal.

The work is divided into four sections: the first section is the introduction, the second section presents the conceptual framework used, the third section presents the simulations and main results, and finally, the fourth section provides the conclusions.

1. FRAMING

The analysis of mitigation strategies in Mexico is based on a conceptual framework where total and sectoral $CO2e_t$ emissions are a function of the $CO2e_t$ emission intensity coefficient relative to the Gross Domestic Product (PIB_{it}) of the corresponding sector, and the Impact, Population, Affluence, and Technology (IPAT) model (Yan and Yu, 2016; York et al., 2003).

(1)
$$CO2e_{it} = \left(\frac{CO2e_{it}}{PIB_{it}}\right) * PIB_{it}$$

(2)
$$CO2e_{it} = PIB_t * \left(\frac{CE_{it}}{PIB_{it}}\right) * \left(\frac{CO2e_{it}}{CE_{it}}\right)$$

Where COe_{2it} represents the total and sectoral CO_{2t} emissions, PIB_{it} is the total and sectoral Gross Domestic Product (GDP), and CE_{it} is the energy consumption. The equations (1) and (2) can be represented in growth rates.

2. SCENARIOS, RESULTS, AND ACTIONS

The database used corresponds to:

- The National Inventory of Greenhouse Gases (INEGI, 2018).
- Gross Domestic Product and Population from INEGI (2020).

Key results obtained from these IPAT models indicate that:

1. In economy-wide terms, greenhouse gas emissions in Mexico show a trend inconsistent with decarbonization, although some sectors contribute more than others. An important change is noted from land-use change, where in the period 200-2010 this vector had been a net sink of emissions, offsetting the rapid increase in emissions from the Energy sector. Although there has been an improvement in Energy emissions, the overall trend of emissions in Mexico is on a generally-ncreasing trend, albeit with something of a plateau up to 2018; from 2018, all indications are that emissions are increasing. The project considered examples of carbon pricing, wiht results described in the project's results documentation; selected policy and practice recommendations on the progressive investment of carbon pricing revenues are put forward.
2. At current energy efficiency rates, greater economic activity implies an increase in energy consumption, which in turn implies greater greenhouse gas emissions, which is inconsistent with a decarbonisation pathway for sustainable development. A transort sector that is highly urbanised and represents 20% of emissions is a clear target for action—especially as between 1990-2020 the vehicle fleet grew by 5.6% while population only grew by 1.5%, with 68% of trips in private vehicles being by a single passenger in Metro Mexico. A postponement of energy efficiency or decarbonisation action for the sector makes a sectoral decarbonisation target around 2050 unrealistic.
3. The agricultural sector has AFOLU activities that can be enhanced to increasedthe capacity of natural sinks—but this requires a restriction in agricultural expansion; the current mitigation potential of AFOLU at the Mexican national level is aorund 20% of annual emissions, but can be increased to 25% (Pye and Bataille, 2016). However, practices related to overgrazing and other livestock producing activities lead to steadily increasing emissions, and need to be corrected in order for the sector to move towards a decarbonization pathway, including an uptake of renewable energy sources.
4. Mexico's industrial sector, represensging about 32% of the GDP (World Bank, 2022b), has emissions growth growing faster that the national GDP. In this sense, because of its need for heat and general requirements, a concerted move must be made to harness efficiencies and to move to electricication wherever possible, and including renewable energy feeds to this sector.
5. The waste sector in Mexico contributes to 7.4% of the country's total emissions in 2019 (SEMARNAT-INECC, 2022); although it is not the main source GHG emissions, its contribution derived from the decomposition of organic matter in wastewater and in uncontrolled sanitary landfills is considerable. Although methane remains in the atmosphere in less quantity and time than CO2, its global warming potential is around 28 times greater (IPCC, 2021), and its generation is closely tied to population growth—so the trend for emissions growth is set to continue. Uses must be adopted for waste so that a society-wide effort addresses this trend—dealing both with the creation of waste—as agricultural, industrial, or urban—and with its management and use, in order for Mexico to move to a decarbonization pathway and harbour a cleaner environment.

Actions to move forward in decarbonization pathways are outlined below.

FINDING 1. OVERALL GREENHOUSE GAS EMISSION TRENDS IN MEXICO

Greenhouse gas emissions in Mexico show an upward trend, although with varying rates and characteristics depending on the source type. The main sources of greenhouse gas emissions are energy consumption and agricultural and industrial activities. Additionally, greenhouse gases from waste still represent a smaller proportion, but with high dynamism. (Gráfico 1).

Figure 1. Evolution of Greenhouse Gase Emissions.

Source: Galindo, et al (2022).
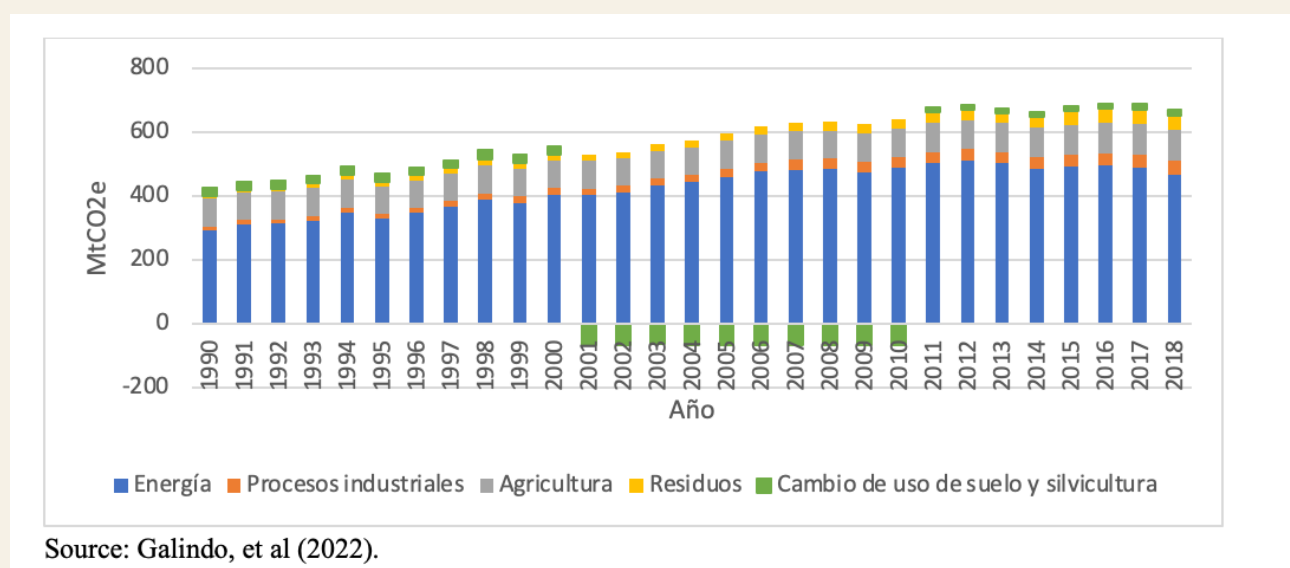
Project/Policy: As part of the macroeconomic analysis carried out by the Mexico team, extensive modelling was developed demonstrating a need for progressive investment of carbon pricing revenues as part of a coherent policy drive to decarbonisation. This was found to be a fragile approach due to the possible inconsistency of application over subsequent governments; nevertheless, carbon pricing is an important tool to consider.

Decarbonizing the Mexican economy will not only transform production processes, it will also significantly alter the lives of all, and especially those of people and communities whose livelihoods are intimately tied to hydrocarbon-intensive activities. Such a significant change cannot be driven by the environmental authority (SEMARNAT) on its own. The whole Federal Government must be involved, and the Treasury Department (SHCP) should be the main institutional driver for changes of such magnitude.

A politically feasible carbon pricing policy should consider the following elements from the design stage:

- *A broad coalition of citizens, businesses, NGOs, and politicians that supports carbon pricing (in either form) will be needed to overcome the political challenges.*

- *A reform based only on the "common good" or analogous arguments is likely doomed to failure. For an effective carbon tax or an effective cap-and-trade system to be politically viable, policymakers must consider allocating part of the ensuing revenue to help the most affected economic sectors to make the transition, to compensate regressive distributional effects, and to support displaced workers and hard-hit regions.*

- *The long-term tax trajectory or, equivalently, the long-term emissions cap trajectory should be clearly established by law to provide the needed certainty for consumers and producers to adjust efficiently to the new conditions.*

- *The government should conduct multiple consultations with affected stakeholders and launch a communications campaign that explains the rationale for the policy, provides the facts supporting the case for carbon pricing, and addresses possible misconceptions. Making it public would also help potential beneficiaries of the reform to construct a focal point for organizing in support of the reform.*

Low Emission Zones

A key component of a mitigation policy based on carbon pricing is the investment of the revenue. There are two main uses. First, revenue from carbon pricing should be considered as part of compensations for potential losers. And, second, revenues should be invested on social and economically progressive actions.

Regarding compensations for potential losers of carbon pricing it is a key issue to consider from its design. Ignoring it, may doom the project's success. Workers from industries that go out of business of that significantly reduce its operations, could be benefited with unemployment benefits and retraining. Revenue may also be used to partially subsidize industries to modernize its technology or to facilitate new business ventures.

On the second potential use of revenues, there exist an ample variety of progressive projects to be implemented. Revenues can be invested on mitigating climate risks. The investment should have a strong progressive component by focusing on reducing regional inequalities, and on the most vulnerable societal groups.

The use of revenues could also be invested in creating a strong and sustainable societal demand for a better environment. Communities and local governments should have a say on how resources are invested. It is important to incentive citizens' participation. Mexico's Mining Fund (Fondo Minero) could be a good model to follow in this respect.

FINDING 2. ENERGY GENERATION AND CONSUMPTION

With over 70% of total electricity generation coming from fossil-fuel sources, the evolution of greenhouse gas emissions from energy consumption shows an average annual growth rate of 1.5% between 1990 and 2020. This trend corresponds to an average annual GDP growth rate of 2.3% and an increase in energy efficiency and decarbonization rates of -0.2% and -0.5%, respectively. This inertial scenario indicates that the rates of energy efficiency and decarbonization are still too low to transition to deep decarbonization. It clearly shows that the decoupling processes of emissions from economic growth in Mexico are insufficient to achieve a carbon-neutral economy by 2050.

Table 1. Inertial Scenario (Business As Usual - BAU) of Greenhouse Gas Emissions from Energy Consumption (Average Annual Growth Rates).

Variables	Tasa de crecimiento promedio anual: 1990-2020
GDP	2.3%
Energy Intensity (EN/GDP)	-0.2%
Carbon Intensity (CO2e/EN)	-0.5%
CO2eEN	1.5%

Source: Prepared by the author.

Prospective scenarios for the energy consumption sector show that higher rates of economic growth (GDP) lead to a significant increase in emissions if the rates of energy efficiency improvement and decarbonization remain constant. For instance, an average annual GDP growth rate of 4% and 5%, with constant rates of energy efficiency and decarbonization growth, would result in average annual growth rates of emissions from energy consumption of 3.3% and 4.3%, respectively (see Figure 1). These scenarios would lead to per capita emissions of 6.58 tCO2e and 7.59 tCO2e in 2050, which are not consistent with a deep decarbonization process.

Table 2. Scenarios with Different Economic Growth Rates in the Energy Sector (Average Annual Growth Rates).

	Scenario	BAU		Scenario	I		Scenario	II	
	2020-2030	2030-2040	2040-2050	2020-2030	2030-2040	2040-2050	2020-2030	2030-2040	2040-2050
GDP	2.3%	2.3%	2.3%	4%	4%	4%	5%	5%	5%
Energy Intensity (EN/GDP)	-0.2%	-0.2%	-0.2%	-0.2%	-0.2%	-0.2%	-0.2%	-0.2%	-0.2%
Carbon Intensity (CO2e/EN)	-0.5%	-0.5%	-0.5%	-0.5%	-0.5%	-0.5%	-0.5%	-0.5%	-0.5%
CO2eEN	1.6%	1.6%	1.6%	3.3%	3.3%	3.3%	4.3%	4.3%	4.3%

Source: Prepared by the author.

Deep decarbonization scenarios for the energy sector show that with GDP growth rates between 3% and 4%, energy efficiency rates of 4% and decarbonization rates of 1% are required (see Table 3). These energy efficiency and decarbonization rates are high and exceed recent evidence in Mexico. To achieve these rates, urgent and substantial structural transformations are essential. Moreover, these rates of energy efficiency and decarbonization need to increase with greater economic dynamism.

Table 3. Deep Decarbonization Scenarios in the Energy Sector (Average Annual Growth Rates).

Variables	Escenario	I		Escenario	II	
GDP	3%	3%	3%	4%	4%	4%
Energy Intensity (EN/GDP)	-4%	-4%	-4%	-4%	-4%	-4%
Carbon Intensity (CO2e/EN)	-1%	-1%	-1%	-2%	-2%	-2%
CO2eEN	-2%	-2%	-2%	-2%	-2%	-2%

Source: Prepared by the author.

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Gráfico 1. Deep Decarbonization Emission Scenarios for the Energy Sector by 2050.

Source: Prepared by the author.
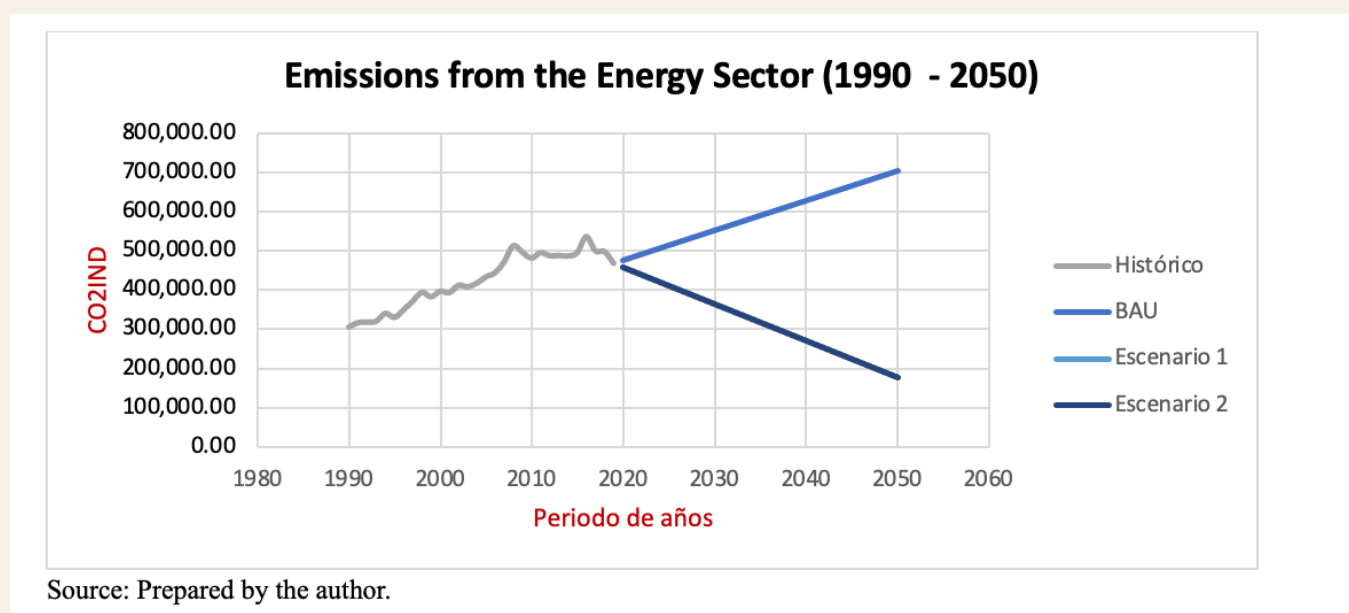
Moreover, in scenarios where deep decarbonization is delayed until 2030, the required rates of energy efficiency and decarbonization become extremely high, making them less credible, increasing implementation costs, and reducing the efficiency of mitigation processes. For example:

- **With a GDP Growth Rate of 4%:**
    - **Postponing Deep Decarbonization Until 2030**: Requires an annual energy efficiency rate of 4% and an annual decarbonization rate of 3% between 2030 and 2050 to achieve a carbon-neutral economy.
- **With a GDP Growth Rate of 5%:**
    - **Postponing Deep Decarbonization Until 2030:** Requires an annual energy efficiency rate of 4% and an annual decarbonization rate of 4% from 2030 onwards.

These elevated rates make deep decarbonization more challenging and costly, highlighting the importance of early action to avoid excessively high requirements in the future (see Table 4).

Table 4. Mitigation Scenarios Starting in 2030 with Different Average GDP Growth Rates.

Variable	Scenario	I		Scenario	II	
	2020-2030	2031-2040	2041-2050	2020-2030	2031-2040	2041-2050
GDP	4%	4%	4%	5%	5%	5%
Energy Intensity (EN/GDP)	-0.2%	-4%	-4%	-0.2%	-4%	-4%
Carbon Intensity (CO2e/EN)	-0.5	-3%	-3%	-0.5	-4%	-4%
CO2eEN	3.3%	-3%	-3%	4.3%	-3%	-3%

Source: Prepared by the author.

Building a consistent and credible decarbonization strategy in the energy sector requires considering the following (Fay et al., 2015):

- **Credible Energy Efficiency and Decarbonization Rates:** The strategy must involve realistic rates of energy efficiency and decarbonization that increase with economic development. Immediate initiation of energy efficiency and deep decarbonization is crucial for the decarbonization goal. Delaying mitigation efforts until after 2030 would necessitate extremely high and less credible rates of efficiency and decarbonization.
- **Focus on Electricity and Transportation:** A deep decarbonization strategy must include significant mitigation processes in electricity and transportation, which are the principal components of energy consumption emissions. This involves generalizing electricity use across all economic activities, households, and mobility, using electricity generated from renewable sources. Supportive policies are necessary, such as implementing a carbon price to encourage investments in renewables, manage electricity demand, reduce fossil fuel-based mobility, and promote the development of new technologies. Additionally, new infrastructure for renewable electricity and public transportation should be developed.
- **Reducing Costs of Renewable Energy:** Consider that the costs of renewable energy are presently rapidly decreasing, which enhances the benefits of climate transition (Bolton et al., 2020; Landa et al., 2016).

Policy/Project: Energy efficiency measures must rise to offset the BAU emissions increase at a rate much higher than the decarbonization rates fo rthe energy sector. Energy efficiency in cooling (e.g. ground source heat pumps, etc.) presents an opportunity to mitigate what will likely be a driver for increased energy consumption emissions. This initiative is not exclusively technological, as it includes interaction with building codes and materials.

Policy/Project: Lowered emissions in the transport sector through improved urbanisation and public transportation, especially if an increasing electrically-powered system is using renewable energy, will deliver material and increasing energy consumption emissions reductions—but this transition is gradual, and must start to be effective before 2030 for the sector to credibly advance.

Low Emission Zones

Low emission zones (LEZ) are a very effective way to reduce emissions. Many cities in the world have successfully implemented LEZ that, according to the existing evidence, have contributed significantly to traffic reduction, less air and noise pollution, shifting to more sustainable transportation modes, and community building.

A LEZ consider charging vehicles for transiting in a specific geographic polygon. A main expected effect is to reduce traffic and its corresponding emissions. LEZ usually consider incentives for modal shifting, such as charge exemptions for electric vehicles and improvement of public transportation to the LEZ area.

Revenue from LEZ can be invested in further mitigation measures and in urban developing of the LEZ area.

Nevertheless, despite its known benefits, implementing this sort of projects has been difficult. In most cases, congestion charge zones have significant resistance from specific actors. There are two core reasons for resistance: first, the nature of the LEZ generates focalized costs for specific groups and disperse benefits across the entire population; and, second, a subset of citizens would be paying for a public service (i.e. using the roads) that was free before.

In order to be successfully implemented, a LEZ project should consider the following points in its design:

- It matters how the project is communicated.
  - The framing is fundamental, as it sets the points of public debate. In some cases, the LEZ was framed as part of a wider strategy of urban development; in other cases, a specific benefit was highlighted—such as traffic improvement, better public transportation, or improvement of the environment.
  - It also matters who communicates the proposal. The main elected official should publicly support the project.
- A sufficiently wide and diverse coalition should be constructed to support the project.
- The approval of the general public is also relevant, as politicians do not like to implement unpopular projects. Arguments of equity and justice have proven successful at building public support.
- Conducting a (successful) pilot project would allow for the public and relevant actors to know first-hand the potential benefits of LEZ.
- After the pilot, a public voting on the LEZ would provide sufficient legitimacy to the project (if successful).

The Mexico team explored the actual feasibility of congestion charge zones in Mexico City and Guadalajara to push for its implementation with local governments. In Mexico City we have partnered with Inicitativa Climática de México (ICM) and in Guadalajara with the Instituto Tecnológico de Estudios Superiores de Occidente (ITESO) for working on researching and creating project proposals. So far, Guadalajara seems like a more feasible option for political reasons.

FINDING 3. AGRICULTURAL SECTOR

Greenhouse gas emissions from agricultural activities show an average annual growth rate of 0.6% between 1990 and 2020 (see Table 5). This is supported by a significant increase in the decarbonization rate. Although this trajectory is not yet consistent with a deep decarbonization process, it represents a significant advance.

Table 5. Inertial Scenario (Business As Usual - BAU) of Greenhouse Gas Emissions from Agricultural Activities (Average Annual Growth Rates).

Variables	1990-2020
GDP	2.3%
CO2AGRI/GDP	-1.6%
CO2eAGRI	0.6%

Source: Prepared by the author.

A higher growth rate in agricultural GDP translates into an increase in emissions under the inertial (Business As Usual - BAU) scenario, despite significant progress in the decarbonization rate (see Table 6). However, considering the inertial decarbonization rates, it is possible to envision strong mitigation processes in the sector. For instance:

- **Agricultural GDP Growth Rate of 4% (2020-2050):** Maintains a constant inertial decarbonization rate, leading to an average annual growth rate of agricultural emissions of 2.4%.

- **Agricultural GDP Growth Rate of 5% (2020-2050):** Maintains a constant inertial decarbonization rate, leading to an average annual growth rate of agricultural emissions of 3.4%.

Thus, an increase in agricultural production is currently inconsistent with deep decarbonization if inertial decarbonization rates are maintained. Therefore, deep structural transformations in the agricultural sector are necessary to decouple economic growth from emissions. Key measures include:

- **Substantial Increase in Agricultural Productivity:** Enhance productivity to reduce emissions per unit of output.
- **Control of Agricultural Expansion:** Prevent the further expansion of agricultural land, which can contribute to increased emissions.
- **Development of Agricultural Activities with Ecosystem Synergies:** Promote practices that align with and benefit ecosystems.
- **Transition to Renewable Electricity:** Ensure that all agricultural activities shift to using electricity generated from renewable sources.

Following these precepts, deep decarbonization must be consistent with maintaining a dynamic agricultural sector that ensures food security and continues to contribute to the balance of trade.

Table 6. Scenarios with Different Economic Growth Rates in the Agricultural Sector (Average Annual Growth Rates).

| Variables	Scenario	I		Scenario	II	
	2020-2030	2031-2040	2041-2050	2020-2030	2031-2040	2041-2050
GDP	4%	4%	4%	5%	5%	5%
CO2AGRI/GDP	-1.6%	-1.6%	-1.6%	-1.6%	-1.6%	-1.6%
CO2eAGRI	2.4%	2.4%	2.4%	3.4%	3.4%	3.4%

Source: Prepared by the author.

Achieving a carbon-neutral economy by 2050 requires substantially increasing decarbonization rates. In the agricultural sector, this implies tripling or quadrupling the current decarbonization rates under average annual GDP growth scenarios of 3% and 4% (see Table 7, Figure 2).

Table 7. Decarbonization Scenarios Consistent with a Carbon-Neutral Economy by 2050 in the Agricultural Sector (Average Annual Growth Rates).

Variables	Scenario	I		Scenario	II	
	2020-2030	2031-2040	2041-2050	2020-2030	2031-2040	2041-2050
GDP	3%	3%	3%	4%	4%	4%
CO2AGRI/GDP	-4.5%	-4.5%	-4.5%	-5.5%	-5.5%	-5.5%
CO2eAGRI	-1.5%	-1.5%	-1.5%	-2%	-2%	-2%

Source: Prepared by the author

Figure 2. Deep Decarbonization Emission Scenarios for the Agricultural Sector by 2050.
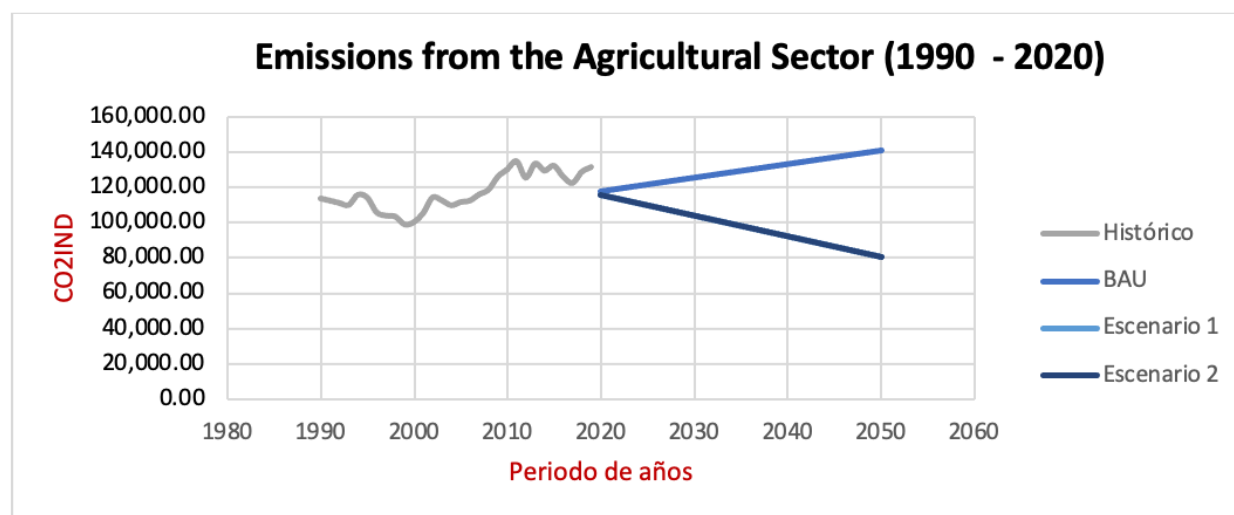
Source: Prepared by the author.

Source: Prepared by the author.

Deep decarbonization scenarios that are postponed until 2030 indicate that the required rates of energy efficiency and decarbonization are extremely high. Specifically, a decarbonization rate of between 5% and 6% is required, with GDP growth rates of 3% and 4% annually, if mitigation is delayed until 2030 (see Table 8). This suggests that postponing mitigation increases costs and may be inefficient.

Table 8. Mitigation Scenarios Starting in 2030 with Different Average Annual GDP Growth Rates in the Agricultural Sector.

Variables	Scenario	I		Scenario	II	
	2020-2030	2031-2040	2041-2050	2020-2030	2031-2040	2041-2050
GDP	3%	3%	3%	4%	4%	4%
CO2AGRI/GDP	-1.6%	-5%	-5%	-1.6%	-6%	-6%
CO2eAGRI	1.4%	-2%	-2%	2%	-2%	-2%

Source: Prepared by the author.

Policy/Project: Develop capacity-building and vocational education for regenerative, climate-conscious, resilient agriculture, including the facilitation for adoption of technologies and practices that increase productivity without increasing the carbon footprint of the sector.

FINDING 4. INDUSTRY

Industrial activities have shown an average annual growth rate of 3% from 1990 to 2020 (see Table 9). This increase is a result of the growth rate of the industrial sector and the absence of a greenhouse gas mitigation process for industrial activities (see Table 9).

Table 9. Inertial (Business As Usual - BAU) Scenario for Greenhouse Gas Emissions from Industrial Activities (Average Annual Growth Rates).

Variables	1990-2020
GDP	2.3%
CO2IND/GDP	0.7%
CO2eIND	3%

Source: Prepared by the author

A higher GDP growth rate in the industrial sector leads to a substantial increase in emissions under the Business As Usual (BAU) scenario (see Table 10). The increase in carbon intensity within this sector means that an elevated GDP growth rate results in a corresponding rise in emissions. Therefore, it is crucial to implement immediate mitigation processes in this sector to address the growing emissions.

Table 10. Scenarios with Different Economic Growth Rates in the Industrial Sector (Average Annual Growth Rates).

Variables	Escenario	I		Escenario	II	
	2020-2030	2031-2040	2041-2050	2020-2030	2031-2040	2041-2050
GDP	4%	4%	4%	5%	5%	5%
CO2IND/GDP	0.7%	0.7%	0.7%	0.7%	0.7%	0.7%
CO2eIND	4.7%	4,7%	4.7%	5.7%	5.7%	5.7%

Source: Prepared by the author.

Scenarios consistent with deep decarbonization indicate that a significant decarbonization rate is essential (see Table 11). This requires:
- **Massive Electrification:** Transitioning to renewable energy sources for industrial activities is crucial. This includes major industrial sectors such as cement and metalworking, which still face significant challenges in advancing toward decarbonization.

Key Requirements:
- **Renewable Energy:** Electrification should be primarily based on renewable energy sources to achieve the necessary reduction in emissions.
- **Sector-Specific Challenges:** Industries like cement and metalworking need targeted strategies to address their specific decarbonization challenges.

These scenarios emphasize the importance of substantial changes in energy use and technology to meet deep decarbonization goals.

Table 11. Decarbonization Scenarios Consistent with a Carbon-Neutral Economy by 2050 in the Industrial Sector (Average Annual Growth Rates).

| Variables	Escenario	I		Escenario	II	
	2020-2030	2031-2040	2041-2050	2020-2030	2031-2040	2041-2050
PIB	3%	3%	3%	4%	4%	4%
CO2IND/PIB	-5%	-5%	-5%	-6%	-6%	-6%
CO2eIND	-2%	-2%	-2%	-2%	-2%	-2%

Source: Prepared by the author.

In a scenario where deep decarbonization is postponed until 2030, it is observed that extremely high decarbonization rates are required, which are considered unrealistic (see Table 12, Figure 3).

Cuadro 12. Mitigation Scenarios Starting in 2030 with Different Average Annual GDP Growth Rates in the Industrial Sector.

Variables	Escenario	I		Escenario	II	
	2020-2030	2031-2040	2041-2050	2020-2030	2031-2040	2041-2050
PIB	3%	3%	3%	4%	4%	4%
CO2IND/PIB	0.7%	-5.5%	-5.5%	-6.5%	-6.5%	-6.5%
CO2eIND	3.7%	-2.5%	-2.5%	-2.5%	-2.5%	-2.5%

Source: Prepared by the author

Figure 3. Deep Decarbonization Emissions Scenarios for the Industrial Sector by 2050.
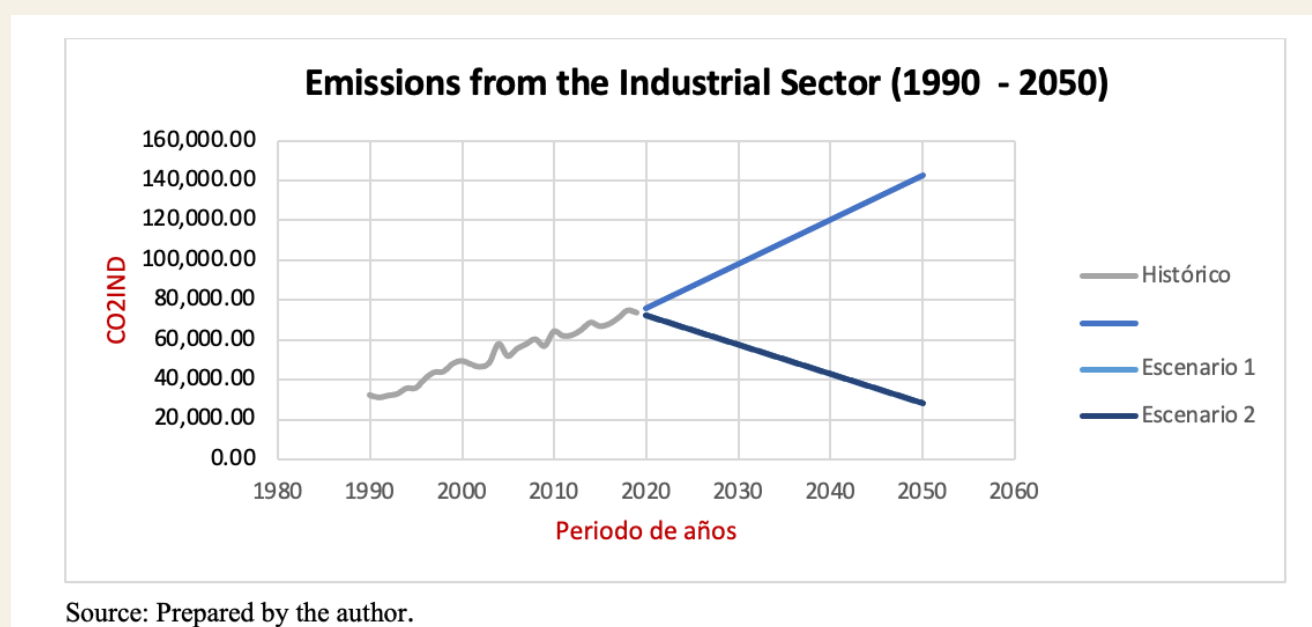
Source: Prepared by the author.

Source: Prepared by the author.

Policy/Project: Industrial activity must present demand for energy efficiency and energy-reduced production methods, capitalising on waste heat and renewable energy wherever possible, with an aim to move to electrification of sources as early as possible, and with an aim to promote circular economies (see below) wherever possible—even in joint zones with other industries.

FINDING 4. WASTE

The greenhouse gas (GHG) emissions from waste show a high average annual growth rate, although their percentage share of total emissions remains relatively small (see Table 13). This indicates the need for early and focused attention on managing these emissions.

Table 13. Business As Usual (BAU) Scenario for Greenhouse Gas (GHG) Emissions from Waste (Average Annual Growth Rates).

Variables	1990-2020
GDP	2.3%
CO2WASTE/GDP	2.3%
CO2eWASTE	4.6%

Source: Prepared by the author.

A higher GDP growth rate translates into a substantial increase in emissions from waste in the Business As Usual (BAU) scenario (see Table 14). This is due to the increased carbon intensity of waste relative to GDP. This dynamic in the growth rate of waste emissions is unsustainable in the long term.

Table 14. Scenarios with Different Economic Growth Rates for Waste (Average Annual Growth Rates).

| Variables	Scenario	I		Scenario	II	
	2020-2030	2031-2040	2041-2050	2020-2030	2031-2040	2041-2050
GDP	4%	4%	4%	5%	5%	5%
CO2WASTE/GDP	2.3%	2.3%	2.3%	2.3%	2.3%	2.3%
CO2eWASTE	6.3%	6.3%	6.3%	7.3%	7.3%	7.3%

Source: Prepared by the author.

Scenarios consistent with deep decarbonization indicate that a significantly high rate of decarbonization for waste is essential (see Table 15). This requires the construction of waste management and disposal infrastructure and the advancing of a circular economy.

Table 15. Decarbonization Scenarios Consistent with a Carbon-Neutral Economy by 2050 for Waste (Average Annual Growth Rates).

Variables	Escenario	I		Escenario	II	
	2020-2030	2031-2040	2041-2050	2020-2030	2031-2040	2041-2050
GDP	3%	3%	3%	4%	4%	4%
CO2WASTE/GDP	-5%	-5%	-5%	-6%	-6%	-6%
CO2eWASTE	-2%	-2%	-2%	-2%	-2%	-2%

Source: Prepared by the author.

Figure 4. Waste Emissions Scenarios for Deep Decarbonization by 2050
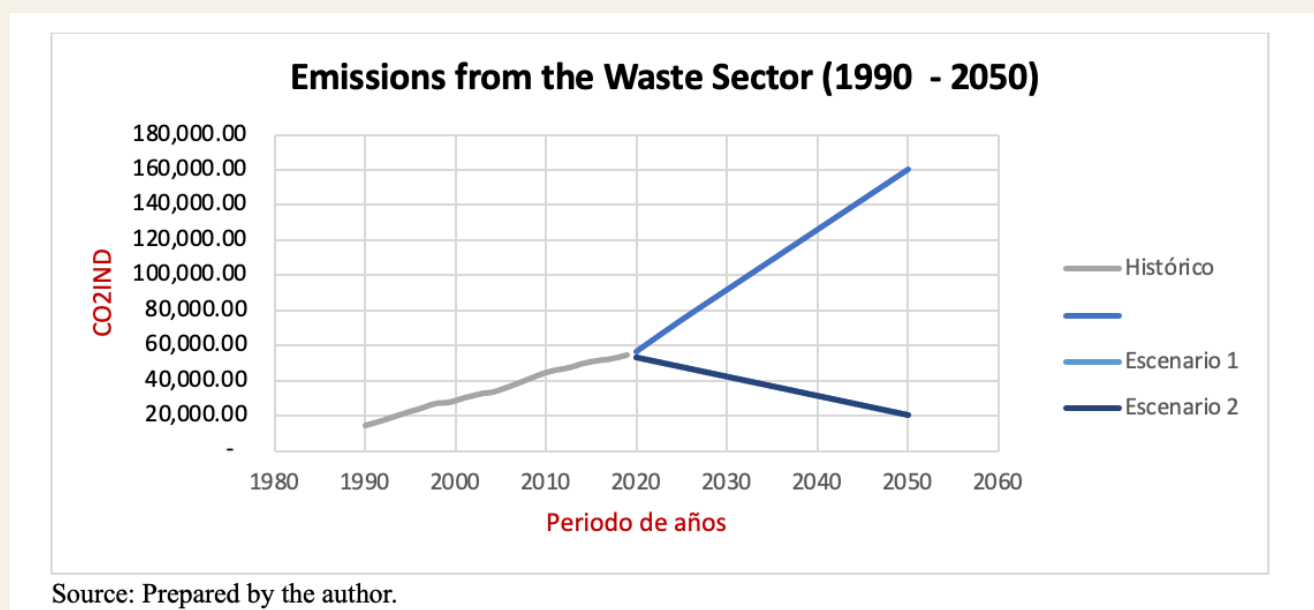
Source: Prepared by the author.

In a scenario where deep decarbonization is postponed until 2030, it is observed that extremely high decarbonization rates are required, which are considered unrealistic (see Table 16). Delaying the establishment of a circular economy and the necessary waste management and disposal infrastructure then results in a scenario that is both unlikely and potentially inefficient and costly.

Table 16. Mitigation Scenarios Starting in 2030 with Different Average GDP Growth Rates in the Waste Sector (Average Annual Growth Rates).

Variables	Escenario	I		Escenario	II	
	2020-2030	2031-2040	2041-2050	2020-2030	2031-2040	2041-2050
GDP	3%	3%	3%	4%	4%	4%
CO2WASTE/GDP	2.3%	-6%	-6%	2.3%	-7%	-7%
CO2eWASTE	3.7%	-3%	-3%	-3%	-3%	-3%

Source: Prepared by the author.

Policy/Project: Regulatory measures and incentives on the supply and demand side for waste need be accelerated in order to create conditions for the development of circular economy and waste-reduction scenarios, from industrial as well as construction and agricultural practices. These measures would carry employment and production benefits, but require innovation, and guardrails so that their implementation doesn't rely on fossil-fuel processes.

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Conclusions

The Paris Agreement on climate change sets the goal of stabilizing the increase in global temperature between 1.5°C and 2°C during this century. To achieve this, the global economy needs to be carbon neutral between 2050 and 2070. Simulations of various prospective scenarios show that the current growth model is not consistent with a deep decarbonization process. That is, there remains a strong positive correlation between GDP growth, energy consumption, and greenhouse gas emissions (Akizu-Gardoki et al., 2018, Cohen et al., 2018).

Therefore, meeting the climate change agreement for Mexico means immediately and significantly increasing energy efficiency rates and deep decarbonization, which is only possible through implementing structural transformations in the current growth patterns and the relationship between GDP growth, energy consumption, and greenhouse gas emissions. To decouple these trajectories, it is essential to implement various strategies across the economy, such as a carbon price and sectoral strategies in electricity, transportation and mobility, and agricultural and industrial activities.

In this context, it is crucial for Mexico to develop a solid and consistent deep decarbonization strategy based on the implementation of a set of public policies.

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VI.   Subnational activities. Well-being (good life) and Environment

The project also worked to develop a sub national portfolio of policies and projects, which could be deployed at sub national level, at an increasingly smaller scope. This entailed identifying a vision and purpose for architecture and urban planning, as well as a series of principles which may help advance those visions and purposes. As an illustration, activities advanced within the project could serve to outline a series of interventions that could be advanced at a city, district, neighbourhood, street and house levels, to both facilitate a good life according to those principles, including a low carbon and climate resilient future. This in turn would help provide a list of characteristics of places which may be at the same time promoting a good life and a low carbon, resilient future.

As this part of the portfolio advanced, it ended up advocating for a more holistic model of development, one that prioritizes the characteristics of the good life in the project, as a way to examine how better to live in specific places within the emissions and impact constraints.

This part of the portfolio was developed through work in the scrums, but also with the addition of teams assembled with experts in cities and universities. Student competitions, and a model to integrate work with universities faculty, and with undergraduate and graduate students and the project. The model took the idea of a good life as developed by the project, using an emerging methodology within the project scrum so as to advance exchanges with Universities. Faculties and students from Urban Planning and Architecture faculties in Mexico and the UK served as initial examples for this model operation.

In what follows, this section presents a vision and principles for an architecture and urban planning directed towards a good, low carbon and resilient life in specific places. Then, it presents a catalogue of some examples of how this could be implemented at a city, district, neighbourhood, and street level. Then, it presents some 10 characteristics of a good life in specific places, with some case examples to illustrate the argument. The whole section advances these recommendations as if it wee a proposed "building code" using the LbD principles developed by the project. An annex outlines measures at different level more in detail.

Vision

Purpose
The purpose of the Learning By Doing Design Code is provide guidance and policy that promotes the good life within cities and neighbourhoods. It is part of an ongoing project that imagines what our built environment would look like, if we got things right? The guidance given is low carbon, resilient and socially considered.

Vision
The Learning by Doing project envisions a low carbon future, that is focused on how communities can live the good life, whilst being resilient and low carbon. Our mission is to inspire and implement

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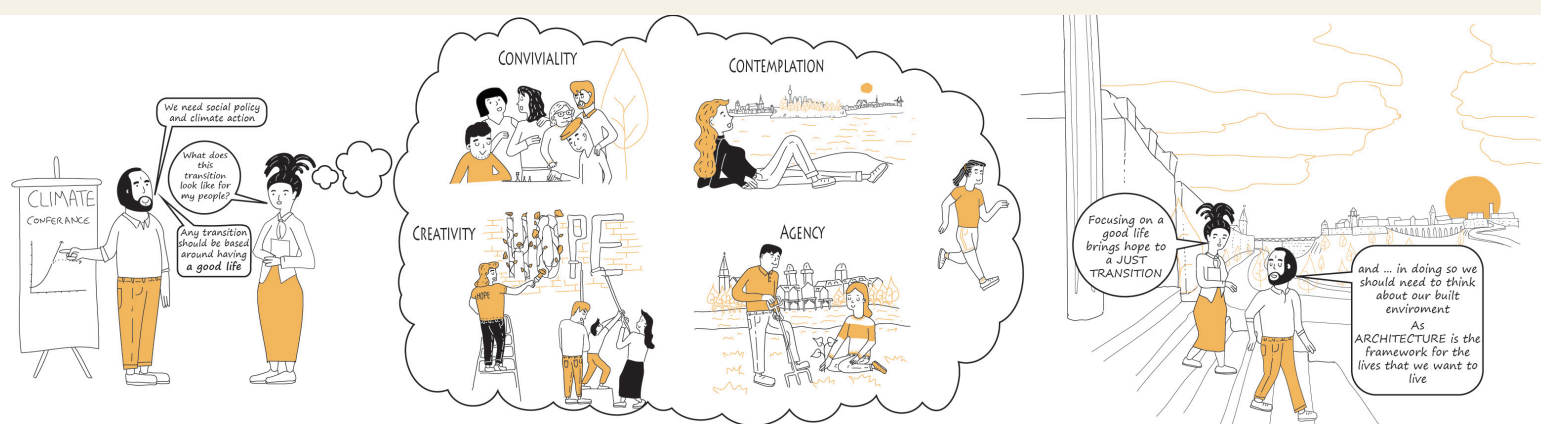
transformative actions that foster a "good life" by 2050—a life that aligns with the 1.5-2°C climate target while embraces the values of freedom, creativity, community engagement, and environmental stewardship. By presenting tangible, appealing scenarios and visions for sustainable living, we aim to move beyond fear-driven narratives and catalyze proactive, inclusive policies and practices.

Architecture

The architecture of our cities provides the framework for the lives that we wish to live. Designing this framework so that it is not just sustainable but is also appealing, creates a positive narrative for a sustainable transition towards a low carbon and climate resilient future that benefits all involved.

Architectural solutions thus far have been increasingly technocratic. In this, they do not follow its etymological origin (of τέχνη, techne, meaning "art, skill, craft"). In the Aristotelian tradition, to the contrary to the modern understanding, technology follows natural processes and that it is human creativity that allows us to use this process to better exist within nature. While these aspects seem to be increasingly ignored in the built environment globally, approaches developed within the more creative versions of the Aristotelian tradition, entail some kind of ethical obligation to sustaining or stewarding natural and human processes.

So, what ideology or philosophy should be placed on the alter so that technology and architecture can address climate change whilst having an ethical obligation to being sustainable. Not just for nature but also for human tradition, craft and existence. The Learning by Doing process outlined certain characterization of a good life. The LbD process advanced to develop an understanding of the good life within the project, underlined the importance of conviviality, creativity, agency, contemplation and beauty - all with a long-standing place within a varied number of human traditions. It is important to note that these characteristics are low carbon and resilient to change. These characteristics also provide an ethical environment and an endeavour where notions of common good and beauty may provide sustenance for past and future generations.

Core Principles
- **Conviviality:** Building vibrant communities where social connections flourish.
- **Creativity:** Encouraging innovative and sustainable solutions that resonate with local contexts.
- **Agency:** Empowering individuals and communities to actively shape their environment.
- **Contemplation:** Designing spaces that promote reflection, spiritual well-being, and appreciation of nature.
- **Beauty:** Prioritizing aesthetic and enduring designs that enhance both cultural and environmental heritage.

All these core principles work side by side with the overall thrust of the project, focused on approaching a level of emissions and resilience compatible with a a 2 -1.5 degree increase in temperature.

These principles may help informed policies and measures at the city, district, neighbourhood and street levels. To these we turn now.

City and District Level

Society Involved : persons are the best actors in their own change. Thus any Just Transition requires citezen participation, collective action and agency, in order to have locally sensitive change. Citizen engagement in urban planning ensures that community needs are met, leading to higher satisfaction and better adherence to sustainability goals. Participatory approaches such as the "Slow The Flow" flood program have been linked to enhanced social cohesion and more resilient urban environments and communities.

Facilitate participatory workshops and forums, such as design charrettes and community mapping exercises, to gather diverse input and ensure collective ownership of development projects.

Compact City: A compact city creates lively sustainable participatory environments. Noted to have high political participation and an exchange of culture. Compact cities tackle energy inefficient urban sprawl in favour of high-density living, mixed-use developments, and efficient land use. Achieving a density of >80 dwellings per hectare can increase walk-ability, reduce commute times, and lowers transportation emissions. Studies indicate that compact urban forms can significantly reduce greenhouse gas emissions compared to sprawling cities.

Clean Transportation: Many studies show a correlation between social inequality and transportation poverty. A good transport system connects isolated individuals in an affordable, convivial and low emissions manner, facilitating the emergence of personal contacts. Clean transportation systems in compact cities, ranging from electric buses to low cost bike-sharing programs, reduce urban air pollution and promote healthier lifestyles. There is a 40% reduction in greenhouse gas emissions in cities with high transit useage (Pucher et al., 2010). Public transit also promotes social inclusion by offering affordable mobility for low-income individuals (Cervero, 2004), and its accessibility improves health outcomes by encouraging physical activity and reducing air pollution (Besser & Dannenberg, 2005).

Good Water Management: Creative water management systems that incorporate natural processes can bring nature into the city. The management of potable and sewage water is a necessary yet intensive process. However, effective management of grey water, such as rainwater collection can reduce the demand on water infrastructure. Furthermore bioswales and sustainable urban drainage systems (Suds) to manage stormwater and reduce urban flooding. Cities implementing integrated water systems have observed reductions in flood risks and improvements in water quality. Water management (and particularly, the use of pumps) may also be a serious user of energy, and offer many opportunities for a low carbon and low emissions options.

Resilience: A resilient landscape has the capacity not only to sustain normality during adversity, but can also actively make spaces more connected to nature. A resilient landscape has the capacity to absorb adversity and spring back. This capacity to sustain day-to-day conditions grants freedom and agency to individuals. The use of hard and soft measures is dependent on risk. However soft natural strategies,
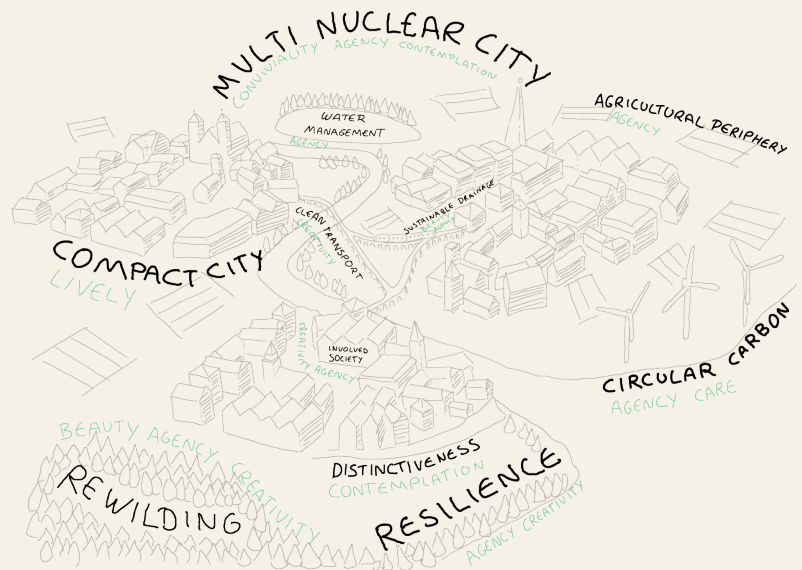
**Compact Urban Areas use
25% less energy in transportation compared
to suburban areas with similar populations.**
International Energy Agency (IEA, 2013)

especially large buffer areas such as parks can improve day-to-day condition bringing beauty into the city, while remaining low carbon and constrain emissions. Furthermore, communities with high resilience show faster recovery rates and reduced economic losses during adversity.

Strategic Forestation: To bring nature into our cities creates spaces for reflection and contemplation. It is a process that encourages community action towards sustainable goals. The integration of urban forests and green corridors improves air quality, reduces urban heat island effects, enhances biodiversity, and helps capture carbon

Good Management of Solid Waste: The accumulation of waste is part of the process of decay within cities. It seeps into watercourses with poses a risk to human health and Biodiversity. Strategies such as zero-waste programs and community recycling initiatives engage communities with sustainable goals. These are bottom up strategies that make neighbourhoods more beautiful whilst diverting substantial amounts of waste from landfills. In Bogotá the formalisation of the role of waste picker has increased recycling in the city and provided economic opportunities for marginalized communities. Bogotá's 20,000 waste pickers recover approximately 1,200 tonnes of recyclable waste per day, that would otherwise go to landfill. The good management of waste (and recycling of resources, see below) is in itself a low carbon strategy.

Cultural Preservation: Engaging with traditional styles and practices builds upon an architectural language that people have developed many millennia. This helps create buildings that people value and want to preserve, which minimises waste in both construction and demolition. Creating cultural landmarks and traditional public spaces creates a shared identity and encourages community stewardship, which are essential for long-term sustainability.

Circular Carbon: The built environment is a repository of resources. We must be creative in how we use existing resources, so as to conserve our natural resources. Circular cities focus on waste reduction, recycling, and the re purposing of materials, aiming to create closed-loop systems where resources are continuously reused. When combined with clean energy sources the city consumes fewer resources (currently 75% of all natural resources are consumed within cities). These in turn reduces emissions, and fosters resilience.

Sustainable Urban Design: We must consider our cities to be natural in order for them to be sustainable, as any natural system has checks and balances in order for it to survive. This means integrating green spaces as they mitigate heat

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islands, improve air quality and buffer climate adversity. Urban environments conversely require a certain density to reduce energy consumption and improve overall quality of life alongside orientation and form. The use of local materials and traditional building techniques, is a low carbon and environmentally appropriate way achieve sustainable urban design.

Zoning + Multi-Nuclear Cities: A poly-centric city has the capacity to provide something for everyone. By decentralising the city individuals have more agency and neighbourhoods are more lively. Decentralised urban centres reduce traffic congestion and pollution as economic activity is distributed more evenly. This poly-centric model supports local economies, reduces commuting times, leading to both a more balanced urban development and a better life.

Neighbourhood and Street Level

Proximity Services and mixed use zoning : City zoning removes the convivial interplay of personal activities, in favour of spaces of transience that can be divided into spaces for sleep and work. By integrating daily services like grocery stores, schools, and healthcare facilities within walking distance reduces car dependence and boost local economies. Neighbourhoods with high service proximity report lower transportation emissions and increased resident satisfaction.

Nearby Green Areas: Green public spaces are fundamental to any good life scenario. They provide a backdrop for contemplation, rationality, creativity and agency whilst also serving as resilient buffers to environmental adversity. It is critical that green spaces are preserved for our environmental, physical and mental health and are not consumed by housing. Any new development should contribute towards the creation of new habitats and enhanced biodiversity.

Non-Motorised Mobility: A sustainable city is one where everyone able to travel without using a car Safe and accessible pedestrian and cycling infrastructure reduces traffic congestion and promotes active lifestyles. Cities that prioritise non-motorised mobility report significant reductions in vehicular traffic and emissions, as well as increased public health benefits.
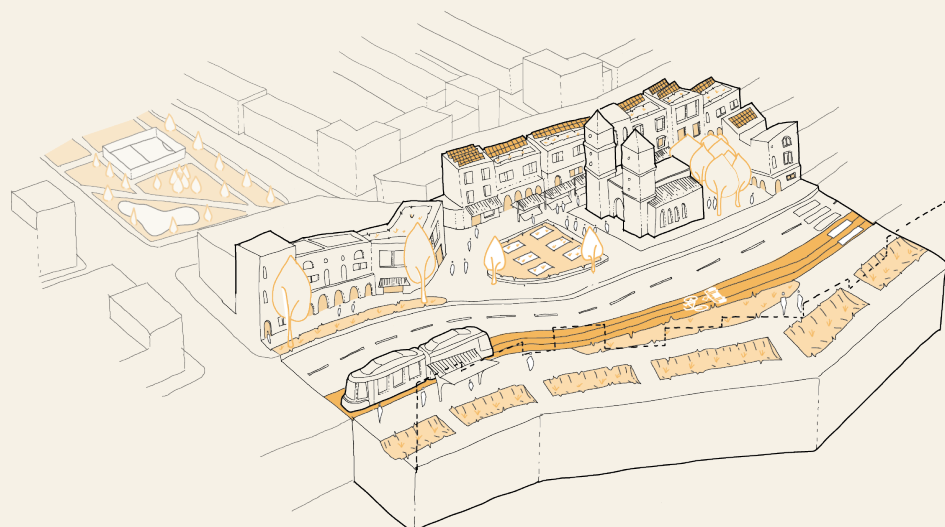
Safety: Safe enviroments foster interaction and consequently the good life. Programs such as - Violence Prevention Through Urban Upgrading, South Africa - are excellent examples, showing how design principles such as eyes-on-the-street, open neighbourhoods and lighting can create safe environments which can develop into spaces that contain the good life. After a 40% reduction in violent crime over 4 years the neighbourhoods public realm has become more vibrant.

Liveliness: The city is a ballet of human behaviours associated with the good life. A good neighbourhood allows these behaviours to flourish in a safe manner. Active streets with diverse uses and vibrant public spaces allows people to live the good life outside of their home. Unlike atomised suburbs, mixed-use developments with collaborative communities create vibrant landscapes that share the good life with all that participate. This supports economic vitality and social engagement.

Collaborative Community: Neighbourhood action stems from shared aspiration and common good found within the community.The principles of a good life are found in most community-driven projects, such as shared gardens, spiritual activities and play. Living the good life with others strengthens neighbourhood networks and reinforces social resilience making communities active participants in their own change.
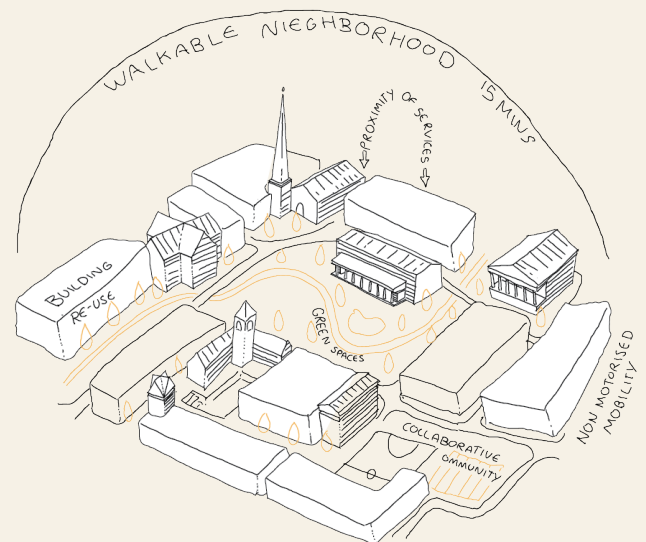
Commons: The city is an ecosystem, whose components are a product of the people that govern them. It is critical that collaborative communities have spaces where they can interact and these spaces are an active representation of the diversity of communities that inhabit them. These creates local spaces where people want to go and enjoy themselves together, thus diminishing the need to trave far (and thus increase the use of resources and emissions). Here architecture is the canvas on which rituals are painted. Projects like El Campo De Cebada, Madrid is a project that provides urban stage to empower residents to participate in space for the sake of the common good. By functioning together with a collective sense of unity, whether that be through the public realm or through re-negotiating social and economic relations in our local communities we can flourish through the purpose, intent and enjoyment of our interactions.

Urban and Building Recycling: New ideas need old buildings and every building has embodied carbon and culture, and it is our ethical obligation to creatively sustain these resources. Knowing when and how to re-use urban resources is an important part of mature urban growth. It is alos a recycling aspect which enhances the low carbon way, while preserve cultural values and renewing the life of the building to better accommodate changing community needs.

Civic Centres and Markets: Civic centres and local markets serve as hubs for community interaction and economic activity. These spaces support local businesses and provide venues for cultural and social events, fostering a strong sense of community. Furthermore, creating cultural landmarks and traditional public spaces gives a locality greater meaning as these spaces create a shared identity and public purpose. This idea of locality is essential to sustain vibrant long -lasting communities, and again, continrutes to create local places that help people avoid the need to use transport.

Sense of Place: Without identity and character neighbourhoods are places of atomised existence, with no collective realisation of what the good life could be. Unique street design that contains landmarks and local culture and identity encourages civic engagement. The living with beauty report highlights the human desire for beauty that can be realised through character and identity. Bland neighbourhoods discourags interaction in the public realm and consequently both hinder the good life and enhance the need to go somewhere else.

Community Gardens: Communal activities such as gardening give us chances to form relations within the community whilst fostering a sense of care and contemplation for our environment. Having the agency to care for green spaces within neighbourhoods creates a sense of shared civic pride. These spaces can range from pocket gardens which provide beauty and contemplation in a dense neighbourhood to urban farms, which can improve food security and create healthy community bonds. Again, another way of both enhance places, constrain emissions, and promote resilience.

Active Frontages and Street Enclosures: A good street scape is one where inhabitation can be understood from the ground floor. Having impersonal components such as car ports on the ground floor should be avoided as they make the street feel unsafe. Rather, interest and activity should be highlighted on the ground floor, to create a lively and safe. atmosphere. Requirements for such uses will likely be higher in town/local centres. These features increase pedestrian traffic, reduce the need for transport, while stimulating local economies.

Characteristics of Places that Embody the GOOD LIFE

1. **A Relationship with Nature**

Cities must be viewed as natural entities if they are to foster the good life and be sustainable. Natural systems provide necessary checks and balances. In the case of urban life it grants respite and pause for contemplation within within urban environments.

A truly vibrant urban environment should nurture a meaningful connection with nature, both within the built and natural landscapes. This relationship is not merely about the presence of green spaces but how they are thoughtfully integrated into the fabric of daily life. Urban parks, green roofs, trees lining streets, and community gardens are crucial elements, offering spaces for contemplation and reflection amidst the hustle of city life. These natural elements foster beauty, enhancing the city's aesthetic appeal, while promoting mental and physical well-being and facilitating the capture of carbon. They also create opportunities for residents to reconnect with the natural world, encouraging a sense of agency over their own environment. Urban design should embrace the challenge of embedding nature into every part of city life, fostering environments that encourage social interaction and collective care for the spaces we share.

- **Case Study:** Castlefield Viaduct, Manchester Castlefield Viaduct is a prime example of successfully integrating nature into an urban environment. This former elevated railway track was transformed into a public park that offers residents and visitors a sense of respite from the city that is woven into the places history. By giving the Victorian viaduct a new lease of life, the national trust have preserved cultural roots and offered respite where need. The project allows visitors to engage with the history and place in a more creative way that highlights the need for contemplation in a busy city.

2. People-Centred Design in Public Spaces

The city is a ballet of human behaviours associated with the good life. A good public realm allows these behaviours to flourish in a safe convivial manner.

Urban spaces must prioritise people. Streets, squares, and parks should serve as vibrant and creative places for social interaction, where people of all backgrounds come together in a shared experience. These spaces should be designed to meet the needs of a diverse community, from children to the elderly, ensuring accessibility and inclusivity. Public spaces should be places where the characterisations of the good life coalesce, inviting people to linger, converse, and contemplate. Designing an open public space without corners creates an "eyes on the street" type of safety. Exemplifying this behavioural trait reinforces a sense of community within a neighbourhood, where individuals feel safe and empowered to relax and act in the ways in which they choose. Here public spaces empower residents to live free open lives, provides creative areas for contemplation a sense of community and belonging to a specific place while fostering a low carbon and resilient future.

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- **Case Study:** Superkilen Park, Copenhagen
  Superkilen Park in Copenhagen is a vibrant public space that weaves through a traditional Danish neighbourhood and celebrates the cultural diversity of its residents while prioritising inclusivity and accessibility. The park features design elements and street furniture from various cultures around the world, representing the community's global heritage. This design. showcases the joys of city life, through a creative public realm that accessible to all. It is a vibrant and joyful platform for the social interaction of all residents, again reducing the need for transport and enhancing a way of life which is inherently low carbon.

3. A Commitment to Sustainability and low carbon futures.

We must not only sustain our environment, rather we must sustain a relationship between the environment and the good life.

Sustainability for the good life involves a holistic integration of environmental responsibility with the well-being and culture of residents. This holistic approach considers the preservation of natural and human systems as one. Buildings and infrastructure should be thoughtfully designed to consider their long-term ecological and cultural impacts. This means fostering a sustainable low carbon existence between as and our environment. The integration of sustainable systems within the urban fabric —such as water management, renewable energy solutions, and green spaces—encourages individuals to adopt sustainable practices and take collective responsibility for their environment. Sustainability in urban design extends beyond technical performance; it is about creating spaces that enhance the quality of life and foster meaningful connections between people and their surroundings. Sustainable urban design not only contributes to environmental health but also inspires creativity and collaboration, addressing global challenges through local solutions. Ultimately, it supports a vision of cities that are beautiful, vibrant, and capable of adapting to future needs, fostering a sense of global awareness through local action.

- **Case Study:** Vauban, Freiburg, Germany
  The Vauban district in Freiburg is an exemplary model of sustainable urban planning. This eco-friendly neighbourhood incorporates solar panels, green roofs, and car-free zones to create an energy-efficient environment. Residents engage in sustainable practices, such as composting and using shared electric vehicles. The district's emphasis on sustainability extends to its social infrastructure, where green spaces and pedestrian-friendly streets encourage community interaction and environmental stewardship.

4. An Empowering Built Environment

Cities have the capability of providing something for everyone, only because, and only when they are created by everybody - Jane Jacobs

The built environment must be a tool for empowerment, offering spaces that stimulate creativity, innovation, and personal expression. Architecture and urban design should not only meet functional needs but should also create opportunities for residents to shape their spaces. Through adaptable designs—whether in public spaces or private homes—individuals and communities should be empowered to personalise their surroundings, contributing to a collective sense of ownership. Buildings, streets, and squares should reflect the values of the people who inhabit them, providing opportunities for creativity whilst fostering a sense of agency. Spaces designed with flexibility in mind allow for new uses to emerge, enabling people to express themselves, collaborate, and experiment. The design of these environments should encourage engagement, ensuring that residents feel motivated to participate in shaping their city and provide for spaces where they may help advance their own agency in developing a low carbon future.

- C**ase Study:** El Campo de Cebada, Madrid
El Campo de Cebada in Madrid exemplifies how public space can empower communities. Originally a derelict site, it has been transformed into an open space for collective use and creativity. Through a participatory design process, local residents helped re-imagine the space, creating a dynamic environment for social interaction, public events, and shared activities. The design allows for flexibility, with movable structures and temporary installations, ensuring the space adapts to the evolving needs of the community. This project demonstrates the power of urban design to provide residents with agency, the opportunity to actively shape their environment,a nd contribute to a low carbon, high resilience future.

5. Creativity and Innovation

A prosperous city requires a constant injection on new ideas and therefore cannot afford to be cut of from creative people and exchange.

Cities are not static entities but dynamic, evolving ecosystems shaped by the interplay of human interaction, innovation, and creativity. Throughout history, urban centres have acted as incubators for the exchange of ideas, a meeting ground where diverse social, economic, and cultural forces collide, sparking progress in both the material and intellectual realms. This exchange fuels cities' ability to adapt and evolve, reinforcing their resilience as they navigate the complexities of an ever-changing world. The growth of cities depends on the creation of environments where technology, culture, and creativity can intersect and reinforce one another. In compact, mixed-use districts, the proximity of residential, commercial, and cultural spaces fosters collaboration and idea exchange, transforming urban spaces

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into laboratories for innovation. It is in these cross-pollinations—between people, resources, and knowledge—that cities find the capacity to not only address local issues but to contribute to global advancement. Cities that recognise the capacity of creativity to reshape a place are better aligned to seek out a good, low carbon and resilient life within day-to-day iterations.

- **Case Study:** Medellín, Colombia
Medellín has transformed itself from a city previously associated with crime and violence into a cultural hub, driven largely by its emphasis on creativity and innovation. The city's commitment to the arts is evident in the establishment of public libraries, cultural centres, and educational programmes. The creation of the Parques del Rio has reimagined public spaces, fostering social cohesion through the arts, tackling urban inequalities, and creating an environment that is compatible with a low carbon and climate resilient future.

6. Housing for All

Housing should empower individuals, connect them to opportunities, and foster vibrant, participatory communities that support both social and economic integration.

A well-designed city must view housing not merely as shelter but as an essential part of the social, cultural, and economic fabric that sustains urban life. Housing should be affordable, sustainable, and adaptable to the evolving needs of its residents. It should strike a balance between privacy and community, offering spaces where individuals can find solitude while still fostering connections with others. In this way, housing can become a cornerstone for social engagement and civic participation, allowing people to shape their environment and assert a sense of agency over their living spaces. Moreover, housing should not be isolated from the broader city context. It must contribute to the aesthetic and social vitality of neighbourhoods, ensuring that materials, design, and layout resonate with the collective identity of the community. Through participatory design processes, residents can reflect their values and needs in the urban landscape, reinforcing a sense of ownership and belonging. When housing fosters creativity, social interaction, and a shared vision, it becomes a powerful tool for building low carbon and resilient and dynamic cities.

- **Case Study:** SPREFLED Co-op, Berlin
This scheme emphasises collective luxury as a product of communal activity. The idea here was to pare back unnecessary individual amenities whilst keeping the values of family and space. These individual and family spaces became cluster units which enclosed larger communal spaces such as workshops, which where open to the neighbourhood. This brought a sense of unity and common good to the neighbourhood as individuals begun to work together for mutual benefit. The architecture here not only facilitates basic human function but created a stage to perform daily rituals with others, creating a sense of common good, flourishing through purpose, and low carbon futures.

7. Human-Centred Transportation

"An advanced city is not one where the poor own a car but one where the rich use public transport." Enrique Penalosa

By prioritising the collective needs of urban inhabitants, cities foster an environment where all citizens, regardless of socioeconomic status, have equitable access to movement. This approach transcends the narrow focus on personal vehicle ownership, embracing a more communal understanding of urban space and its shared benefits. In this vision, transportation becomes a crucial element of the city's social fabric, not merely a means of transit but a cornerstone of urban life that shapes how people interact with their environment and each other. Investing in the character and design of transport hubs is fundamental to this approach. These spaces, from green corridors and pedestrian pathways to well-designed bus shelters, contribute significantly to the quality of urban life for all residents while helping to substantially reduce GHG emissions. Such investments support a more sustainable and inclusive city, reducing congestion, emissions and pollution while enhancing the aesthetic and cultural appeal of urban areas.

- **Case Study:** The Bogotá Ciclovía, Colombia
  The Bogotá Ciclovía is a well-known initiative that prioritises human-centred transportation. Every Sunday, the city shuts down certain streets to motor traffic, allowing cyclists, pedestrians, and families to use the roads freely. This initiative promotes physical activity, creates a sense of community, and demonstrates the city's commitment to sustainable, low carbon, transportation while encouraging a healthier lifestyle.

8. Cultural and Historical Sensitivity

A city and its architecture must reflect our spiritual and material values, serving as a public good that belongs to all and contributes to a common understanding of beauty

Cities thrive when they are designed with a respect for their cultural and historical layers, blending the old with the new in a way that feels organic and alive. The complexity and variation found in traditional architecture gives a city its unique character, offering richness and meaning that uniform, modern developments often lack. This diversity in the form of traditional spaces reflects a diversity and richness in thought, where architecture is not just a provision for individual liberties. Preserving traditional techniques and landmarks isn't just about nostalgia—it's about maintaining the threads of continuity that tie a community together. These elements provide a sense of place, grounding people in their shared history while still leaving room for growth and innovation. Cities must balance this respect for heritage with a forward-looking approach, allowing space for new ideas and expressions that reflect the evolving needs of their residents. When cities listen to their communities, incorporating local traditions and values into the urban fabric, they create places where people feel connected and engaged. This thoughtful integration of the past and present fosters a sense of pride, belonging, and vibrancy that keeps cities dynamic and full of life.

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- **Case Study:** Cayala, Guatemala City
Cayalá, Guatemala, can be seen as a contemporary example of how urban design can blend modern needs with a respect for cultural and historical values. The development reflects an effort to create a cohesive urban landscape that celebrates local traditions while integrating contemporary architecture and design. In line with the idea that the architecture of a city is a public good, Cayalá's architecture celebrates a shared understanding of beauty, aiming to bring people together within its carefully planned environment. Taking architecture as a public good, when thought carefully, opens up the opportunity to advance a low carbon and resilient agenda that is respectful of the various traditions in which it is advanced.

9. Resilient and Adaptive Urban Design

A resilient landscape sustains the good life through environmental and societal change. In this manner a resilient city is not limited to managing the built environment but it actively improves day-to-day conditions and supports the good life.

Urban spaces must be designed to withstand the growing challenges posed by climate change, from rising temperatures and flooding to resource scarcity and environmental stress. A resilient city must buffer these uncertainties to maintain a sense of normality day-to-day. A resilient city combines innovative green infrastructure—such as urban forests, sustainable drainage systems, and flood mitigation strategies—with adaptive building techniques that utilise local, low-carbon materials. Thoughtful design integrates resilience into every element, ensuring that urban environments not only protects against climate-related risks but also offer opportunities for contemplation and physical activity, creating spaces that support well-being and collective agency. Resilient spaces can empower community engagement and education. Programs like "Slow the Flow" encourage local communities to participate in environmental stewardship.

- **Case Study:** Bo01 Malmö, Sweden
The Bo01 district in Malmö is a model of resilient urban design. Built as part of the city's efforts to address climate change and environmental challenges, it integrates sustainable architecture, green roofs, and innovative drainage systems. The development showcases adaptive design techniques that allow the area to thrive despite its coastal location and the potential risks of flooding. With its focus on sustainability, beauty, and community engagement, Bo01 demonstrates how urban spaces can be designed to be both resilient, engaging and beautiful fostering a stronger connection between residents and their environment.

10. A Sense of Belonging

Cities are the places where a collective identity emerges. They must allow the people to come together in ways that support both their individual aspirations and their shared dreams.

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A successful city fosters a sense of belonging for all of its residents. Urban spaces should create an environment where individuals feel they are part of something larger than themselves—a collective community that shares in the responsibility for shaping the city. Whether through public spaces, cultural institutions, or neighbourhood events, the city should offer opportunities for people to connect, express themselves, and contribute to the shared vision of the urban environment. The design of these spaces should foster both individual reflection and social interaction, ensuring that people can come together, exchange ideas, and create lasting bonds. A sense of belonging and consequently a sense of agency is essential for building strong, low carbon, and resilient communities, who participate in the ongoing evolution of the urban landscape. By prioritising beauty, inclusivity, and personal connection, neighbourhoods are not just an atomised collection of housing site—they become places where people act, creating resilient neighbourhoods.

- **Case Study:** Pembroke House, London
  Pembroke House in Walworth, London, is a community charity that fosters a strong sense of belonging. By offering programs like the Walworth Living Room, which hosts activities for all ages such as music, crafts, and a café, it creates a welcoming space where people can connect. Initiatives like the Neighbourhood Food Model and We Walworth address local inequalities and promote collaboration, while encouraging people to engage with one another. Through these efforts, Pembroke House helps build social cohesion, empowering residents to participate in community-driven projects, strengthening bonds, and contributing to a more inclusive, supportive neighborhood.

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Anex 1. A catalogue of measures at city level and below.

This effort also focused on creating a portfolio of policies and projects tailored for sub-national implementation, scaling down to cities, districts, neighborhoods, streets, and homes. Developed through scrums and collaboration with city and university experts, it involved student competitions and partnerships with faculties in urban planning and architecture, particularly in Mexico and the UK. The portfolio emphasized the "good life" concept, fostering exchanges between academia and the project.

It also explored well-being dimensions through various frameworks and indices, using smaller-scale divisions to refine the portfolio. By integrating perspectives from economics, psychology, and environmental science, the approach argued for a holistic development model that links ecological sustainability, social relationships, and well-being. This perspective aligns with the project's vision of a "good life" within emissions and impact constraints, adapted to specific local contexts.

Well-being is a multifaceted concept that varies across cultures and disciplines, but it generally refers to a state of living well. It has been explored through three primary perspectives: the physical-economic approach, the social-emotional approach, and the environmental approach. The physical-economic view focuses on tangible metrics such as GDP, income, and quality of life indicators, like those measured by NUMBEO and the Human Development Index. These indicators often link well-being to material conditions like housing, employment, and healthcare. The social-emotional approach, championed by positive psychology, emphasizes emotional health, relationships, and life satisfaction. It incorporates theories like Martin Seligman's PERMA model, which outlines the importance of positive emotions, engagement, and meaningful relationships for well-being. Lastly, the environmental approach ties well-being to sustainable living, stressing that genuine happiness cannot be achieved at the expense of the planet's health. Tools like the Happy Planet Index (HPI) assess how well countries balance human happiness and ecological sustainability.

Traditional economic models, such as GDP, fail to measure well-being comprehensively and often lead to environmental degradation. While wealthier countries may score higher on quality of life indices, they often rank poorly in terms of sustainability, as seen in the discrepancy between NUMBEO's rankings and HPI scores. For instance, countries like Luxembourg and the Netherlands rank high in quality of life but have large ecological footprints that contribute to climate change. In contrast, nations with lower environmental impact, like Bangladesh, fare better in sustainability indices, showing that true well-being is not merely about economic growth. The report concludes that a new development model, one that prioritizes collective happiness and environmental sustainability over relentless economic growth, is essential for achieving long-term well-being.

In what follows, this section presents measures at varying scopes of interventions that might improve the quality of life within the context of the project's characterization of a good life. This section describes a series of interventions that could be advanced at a city, district, neighborhood, street and house levels. This part of the portfolio was developed through work in the scrums and with teams assembled with experts in cities and universities. Student competitions, and a model to integrate work with universities faculty, and with undergraduate and graduate students and the project.

The Concept of Well-being. Diversity of Approaches

In Learning by Doing, we believe that one fundamental aim of every individual and of society in general is to achieve a good life.

The dictionary of the Royal Spanish Academy defines well-being as:

Set of things necessary for living well.

Comfortable or well-supplied life that leads to enjoyment and tranquility.

For this report, we assume that a good life is living with well-being.

However, in a constantly changing world inhabited by eight billion people, it is common for there to be multiple views on what constitutes a good life and, consequently, what well-being means. Well-being has been studied and

interpreted from various perspectives, such as philosophy, psychology, sociology, political science, environmental sciences, and especially economics, among many others.

In order to synthesize this universe of views, we could say that there are three major approaches to well-being:

• Physical-Economic Approach

From this perspective, well-being is primarily related to the GDP of a country or region. Employment, people's purchasing power, cost of living, housing prices, access to housing, and access to physical satisfactors. This approach has had the most influence in recent decades. Below are some of the most relevant examples.

• NUMBEO

The significant collaborative database on countries and cities called NUMBEO, which measures the quality of life in most countries worldwide, takes into account the following factors: purchasing power, security, healthcare, cost of living, price/income for properties, commuting time in traffic, pollution, and climate. According to these factors, as of mid-2023, the countries with the best quality of life in the world are Luxembourg, the Netherlands, and Iceland. The countries with the worst quality of life are Venezuela, Bangladesh, and Nigeria. Mexico ranks 48th out of 84 countries.

• Human Development Index

The United Nations Development Programme (UNDP) calculates the Human Development Index using three basic dimensions: life expectancy at birth, years of schooling, and gross national income per capita.

• OECD and INEGI

The National Institute of Statistics, Geography, and Informatics of Mexico (INEGI) uses the same eleven well-being indicators as the Organization for Economic Cooperation and Development (OECD). These indicators include housing, income, employment, services, security, education, environment, civic engagement and governance, health, life satisfaction, work-life balance, social and community relations.

• Quality of Life Index

There are various criteria and methods for measuring the Quality of Life.

Social and Emotional Approach

From this perspective, well-being is also related to life expectancy, health, and education, but above all, it involves aspects such as leisure time, positive social and family relationships, community collaboration, mental health, and positive emotions. It encompasses having a sense of purpose, goals, and achievements, as well as happiness, love, and compassion. This approach has been gaining ground in recent decades. Here are some relevant examples.

Positive Psychology

Positive psychology has been trying to clarify what well-being is for decades, and here are some examples contributed here.

Studies, such as those conducted at the University of Illinois, reveal that often the concept of well-being is intimately linked to the culture and society in which one lives. Having a fulfilling existence is often related to what we see around us and what we aspire to for ourselves: a home, a good job, financial comfort. However, Martin Seligman points out that we often adopt values that do not harmonize with authentic well-being. Sometimes, we desire things that do not resonate with what we truly need. For example, someone may yearn for more money to do whatever they want, yet lack vital life purposes, enriching relationships, or a positive self-concept or self-esteem. Psychologists Nansook Park and Christopher Peterson (University of Michigan) noted that the good life requires experiencing more positive emotions than negative ones. It involves knowing how to use our talents and strengths in the face of adversity. It also means having good relationships, feeling satisfied in our work, and having hope for the future. Finally, to

work towards personal well-being, Seligman designed the PERMA model based on five factors:

Positive emotions.

Engagement, a goal, an objective.

Positive relationships, with people we love and with those who surround us.

Meaning and purpose in our life.

Sense of accomplishment.

Happiness

Recently, the study and measurement of well-being have made a strong foray into the topic of happiness. Below are some relevant sources of information.

The *World Book of Happiness*

In his *World Book of Happiness*, Leo Bormans presents a compilation of research from 100 experts in positive psychology (well-being and quality of life) from 50 different countries. The result provides insights based on scientific studies with people from around the world. The topics covered include free time, health, well-being, money, the future, compassion, genetics, free will, humor, pain, family, friends, and more. Among the conclusions of the 100 experts, there is a wide variety of factors by which people experience well-being or have a good quality of life. Although the book does not present a detailed summary, the vast majority of these factors are not related to the economic development level of these individuals or the place they live but rather to their understanding of their environment and their relationship with it. Social, cultural, family, friendship, and community issues play a significant role in this.

Harvard Happiness Study

It is widely believed that achieving fame and wealth is essential for a happy life. However, a Harvard study, conducted over 75 years with 724 participants, demonstrates otherwise. The aim of the study is to understand what factors make one feel happy, fulfilled, and complete. The study subjects have spanned various ages since it began in 1938, with some participants passing away while spouses, children, grandchildren, and great-grandchildren of the men who initially started as the only subjects of the study have joined. The fact that the research has been conducted over so many years, with so many different generations and diverse historical moments, provides a more comprehensive view of what makes humans feel content. The conclusion is that the most crucial reasons for aging well and living a long and happy life are not the amount of money accumulated or the renown received. The most important factors for long-term health and well-being are the strength of relationships with family, friends, and partners. In contrast, loneliness proves devastating to health and does not bring any happiness.

The Happiest Man in the World

Scientists at the University of Wisconsin studied the brain of Matthieu Ricard, a doctor in molecular biology, Buddhist monk, and author of several books, including "Happiness: A Guide to Developing Life's Most Important Skill." The studies were conducted using nuclear magnetic resonance imaging with hundreds of volunteers to measure the level of happiness of each participant, and the results showed a significant difference between Ricard and the rest of the participants, leading to his declaration as "the happiest man in the world." As a result of his own studies and spiritual practice, Matthieu Ricard declares in his book and lectures that the secret to happiness is altruism and compassion. "The pursuit of selfish happiness does not work; it is a situation where everyone loses. One makes their own life miserable while making everyone else's life miserable. In contrast, altruism is a situation where everyone wins. The goal is to bring happiness to others and alleviate their suffering, and as an additional benefit, one feels great happiness by being kind and benevolent. Anyone can be the happiest woman or man in the world simply by being kind, compassionate, open to others, and easily satisfied with external conditions." The above, translated into societal terms, equates to living a life of respect and cooperation within the community and the environment, acting for both personal and collective benefit.

The Happiest Country in Asia.

Bhutan was the first country in the world to shift from the traditional measurement of Gross Domestic Product (GDP) to Gross National Happiness (GNH), an innovative concept that currently positions it as the happiest country in Asia. In this context, happiness is understood as "that which allows for development that balances the needs

of the body with the needs of the mind" of the inhabitants. To calculate GNH, the Bhutanese government created a measurement based on four pillars:

Conservation of the environment

Sustainable and equitable socio-economic development

Preservation and promotion of culture

Good governance

Based on these concepts, certain indicators are defined, such as the use of time for work, family, and friends. Community vitality, which includes significant connection with neighbors, for example. Culture and resilience, which encompass respect and promotion of traditions and indigenous peoples. Good governance, with civil society participation and transparency. And, finally, individual happiness.

Bhutan's initiative has had a strong impact on significant institutions such as the UN, which, inspired by its example, launched the "World Happiness Report" for the first time in 2012. This report indicates the need for a new economy and a new paradigm, asserting that the GDP-based model is not sufficient and that development must also necessarily mean happiness.

Indeed, in recent years, various voices have risen affirming that GDP seems to fail as a measure of progress, as it does not necessarily reflect well-being or consider the social or environmental costs involved. Following this initial encounter, the UN called for the development of a new global development program, now baptized as "Happiness: Toward a Holistic Development Model." This program proposes a model where the vision of collective happiness is seen as the key to improving the quality of life and makes a concrete call to governments worldwide to place the happiness of their inhabitants at the center of their public policies.

Environmental Approach

Environmentally speaking, well-being is essentially related to the ability to sustain human life on Earth over time. This approach is perhaps the most recent but calls for urgent changes in our way of living and understanding well-being.

• Happy Planet Index

To date, there aren't many measurement systems for well-being from an environmental perspective. However, a notable example is the Happy Planet Index (HPI), which is a measure of sustainable well-being that ranks countries based on how efficiently they achieve a long and happy life using our limited environmental resources. The HPI assesses the efficiency with which a country's population uses its natural resources, although it does not measure the emotional happiness of a population as a result of the lack or success of it. The HPI states that it "helps answer the question: Is it possible to live a good life without costing the Earth? The crises we face, persistent inequalities, accelerated climate deterioration, and rapid loss of biodiversity are interconnected and stem from the same central problem: our economies are structured, governed, and measured to promote short-term economic growth above long-term collective well-being. Governments too often prioritize rapid economic growth over any other concerns, losing sight of what truly matters: long, happy, and sustainable lives for people worldwide.

The organization behind the HPI argues that "our current economic system is driven by a growth-at-all-costs mentality, measured by Gross Domestic Product (GDP). There is a deep-seated belief that GDP growth equates to greater well-being and prosperity and is universally beneficial. In reality, GDP growth alone does not signify a better life for everyone, especially in already affluent countries. It disregards inequality and the things that truly matter to people, such as social relationships, health, or how they spend their leisure time, and fundamentally, the planetary boundaries we face." It adds that "due to its fixation on economic growth, conventional economics is highly concerned with efficiency: how to maximize the number of outcomes (income or products) produced by a certain amount of inputs (human and environmental resources)." It poses the questions: "Instead of pursuing growth at any cost, even if it is detrimental to well-being or sustainability, what if we strive to create well-being and pursue sustainability, regardless of the impact on growth? If the purpose of the economy were not to produce more income or products but to produce more well-being and sustainable well-being, how would we measure economic efficiency?"

With this philosophy, the HPI consists of measuring three factors: life expectancy, well-being, and ecological footprint. The countries with higher scores are Costa Rica, Vanuatu, and Colombia, while those with lower scores are the Central African Republic, Mongolia, and Qatar. Mexico ranks 23rd among 152 countries and the UK 14th. It is noteworthy that, of the top 10 countries with the highest scores, 8 are from Latin America and the Caribbean.

2.2. Why is well-being not achieved at the expense of climate change?

According to the information presented in the previous section, while NUMBEO ranks Luxembourg, the Netherlands, and Iceland as the top three countries with the best quality of life, the HPI places them at 143rd, 18th, and 52nd, respectively. On the other hand, while NUMBEO identifies Venezuela, Bangladesh, and Nigeria as the three countries with the worst quality of life, the HPI ranks them at 46th, 22nd, and 137th, respectively.

More specifically, from a development perspective, Bangladesh ranks second to last in Quality of Life with a Purchasing Power Index of 69.46. From a sustainability perspective, it has an ecological footprint of 0.88. On the other hand, Luxembourg, the country with the best Quality of Life according to the development perspective (Purchasing Power Index of 133.16, 1.91 times higher than Bangladesh), has a sustainability perspective with an ecological footprint of 12.59, which is 14 times higher than Bangladesh.

In the case of Mexico, it ranks 48th in NUMBEO's Quality of Life Index and 28th in the HPI.

This only confirms what is already well-known: countries with higher purchasing power consume more natural resources and energy, resulting in more pollution and contributing more to climate change. However, the environmental cost of more developed countries does not translate into greater happiness or life satisfaction for their inhabitants compared to less developed and environmentally less harmful countries.

This further confirms that the prevailing development model is not only failing to lead the human species to higher levels of genuine well-being but is also making incorrect and inefficient use of the planet, as its deterioration does not even bring real benefits.

2.3. How can well-being be achieved without impacting the environment?

In a very straightforward manner, it could be said that what needs to be done to lead a good life sustainably is:

A. Reduce activities and/or conditions that impact the environment.

B. Increase those that promote genuine well-being.

C. Adapt the economic system to enable the above.

The main sources of environmental impact and the primary sources of well-being are defined next. The latter are divided into sources of physical-economic, social, and emotional well-being, as well as well-being directly related to environmental aspects.

    A.   Main sources of environmental impact in cities:

Consumption of rural land

Consumption of natural resources

Use of dirty energy

Excessive water consumption

Air pollution

Water pollution

Solid waste pollution

    B.   Main sources of Physical-economic well-being:

Physical integrity (public safety)

Physical health

Adequate nutrition

Decent housing

Potable water
Electricity
Transportation means
Level of economic income

    C.   Main sources of Social and emotional well-being:
Community relations
Family relations
Personal relationships (friendships)
Belonging to a social group
Mental health
Emotional stability
Self-esteem
Personal fulfillment

    D.   Main sources of Enviromental well-being:
Low levels of atmospheric pollution
Low levels of water pollution
Low vulnerability to natural disasters
Climatic comfort
Availability of green areas

2.4. List of Key Features of Sustainable Well-being

Based on the foregoing and with the aim of reducing environmental impacts and increasing well-being levels, the characteristics of what we will call here "sustainable well-being" are defined, intended to be promoted at various levels or scales of human settlements.

City Level
Compact city
Good water management
Proper solid waste management
Clean transportation
Citizen participation

Neighborhood Level
Proximity services
Nearby green areas
Non-motorized mobility
Collaborative community
Urban and building recycling

District Level
Multinuclear city
Sustainable urban design
Strategic afforestation
Agricultural periphery
Disaster prevention and resilience

House Level
Telecommuting
Housing expansion
Green architecture
Clean energy
Green roofs and urban agriculture

A Good Life: Features of Sustainable Well-being. City level

1. Compact City

• Present challenges

In the last years of the previous century and the first two decades of the current one, cities grew disproportionately towards their peripheries, generating enormous problems with a growth model that is: 1) environmentally unsustainable, as it consumes large natural areas and causes long and costly commutes with the burning of a significant amount of hydrocarbons and the consequent pollution; 2) socially unjust, as it pushes the poorest to areas increasingly distant from employment sources, services, and urban amenities; and 3) economically inefficient, because with lower property tax revenue, services have to be provided over a larger area.

• Dystopia / current trajectory.

This model of urban sprawl, based on automobile usage, has already reached a crisis point. In addition to the disastrous impacts it has caused on the environment, thousands of families have abandoned their homes in the periphery to return to the city centres. This has led to the resurgence of housing production in a city with land values beyond the means of buyers, prompting developers to construct apartment towers wherever they find cheaper land. If things continue as they are, the outlook appears disastrous, with large, dispersed, semi-abandoned, and unsafe areas on the outskirts, and tall buildings encroaching on peaceful neighbourhoods, negatively impacting the urban and social fabric, leading to potential neighbourhood conflicts and social protests.

• Utopia / working towards

There are a number of measures for cities to curb urban sprawl and systematically increase their urban density through a multi-faceted strategy that considers: a) the occupation of vacant homes, b) the use of vacant lots, c) housing doubling, which involves constructing an additional dwelling on an existing single-family home, d) transit-oriented development (TOD),a involving the construction of apartment towers only along mass transit corridors, and e) densification in urban sub-centers.

• Agents of change
To achieve this transformation, it is essential for municipal and metropolitan authorities to actively promote a new model of a more compact city, and for the real estate sector to collaborate in the rational densification of cities while respecting the characteristics of existing urban and social fabrics.

• Benefits
Environmental: Reduction in land and natural resource consumption
Social: Closer proximity to services and urban amenities
Economic: Reduction in the cost of public services / smaller area to manage

2. Effective Water Management

• Present challenges
Water is currently a scarce but indispensable resource for life, facing challenges in many regions of the world.

• Dystopia / current trajectory.

It is predicted that the crisis of water scarcity will lead to significant regional conflicts, including famines, wars, deaths, and large-scale migrations.

• Utopia / working towards

Responsible Consumption
To begin, it is necessary for the population to minimize water consumption, promoting responsible use of this vital resource.
Renewal of the Hydraulic Network
It is crucial to renovate the deteriorated distribution networks, as it is estimated that in many cities, nearly one-third of the available water was being wasted through these systems.
Wastewater Management
It is imperative to ensure that all wastewater is treated and, to a large extent, reused through high-tech systems with minimal energy usage. Where feasible, incorporating natural treatment systems should also be considered.
Rainwater Harvesting
The collection and utilization of rainwater can contribute to the required water supply, in addition to aiding flood control and the regeneration of groundwater tables.

• Agents of change
Certainly, the determined intervention of government authorities responsible for water supply is necessary, but the conversion of water consumption habits by the population is indispensable. Additionally, in many instances, water treatment and distribution service fees are so low that users are not concerned about conservation, and governments hesitate to update them due to political costs.

• Benefits
Environmental: Reduction in large-scale projects impacting natural habitats.
Social: Ensuring vital supply, improving public health, and controlling floods.
Economic: Savings in water capture and conveyance infrastructure.

3. Effective Solid Waste Management

• Present challenges
It is widely acknowledged that the serious problem of the increasing quantity of solid waste of all types is accumulating on the planet, flowing through rivers, and inundating the seas.

• Dystopia / current trajectory.	• Utopia / Working towards
Many voices are warning of a catastrophic environmental future, particularly due to the escalating increase in waste. Among many other environmental impacts, its decomposition is a source of methane and carbon dioxide released into the atmosphere, harming the ozone layer, contributing to the greenhouse effect, and thus accelerating climate change.	Consumption and Disposal Habits The most crucial aspect is to ensure that the global population changes its consumption and disposal habits since, according to market laws, waste-producing companies respond to consumer demand. However, achieving this is the most challenging, as numerous recommendations have been made to the population for some time to reduce waste accumulation, with insufficient results. Among the required changes in consumption and disposal habits, the following stand out succinctly: - Reduce, which involves buying less and consuming better, opting for local and nearby products without unnecessary wrapping and packaging. - Reuse everything we use, such as glass, plastic, paper, wood, fabric, etc. - Repair instead of discarding everything that is possible. - Recycle, giving new use to what cannot be used in its current state, such as converting organic waste into compost to better nourish plants. Packaging It is essential for companies producing goods, containers, and packaging that contribute to waste to eliminate or minimize these waste components. This requires mandatory government standards, along with oversight and sanctions when necessary. Advertising Advertising pushes the population, increasingly and with more effective resources, into the current spiral of consumerism and waste. On one hand, it is necessary to intensify awareness campaigns to help the population discern the advertising onslaught. On the other hand, governments must regulate the type and content of advertising with much greater rigor, employing strict criteria for environmental protection and social responsibility. Management Well-managed, solid waste can become a financially self-sufficient activity and even an attractive business. Recycling, sustainable incineration, the production of biogas, and other trending technologies are already demonstrating this potential.

• Agents of change

The primary agents of change are the companies producing goods, containers, and packaging that contribute to waste, as well as the advertising system that propels the population into the current spiral of consumerism and waste. However, it is likely that their practices won't change without governmental regulations compelling them to do so. But what would be most effective is a resounding refusal by consumers to buy polluting products. This requires a revolution in consumption habits, necessitating strong leadership, persistent awareness campaigns, and generational time for change.

• Benefits

Environmental: Reduced consumption of natural resources, energy, and pollution.
Social: Increased civic responsibility.
Economic: Increased economic activity, jobs, and savings.

4. Clean Transportation

• Present challenges
Emissions from transportation, especially private vehicles, are one of the most significant sources of pollution contributing to climate change, along with causing health problems.

• Dystopia / current trajectory.	• Utopia / Working towards
While there are advancements in transitioning to electric vehicles, if this process is not accelerated and widely adopted, there is a risk of arriving too late to reverse global warming.	To reverse this trend, changes are necessary in several areas, including: a) the implementation of quality, efficient, and secure public transportation adequately planned, including high-density corridors with mass transit and feeder routes that encourage the population to stop using private vehicles; b) the conversion of the vehicle fleet from hydrocarbon consumption to electricity.

• Agents of change

In this matter, the participation of global and regional actors is required, primarily vehicle manufacturers and sellers, as well as national governments, to promote and support the transition to electric or clean energy-powered vehicles.

• Benefits
Environmental: Reduced pollution.
Social: Improved, more extensive, and safer transportation.
Economic: Lower operating costs.

LEARNING *by* **DOING**

5. Citizen Participation

Present challenges

As seen, solving the environmental problems facing the planet, particularly those related to climate change, will not be achieved solely by governments or companies whose processes impact the environment.

• Dystopia / current trajectory.

If the global population continues to wait for something to happen or even a portion of it remains skeptical of climate change, the predicted catastrophic consequences will become a reality, seriously endangering the human species.

• Utopia / Working towards
 Citizen Participation
To achieve the necessary changes to reverse environmental deterioration and climate change fundamentally and permanently, it is essential to fully involve citizens in at least two significant challenges. On one hand, it is necessary to change the patterns of life and consumption that have directly or indirectly led us to the environmental crisis we now face. On the other hand, there is a need for continuous pressure on governments, companies, economic sectors, and decision-makers to implement and monitor the required changes.
 For this, timely and reliable information is necessary, along with awareness campaigns and environmental education programs.
 Environmental Education
 Environmental education and a culture of caring for nature, especially among the new generations, should be the backbone of citizen participation and community collaboration. It should be understood that every action we take has impacts on the environment, and we are responsible for them. The goal should be that, in the near future, all citizens have full awareness and responsibility for nature and participate, in some way and according to their knowledge and abilities, in activities for the protection and improvement of the environment.

• Agents of change

The general strategies and lines of action will likely come from research centers, citizen organizations, and global or regional agencies. However, the most effective way for citizens to implement changes is at the local level.

• Benefits
Environmental: Overall environmental improvement and specific mitigation of climate change.
Social: Social integration, citizen collaboration, community building, a sense of belonging, a sense of individual accomplishment.
Economic: Involvement of the population in sustainable production processes.

A Good Life: Features of Sustainable Well-being District level

1. Multi-nuclear City

• Present challenges

The zoning of cities with separate land uses has created vast areas designated for a single activity, forcing people to travel long distances from home to work or other activities. This results in significant consumption of time, money, and dirty fuel, leading to air pollution. Among other issues, this has become one of the main causes of climate change.

• Dystopia / current trajectory.

With this urban model, people are condemned to spend a significant part of their lives in a car or bus, reducing the time they allocate to their families and deteriorating their mental health. The large single-use areas become increasingly unsafe, with residential areas deserted during the day and work areas deserted at night. If things continue this way, the future outlook is catastrophic environmentally, socially, and economically.

• Utopia / Working towards
To reverse the current problem and avoid dystopia, it is necessary for large cities to evolve by adopting a polycentric planning model. This involves developing self-sufficient urban districts and a system of sub-urban centers that concentrate the necessary amenities to cater to a population within a walkable radius of 2 kilometers on a daily basis.
This is equivalent to having small cities within metropolitan areas, functionally self-sufficient through the implementation of actions related to transportation, infrastructure, land use, and public facilities. With the organized mix of land uses and urban activities, it is possible to bring housing areas, workplaces, and service centers closer together, retaining the population in their districts without the need to leave, significantly reducing commuting costs, time, and consequent pollution.

• Agents of change
For this to happen, a different approach is required from technicians and authorities responsible for urban planning, along with coordinated urban development management involving the real estate and housing production sectors.

• Benefits
Environmental: Reduced pollution due to shorter commuting distances.
Social: In smaller urban cores within the larger city, people live with greater tranquility, social interaction, and proximity to basic needs, while having access to metropolitan-level services and amenities. Shorter commuting times mean more available time.
Economic: Lower fuel expenses.

LEARNING *by* **DOING**

2. Sustainable Urban Design

• Present challenges

Currently, cities generate most of the environmental impacts afflicting the planet, particularly contributing to the majority of greenhouse gases causing climate change.

• Dystopia / current trajectory.	• Utopia / Working towards
If things continue this way, the predicted collapse will become a reality.	**City-Nature Harmony** The idea has become widespread that cities are incompatible with environmental sustainability. However, cities are not inherently harmful to nature; the issue is that they are poorly designed and mismanaged. In fact, many species like bees, ants, termites, and others build and live in cities that are perfectly integrated with nature. Therefore, it is essential to understand that cities are not necessarily detrimental to the environment if well planned and well designed. Cities can and should be the solution to climate change and the sustainable life of the planet. Achieving this change is possible with appropriate strategies and actions. **Urban Ecosystem** To begin, it is necessary to perceive the city as an urban ecosystem that we must design and operate differently from the rest of the planet's ecosystems but in harmony with nature. This approach aims to reverse the current trend of consuming more natural resources from outside the city than what is generated within it and producing a significant amount of pollutants without equivalent mitigation. **Natural Areas and Large Parks** Cities have expanded, covering vast continuous urban areas without leaving spaces of nature that help mitigate the growing and harmful pollution. This situation exposes the population to the effects of pollution, both in terms of climate change and physical and mental health. If this continues, it would elevate levels of chronic diseases and mortality. To prevent dystopia, it is highly beneficial to preserve natural areas and large urban parks on the urban peripheries and interspersed between urban districts. These areas can aid in carbon absorption, improve the climate, preserve biodiversity, and enhance the quality of life for the population. **Sustainable Urban Design** It is already evident that significant shifts toward sustainable urban design have transformed cities from being part of the problem to becoming a solution for reversing climate change. Environmental policies have been triggered by strategic projects, creating positive momentum for replication and multiplying benefits. **Open City** It is essential to stop constructing large gated communities and closed developments, as they not only disrupt the urban fabric but also encourage the use of private vehicles and social exclusion. On the contrary, it is crucial to establish a better-connected urban network and foster a more inclusive and harmonious society. **Safe Public Spaces** Specialized studies have proven that street and public space safety improves significantly with an increased flow of residents, thanks to the diversification of land uses and activities at all hours of the day.

• Agents of change

In this context, the key agents of change are urban planners, urban designers, and professionals involved in sustainable technologies and processes. However, the participation of government authorities responsible for regulations and corresponding planning, as well as companies involved in the development of these large urban projects, is also crucial.

• Benefits

Environmental: Reversal of environmental impacts, generation of clean energy, collection of rainwater, food production, generation of urban biodiversity, climate improvement, among others.
Social: Improved levels of safety, satisfaction, physical and mental health, and comfort.
Economic: More functional, attractive, competitive, and productive cities.

LEARNING *by* **DOING**

3. Strategic Afforestation

• Present challenges

While afforestation campaigns have been implemented in cities in recent years, the reality is that the vast majority of planted trees are not suitable for the location or optimal carbon absorption. Additionally, the survival rate of planted trees is very low.

• Dystopia / current trajectory.

Without making adjustments to the way most cities are reforesting and without significantly increasing the number of trees in them, carbon production in cities will continue to be much higher than the absorption of this gas.

• Utopia / Working towards

Zero Rate
While planting trees in cities brings multiple benefits, the primary goal of urban reforestation, as a climate change remediation agent, should be to absorb all the carbon produced in the city. To achieve this, it is necessary to increase the number of trees with species that absorb the most carbon. Studies already identify tree species that are more efficient in carbon absorption and methods to measure it. The next step is to implement nurseries and the mass production of these species.
Afforesting Every Available Space
There are still many cities where only public parks are considered green areas. Roads, medians, infrastructure rights-of-way, or residual plots are not seen as potentially afforestable. Currently, it is necessary to plant as many trees as possible in every available space.
Appropriate Species
Afforestation should be carried out with species that, in addition to being efficient in carbon absorption, are fast-growing, low-maintenance, adapt to the urban environment in which they are planted, and promote faunal diversity in the city.

• Agents of Change
Certainly, the primary actors should be local governments, but environmental organizations and society must participate in a very relevant manner.

• Benefits
Environmental: CO2 absorption, climate change mitigation, improvement of air quality, support for fauna, and reduced energy consumption for air conditioning.
Social: Improved health and mood; enhanced comfort climate; potential for social participation and integration.
Economic: Decreased spending on health, air conditioning, among others.

LEARNING *by* **DOING**

4. Agricultural Periphery

• Present challenges

The recent wave of urban sprawl has left many residential complexes far from the urban area without sufficient services, amenities, proper transportation, and job opportunities. Many of these areas are partially or completely abandoned by their owners, who have chosen to return to the city and stop paying their mortgages.

• Dystopia / current trajectory.

Faced with the trend of real estate demand to return to more urbanized areas and the declining demographic growth rates, the chances of these peripheral residential complexes consolidating are very remote. The scenario is one of economic and social deterioration, with high levels of insecurity.

• Utopia / Working towards

An interesting alternative for the consolidation and improvement of these problematic peripheral areas, especially where suitable conditions exist, is to promote high-profit agricultural or agro-industrial production centers linked to supplying the city.

Such initiatives could be linked to a sustainable food production program that helps mitigate the issue of industrial food production, which is one of the main contributors to climate change. The production of beef and deforestation for extensive cultivation have been particularly harmful to the environment. The former is a major source of harmful emissions into the atmosphere, while the latter reduces natural carbon absorption areas. Not to mention the issues posed by pesticides and genetically modified foods, affecting both ecosystems and human health.

In addition to environmental collapse, the future envisions, on one hand, growing issues of obesity and health in affluent regions and, on the other hand, severe famines and migrations in impoverished regions.

Certainly, the change in food production must go hand in hand with a shift in the population's food consumption habits, including consuming less beef and more fruits and vegetables.

• Agents of Change

For the transformation of dispersed and disjointed peripheries into centers of agricultural production and agribusiness, key actors would be local governments with strategies, promotion, and incentives. Additionally, producers and landowners, who likely acquired the land for real estate development, would need to consider this alternative.

At the local level, fostering and promoting the formation of citizen organizations that advocate for urban agriculture, even in neighborhoods and homes, as well as the production and trade of small-scale organic foods, is essential.

However, for the transformation of the entire food industry, complex agreements at the highest levels of decision-making are required.

Benefits:

Environmental: Decrease in the occupation of natural areas for agricultural activities, optimization of natural resource utilization, and reduction of pollution from transportation.

Social: Increase in security, services, and social cohesion.

Economic: Job creation, economic diversification, and dynamism.

LEARNING
by **DOING**

5. Disaster Prevention and Resilience

• Present challenges Climate change is exacerbating natural disasters worldwide.

• Dystopia / current trajectory.	• Utopia / Working towards
It is predicted that the impacts of climate change will be catastrophic, causing increasingly frequent and severe hurricanes, massive floods, landslides, fires, and other calamities that will affect many areas of the planet, resulting in a significant number of deaths among the global population.	It is imperative to prevent all types of natural disasters, involving the entire population through intense government campaigns for citizen awareness and preparation for action before, during, and after disasters.

• Actors of Change
Governments, citizen associations, and the general population.

• Benefits
Environmental: Reduction of impacts and loss of natural resources.
Social: Reduction in loss of lives and disabilities.
Economic: Reduction of material losses and costs in health and reconstruction.

LEARNING *by* **DOING**

A Good Life: Features of Sustainable Well-being. Neighbourhood level

1. Proximity Services

• Present challenges

The urban model based on car usage and the zoning of large residential areas without other uses has led the population to excessively rely on private vehicles.

• Dystopia / current trajectory.	• Utopia / Working towards
If this continues, pollution and transportation times and costs would continue to increase.	All neighbourhoods and/or residential complexes across all socioeconomic levels should have all the necessary services and amenities to meet the daily needs of the population within a walkable distance of less than 15 minutes.

• Actors of Change
Primarily, planners and local authorities are needed to implement plans that anticipate the required services and amenities. Likewise, authorities must promote what is necessary, both with the involved public entities and the private sector. Clearly, the participation of service providers and suppliers is indispensable.

• Benefits
Environmental: Reduced pollution from transportation.
Social: Necessary services in close proximity, resulting in savings in time and transportation costs, as well as more time to spend with family.
Economic: Lower transportation costs.

2. Nearby Green Spaces

• Present challenges

Until recently, regulations specified a certain amount of square meters of green areas per inhabitant, but without specifying accessibility standards for the population to these areas. Thus, in addition to most cities not meeting the recommended square meters per inhabitant, the few existing green areas are inequitably distributed in cities, with many of them distant from the majority of the population.

• Dystopia / current trajectory.	• Utopia / Working towards
Without green areas, cities will worsen in terms of pollution, climate, floods, and noise, deteriorating social climate and the quality of life for the population.	According to recent standards regarding the provision of green areas in cities, all residents should have access to a public green area, even if small, within 400 meters of their homes.

• Actors of Change

It is common for local authorities not to have the resources to adequately implement and maintain all the required green areas. To remedy this problem, it is recommended to establish citizen groups or committees that adopt these green areas and take care of them. Additionally, it is very convenient to promote among the population the planting and conservation of as many trees as possible.

• Benefits

Environmental: Increased carbon absorption and climate improvement.

Social: Better physical and mental health, emotional improvement, community life promotion, exercise motivation, urban quality improvement.

Economic: Increase in associated commercial and service activities.

3. Non-Motorized Mobility

• Present challenges
As mentioned before, the fact that people travel long distances in vehicles burning fossil fuels causes enormous pollution, in addition to requiring a significant amount of time and economic cost.

• Dystopia / current trajectory.

The urban model based on the automobile has already been surpassed, and there is no way, neither physically nor economically, to continue building roads for a vehicle fleet that grows endlessly, clogging cities with cars to the point of immobility.

• Utopia / Working towards

The consolidation of mixed-use neighborhoods, the proximity of everyday needs, and the provision of pedestrian areas and bike lanes are necessary to increase non-motorized mobility and reduce dependence on cars.
Additionally, universal accessibility needs to be increased, ensuring it is widespread in all spaces of transit or public access for people with disabilities.

• Agents of Change
Mainly, committed public officials are needed to advocate for these causes, convincing politicians and leaders of the benefits of implementing urban projects of this kind.

• Benefits
Environmental: Reduction of atmospheric pollution.
Social: Increase in citizens' health due to exercise and weight reduction.
Economic: Decrease in transportation costs and times, reduction in health budgets.

LEARNING *by* **DOING**

4. Collaborative Community

• Present challenges

As mentioned earlier, without society's involvement, it is challenging to implement the necessary changes to achieve a sustainable future and a life of true well-being.

• Dystopia / current trajectory.
The future of society could be much worse than the lack of collaboration if problems lead to local, national, regional, and global conflicts.

• Utopia / Working towards

Regardless of the valuable work carried out by citizen organizations and global or regional agencies, for the change to be profound and permanent, it must be rooted in local communities. The need to confront the crisis should make us understand that all individuals depend on each other and that we must evolve towards a more collaborative society. Depending on each community's characteristics, it is necessary to promote groups that work on the priority aspects of each place, such as the following.

Tree planting and green areas

Given the lack of resources from local authorities to create and maintain necessary tree planting and green areas, the involvement of local groups in reforestation and the development and maintenance of community green spaces is very valuable.

Garbage Collection One of the aspects better addressed by community work in neighborhoods is related to the order and cleanliness of public spaces.

Neighborhood Identity

The various ways of adapting to a more sustainable life give each neighborhood its own identity, contributing to raising the dignity of individuals and reinforcing community bonds and solidarity.

• Actors of Change

Undoubtedly, the main actor in this matter is the community itself, but the promotion of initiatives, programs, projects, and collaborative actions by local governments or citizen organizations is crucial. Support from the educational and business sectors is highly valuable.

Benefits
Environmental: Reduction of air, water, and soil pollution.
Social: Greater citizenship development, social integration, identity, a sense of belonging, and public safety.
Economic: Generation of associated commercial and service activities.

5. Urban and Building Recycling

• Present challenges

With urban growth, the evolution of economic activities, the deterioration of buildings, the increase in land values in certain city areas, and the need to renew urban areas and deteriorated or underutilized buildings, the abandonment of deteriorated city areas and the demolition and construction of new buildings have increased.

• Dystopia / current trajectory.
The above implies the waste and the new requirement for a large amount of natural resources and energy in the production and transportation of construction materials and the building itself.

• Utopia / Working towards
It is necessary to encourage the renewal of deteriorated and underutilized urban areas, as well as the recycling of deteriorated and obsolete buildings, through projects that involve conversion according to the new needs of society and individuals.

• Actors of change
The initiative, promotion, regulation, and incentives from local governments are required, as well as the involvement of property owners and professionals from various specialties who create economically feasible and attractive projects.

• Benefits
Environmental: Reduced waste and consumption of natural resources and energy.
Social: Preservation of built historical and cultural heritage.
Economic: Savings on demolition expenses, debris transportation, and new constructions.

LEARNING *by* **DOING**

A Good Life: Features of Sustainable Well-being Housing level

1. Work at Home

• Present challenges

With the digital age, there has been a trend of working online from home, and with the Covid-19 pandemic, remote work has exponentially increased, not only in computer-related activities but also in various non-technological manufacturing and other activities.

• Dystopia
Experts in the field consider it unlikely that this trend will reverse. Therefore, without providing suitable spaces for the integration of domestic and work activities, there is a high likelihood of facing issues related to strong incompatibilities, including disturbances to neighbors, security, health, and others.

• Utopia / Working towards

Regulated work-at-home practices need to be allowed, and homes should be adapted for such purposes.

• Agents of change

Primarily, local authorities that regulate only what is essential for work-at-home practices and mixed-use at the neighborhood level.

• Benefits

Environmental: Reduction in commuting and transportation-related pollution.
Social: Reduced traffic stress, greater flexibility in time usage, spending more time with family, and having more free time, among others.
Economic: Better utilization of family resources and time. Savings on transportation.

2. Housing Division

• Present challenges

As mentioned earlier, it is urgent to reverse the trend of urban sprawl through the reasoned densification of the city. Additionally, the increase in urban land prices makes it challenging for the majority of the population to access housing, especially within the urban area.

• Dystopia	• Utopia / Working towards
The problems caused by not reversing the current trend have already been outlined.	In the majority of Mexican, Latin American cities and the Caribbean, there are extensive urbanized areas with single or two-story houses. By allowing housing division, constructing an additional dwelling on top of an existing one, it would be possible to densify large areas of cities, utilizing existing infrastructure and amenities without negatively impacting the urban and social fabric. This approach offers housing for sale or rent at much lower costs than acquiring and urbanizing new land.

• Agents of change

Local authorities allowing and promoting housing division and potential homeowners.

• Benefits
Environmental: Reduction of occupation in rural areas, pollution, and use of natural resources.
Social: Increased access to housing for sale or rent within the city.
Economic: Reduction of land and urbanization costs.

3. Green Architecture

• Present challenges

From an environmental perspective, the industrialization of housing and construction, on the one hand, has led to the consumption of large amounts of natural resources and energy, involving phases such as extraction, industrialization, manufacturing, transportation, and construction. On the other hand, this type of design increases electricity and water consumption, as well as the generation of liquid and solid waste. All of this has resulted in a massive cocktail of environmental impacts.

• Dystopia
Faced with the energy crisis, a real estate disaster is highly likely, with millions of square meters of abandoned buildings and urban areas in irreversible decay.

• Utopia / Working towards
Over the past few years, there has been a growing trend in architecture that seeks to minimize the impact of human activity on the environment through the design and construction of buildings using natural materials. This involves rejecting the use of toxic substances in the manufacturing of construction materials, limiting negative impacts on the environment, reducing energy and water consumption, and improving thermal performance. It also considers environmentally friendly practices at every stage of the process: design, construction, maintenance, rehabilitation, demolition, and recycling. There are even various types of certifications for sustainable buildings. This model needs to be refined and widely adopted through official standards and promotion and training programs. At the household level, in addition to what has been discussed in other sections of this document, there is a variety of so-called ecotechnologies that should be implemented. These include thermal materials, solar protections, cross ventilation, rainwater harvesting, solid waste recycling, and others.

• Agents of change
Government authorities regulating and incentivizing, researchers proposing new alternatives, developers of large buildings incorporating technologies, companies adopting building certification, and individuals implementing green technologies in their homes.

• Benefits

Environmental: Greater energy efficiency, less pollution, reduced water usage, among others.
Social: Increased responsibility and involvement in environmental care.
Economic: Lower costs of energy consumption, operation, and maintenance. Better commercial positioning for companies.

4. Clean Energy

• Current Issue
  It is clear that excessive energy consumption, especially from fossil fuels, is the main cause of greenhouse gas emissions.

• Dystopia
  The consequences of this issue are also evident if it is not corrected in time.

• Utopia / Required Changes
  In addition to the changes required at the clean energy production level, a few changes are needed at the household level: a) reduced consumption and responsible use of energy. Using only necessary systems, appliances, and lighting in terms of quantity and time; b) Energy-efficient lighting and appliances. It is necessary to use energy-efficient systems and lamps for all public and private lighting. Also, retrofit electrical appliances to consume less energy; c) Solar Panels. It is necessary to encourage technological advancements and mass production of solar panels to reduce their cost to a level where practically every home and building can afford them.

• Agents of change
Authorities in regulatory and incentive roles, manufacturers, and users.

• Benefits
Environmental: Reduced pollution and climate change mitigation.
Social: Increased responsibility and involvement in environmental care.
Economic: Energy consumption savings.

5. Green Roofs and Urban Agriculture

• **Current Issue**
In many cities, unplanned urban saturation has left no space for the required green areas.

• **Dystopia**
Without alternatives for green spaces, these cities and their inhabitants are condemned to a life increasingly detached from nature.

• **Utopia / Required Changes**
Green Roofs
In most cities in Mexico and Latin America, the majority of houses and buildings have flat roofs that can be utilized for growing vegetation in pots or containers that do not transfer moisture to the roofs. This would provide outdoor green spaces for recreational activities and increase the city's green mass. Terraces and balconies at all levels of houses and buildings can be utilized in the same way.
Urban Agriculture
As mentioned before, there is a need to change our dietary habits by consuming less beef and more fruits and vegetables. Some of these can be grown in our own homes or in small community plots in our neighborhoods, engaging in a physically and mentally healthy activity.

Agents of change
Government agencies in the sector providing promotion, information, and training, interested social organizations, and, of course, the general population.

Benefits
Environmental: Reduction of pollution and increase in cultivable land within the city.
Social: Increased family interaction and social integration, improved nutrition and health.
Economic: Reduced family expenses and economic generation.

LEARNING *by* **DOING**

Additional Recommendations

For several decades, there have been warnings about the environmental impacts of human activity on the planet, and more recently, the danger posed by climate change. In terms of city planning, a multitude of alternatives with varying degrees of formality has been proposed. However, despite the progress made in the field, it seems that these advances are not as expected or necessary to reverse the rapid deterioration. It appears that, after the proposed ideas, there has been a lack of appropriate execution instruments. In other words, the emphasis seems to be on what needs to be done, but there is not enough definition of how to do it, at least as observed in cities in Mexico and Latin America. In this regard, some recommendations are outlined below.

Strategy, Monitoring, and Adjustment

The urban development plans of most cities do not comprehensively include an environmental strategy, particularly in terms of climate change mitigation. It is necessary to monitor the compliance and performance of these strategies and adjust them if needed to adequately respond to changing requirements.

Instruments and Management

As mentioned earlier, it is not enough to create good plans; it is essential to design and implement instruments that allow the plans to be fully executed and serve as a guide for city management.

Transparency and Accountability

Since regional and local governments are responsible for developing and executing planning, including environmental protection and climate change mitigation, progress in honesty, transparency, and accountability is essential. The involvement and participation of NGOs and citizens are necessary for this.

Financing, Circular Economy, and Production Chains

Urban and real estate development is a significant source of economic generation. However, in most cases, this economic generation is not shared with the city that generates it. It is necessary to propose new forms of shared financing for actions required for the sustainable well-being of the city. Additionally, promoting circular economy schemes and production chains, according to the comparative and competitive advantages of each city, is needed to better utilize its natural resources and environmental characteristics.

Multisectoral Alliances and Networking

To advance to more sustainable development levels, cities must promote multisectoral alliances among the various sectors involved in city development and make the most of the possibilities to exchange information and experiences with other cities.