

Mobility system change in Lisbon



Summary | 3

① Introduction | 4

The need for system change | 4

Our intent | 4

The process | 5

② Key interventions & interdependence | 6

How to read the map | 6

Strategic vision | 7

Key variables | 7

Designing virtuous and reinforcing feedback loops | 7

Interventions to enable the shift | 8

③ Conclusion | 11

Summary

Limits to growth exist within every technological paradigm. For billions of urban residents and workers, the mobility systems they rely upon — to access jobs, schools, markets, civic and social life — are running up against those limits. Mobility must increasingly respond to urban populations that are growing larger while they also demand that the design of their cities addresses the three most pressing global sustainability challenges: the climate emergency, the loss of nature and growing inequality.

A global consensus has emerged in recent years that *sustainable urban mobility* is **safe, clean, efficient** and **accessible** for all. Following from this broad, aspirational statement of vision, the next step is to better understand the system as it exists today and redesign it so that is well-adapted to a future commensurate with that vision.

Mobility systems are complex, featuring many stakeholders and emergent behavior that cannot be predicted through the analysis of its component parts in isolation. In the face of this complexity, realizing systems change requires a holistic approach, one that is as concerned for the implicit aspects of relationships and stakeholder mental models as it is about formalized policies and resource flows.

Under the leadership of the World Business Council for Sustainable Development's (WBCSD) Transforming Urban Mobility program, work has proceeded to address this complexity head-on through the development of a systems map of sustainable urban mobility. By synthesizing the current state of the system

structure and identifying the landscape of potential solutions to shift the system, the map serves as a basis for robust dialogue among a city's mobility stakeholders; a participatory strategy development approach that builds relationships; a more holistic understanding of the problem; and a deeper appreciation of the mental models that guide stakeholder decision-making. Additionally, the map seeks to aid stakeholders in self-identifying areas for collective action.

The City of Lisbon, Portugal, took up the mantle of validating a first application of the map and the process for engagement with it. Through a series of virtual workshops, Lisbon's mobility stakeholders engaged in a facilitated dialogue around the systems map. The output of these meetings was a Theory of Systems Change map, specific to Lisbon, that centers around the design of a mobility system that, for passengers, is integrated & intermodal and for goods, is connected and zero-emissions.



① Introduction

The need for system change

The development of cities sparked a leap forward for humankind. By consolidating economic and social activities around these points on the globe, our ancestors overcame the inefficiencies of nomadic life and unlocked the surpluses necessary to develop civilization. When cities outgrew the human scale, we added mobility so that we could continue to meet friends and family, hold a job, receive care, receive an education, and buy the goods and services needed for our homes and businesses.

Cities and mobility remain essential in the 21st century. Nonetheless, the people tasked with planning and managing today's urban mobility systems feel that an evolutionary shift is underway. The infrastructure, vehicles, regulation, operations and governance models that connect residents to goods and one another are running up against the limits of their legacy configurations. Increasingly, elements of this system are proving to be maladapted to the needs of a sustainable future.



Transforming a complex system like urban mobility requires adaptive leadership — the action of people and organizations capable of continually clarifying a shared vision of the future and revealing the current reality.

Following the example of the 17 Goals of the UN's 2030 Agenda for Sustainable Development, systems-level initiatives [Sustainable Mobility for All](#) and Transforming Urban Mobility have worked to establish that vision, defining a sustainable mobility system as one that is **efficient, safe, clean and accessible for all**.

Such a positive, holistic, and aspirational vision is critical to enabling systems change. By helping system stakeholders see beyond the resolution of individual problems, this vision forms a basis for collaboration.

New technologies and business models, including ride and vehicle sharing services and forms of personal "micro" mobility, as well as fully electric powertrains are hitting the streets (and sidewalks). Many of these inventions seek to substitute incumbent mobility offerings, providing more convenience, lower prices or environmental impact, or more comfort to users through big data applications, platform business models, and innovative vehicles.

Some of these inventions are specifically responding to the challenges laid out in our visions of sustainable urban mobility, working to reduce tailpipe emissions, improve safety and increase access for underserved populations.

Municipalities around the world are under pressure to respond to these disruptions— to rapidly identify how these inventions can be deployed in a way that contributes to progress toward their sustainability goals while avoiding unforeseen and unintended consequences.

To ensure alignment of innovation with the vision of sustainable mobility, the second aspect of adaptive leadership requires that we raise the collective capacity to manage complexity and to identify collaborative and mutually reinforcing actions. This involves integrating the perspectives of stakeholders from different fields and sectors, so that we can later arrive at a holistic strategy capable of delivering systems change toward sustainable mobility.

Our intent

WBCSD's *Transport and Mobility Pathway*, made up of industry members representing the world's leading companies moving toward sustainability, share a vision of urban mobility as efficient, safe, clean, and accessible for all. WBCSD members also know that their ability to effectively shift their own businesses will be key to ensuring the success of the systems change effort overall.

While the best way to predict the future may be to create it, no one organization can shift a system entirely on their own. Business and city leaders work together to increase the chances that investments made in adapting products, business models, governance and regulations are fit for the future.

In the City of Lisbon in Portugal, WBCSD has contributed to creating an ecosystem of more than 120 companies that collaborate with the city authorities to reduce the negative impacts of mobility through a [Corporate Mobility Pact](#). To support and advance this work

further, WBCSD's Transforming Urban Mobility program commissioned the design of a Sustainable Urban Mobility Systems Map as a tool for facilitating collaboration among cities and businesses worldwide and creating pathways toward more sustainable urban mobility.

The process

With the mobility system maps in-hand, WBCSD and the Camara Municipal of Lisbon, convened a diverse group of system stakeholders over three iterative sessions to build a theory of systems change for sustainable mobility in Lisbon.

SIMFO, a system change company, facilitated a workshop in which the systems map served to ground participants, supporting them to engage with the full complexity of the mobility system while considering the key barriers and opportunities for shifting that system.

Findings were distilled into a simplified Theory of Change map that responded to the group aspiration for Lisbon's Mobility and filtered a large number of possible interventions into a set of critical priorities.



② Key interventions and interdependence

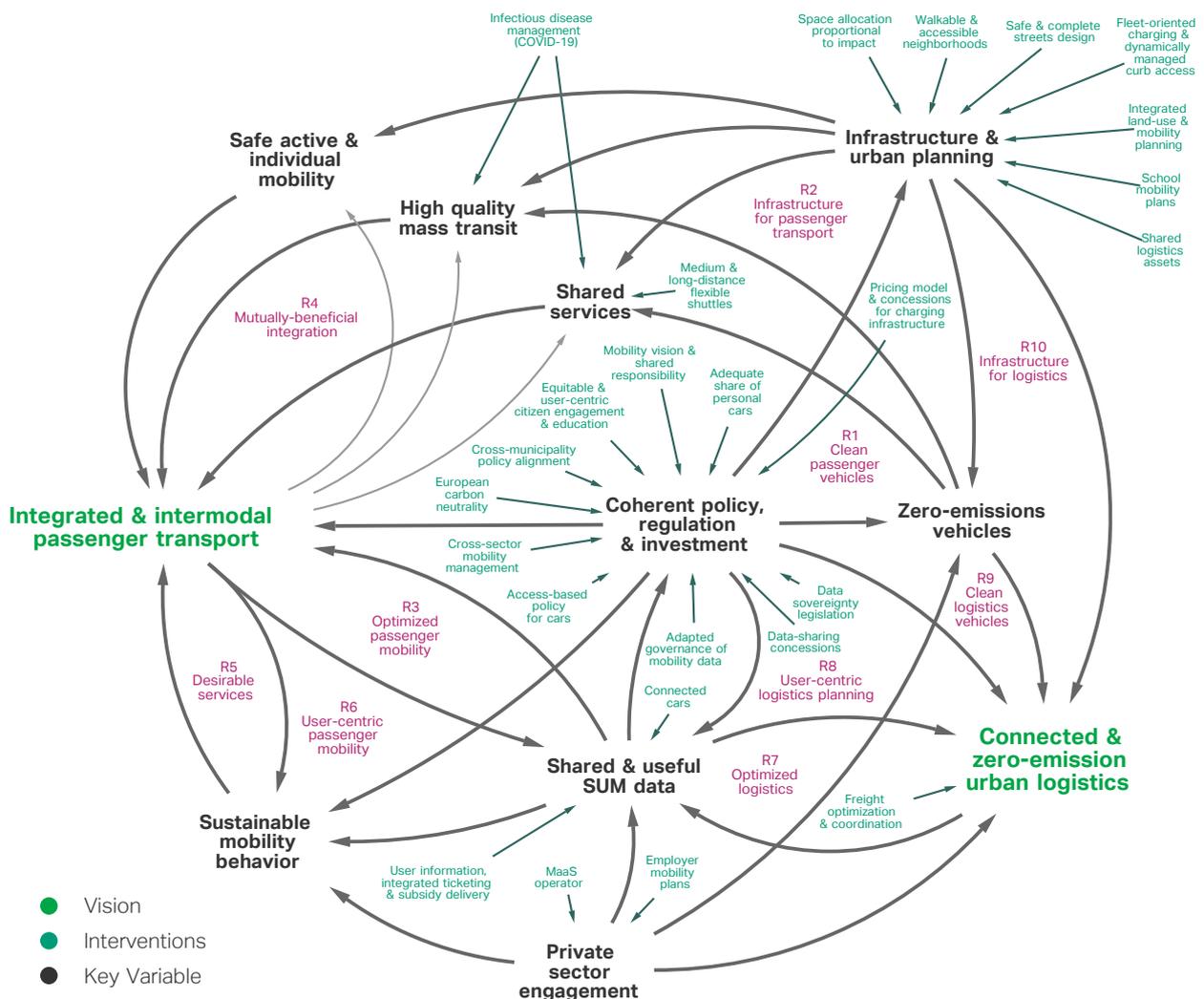
How to read the map

- Strategic vision**
 There are only two of these in our theory of systems change and they represent the key strategies that will drive our goals of safe, clean, efficient and accessible mobility for all

- Key variables**
 These are the areas in which we take action, important objectives for achieving the strategic vision
- Interventions**
 These are the specific actions to take that will realize our strategy

Additionally, the map includes feedback loop labels, indicated in pink. The R designation stands for Reinforcing, one of two feedback loop types in system dynamics, also called a Positive Feedback Loop (The other type, not represented here, is a Balancing or Negative Feedback Loop).

Figure 1: A theory of change for sustainable mobility in Lisbon



Strategic vision

While the goals of a sustainable urban mobility (SUM) system are gauged by measures in the categories of **clean, efficient, safe** and **accessible for all**, Lisbon's mobility stakeholders identify two important intermediate elements that function both as a strategic direction and a desired outcome. These are:

- 1. Integrated & intermodal passenger transport**
Such a system leverages the advantages of multiple mobility modes, reducing systemic impact of mobility provision, while providing users with an attractive alternative to the single user personal vehicle.
- 2. Connected & zero-emission urban logistics**
As demand for deliveries in urban areas increases and changes in favor of smaller and more frequent deliveries, connectivity aids in optimization while greening fleets cuts down on ambient urban air pollution.

Key variables

To deliver these two strategies, the group drew from the systems map to identify eight key variables or action domains, including:

- 1. High-quality mass transit**
rail, bus, boat and metro services moving large numbers of people along high-demand routes efficiently, safely, comfortably and with minimal environmental impact.
- 2. Safe active & individual mobility**
The result of safe streets and neighborhood design that encourages walking, biking and other forms of individual mobility, complemented by sharing services that provide the actual bikes, scooters and mopeds.

- 3. Shared services**
Novel service forms based on shared vehicles, including taxis and ride-hailing services, free-floating car and moped rentals, point-to-point minibuses and more.
- 4. Sustainable mobility behavior**
Sustainable mobility will only be realized where supply meets demand. This is the result of families choosing those options that best meet their own needs without compromising the needs of others, today or in the future. This follows the principle of avoiding, reducing and shifting trips.
- 5. Zero-emissions vehicles**
Cars, buses, vans, trucks, motorcycles and scooters that do not contribute to ambient air pollution or atmospheric carbon while in use.
- 6. Infrastructure & urban planning**
The activity of allocating space, setting rules for development and constructing infrastructure that is adapted to the needs of safe and sustainable urban mobility. Sensors, digital infrastructure, vehicle-to-infrastructure communication, electric vehicle charging equipment, and transfer centers are included in this definition, alongside more traditional infrastructure like road, rail and signals.
- 7. Coherent policy, regulation & investment**
The result of a concerted and consistent effort to align regulatory and policy instruments to the broad strategies identified by integrated & intermodal

passenger transport and zero-emissions logistics.

- **Shared & useful SUM data**
The availability of mobility-related data and the capability to derive insights from them that benefit the planning and operations of sustainable urban mobility.

Designing virtuous and reinforcing feedback loops

Change is often non-linear in nature and driven by reinforcing feedback loops. We seek to identify these loops, designing interventions so that reinforcing loops support of our strategy.

Shared & useful SUM data enables smart logistics and user-centric passenger mobility

Loop R3 and R7

Digital mobility services providers and platforms have demonstrated the power of ubiquitous data, if secured and well-utilized, to optimize mobility systems. This reinforcing feedback loop centers on data that is accessible, secured and shared ethically by all public and private sources, and transformed into insights and data products to inform the mobility system's actors and eventually the whole system. This data can become useful across multiple planning time scales, from a momentary routing decision or reserving a vehicle, to setting access rules and allocating urban space based on the evolving needs of residents and businesses operating in the city.

Integrated & intermodal passenger transport benefits individual mode operators while enhancing user experience

Loop R4

Strengthening an integrated & intermodal passenger transport system will require the participation of Lisbon's incumbent operators to collaborate with other actors, including those currently positioned as competitors. To win their participation, the integration of modes must strengthen the individual operators and service providers and create value for the whole group. For example, better alignment between schedules could enhance utilization while shortening transfer times for passengers and support better intermodal hub design and demand-capacity alignment.

In another case, a better planning of services that are poorly using the operator's assets could help reduce operating costs.

Data-driven policy provides a solid foundation for planning cities & building infrastructure

Loops R2 and R3

Planning and shaping demand for vehicles helps to create pathways that drive impact for decades. Data-driven planning, combined with a strong mobility vision, can unlock deeper and more accurate insights into patterns of mobility, the identification and prioritization of problems, and the modeling of future scenarios. The ability to leverage the wealth of mobility data created each day depends upon the effective design and operation of a local data-sharing and management capability. If well-deployed, this capability will inform and shape effective policymaking and power technology that can help deliver sustainable mobility planning, use of infrastructure and vehicle demand management.

Interventions to enable the shift

The interventions in the following section are not exhaustive but seek to represent prioritization from the perspective of Lisbon's mobility stakeholders to shift the design and operation of the system and align it to the shared vision. The interventions identified can be grouped in four categories: user centrality, planning and regulation, mobility data and commercial logistics operations.

User-centricity

A mobility system designed around the needs of users to access their city, not operators or vehicles

A strong emphasis on designing for the needs of passengers requires a re-evaluation of how policy is made and signals a shift away from the historical focus on the supply side of operations. This shift is enabled by digitalization.

While an integrated & intermodal passenger transport system promises strong collective benefits for the city, user-centricity serves as a strong reminder that it is the choices of workers and residents that ultimately determine the success of the system that is put in place. As we see urban residents increasingly relying upon e-commerce for receiving goods, user-centricity is not limited only to the impact on passenger transport, but to urban freight as well (user-centric logistics planning). Medium & long-distance shuttles, operating point-to-point on high-demand routes using smaller rolling stock than traditional city buses, were one such intervention that stemmed from a focus on designing for user-needs in an equitable way.

The Lisbon Theory of Change map reaffirms the importance of long-standing notions of citizen engagement and education to design mobility for user needs. In fact, a vision of designing around user needs by leveraging the digital apps and interfaces as a rich source of data creates a reinforcing loop between the integrated & intermodal passenger transport system and the **shared & useful SUM data** (R6 user-centric passenger mobility).

The COVID-19 global pandemic introduced new challenges to the realization of Lisbon's sustainable mobility goals. Overall travel volume was suppressed as residents limited social engagements and shifted to working and learning from home. This introduced operational and financial challenges for transport operators in the short-term and which may have lasting effects. It also led many residents to substitute use of shared and public transport for a personal vehicle.

The Theory of Change reflects this challenge to the vision of an intermodal transport system, much of which is served by shared modes, and suggests that it must be fully considered and acknowledged by infectious disease management (COVID-19) to achieve the vision, which remains unchanged by the pandemic.

Planning & regulation

Designing the city around sustainable urban mobility

For Lisbon, a sustainable city starts at the scale of the neighborhood (walkable & accessible neighborhoods). Incentives and regulations like zoning, can encourage the private sector to provide for residents' daily needs at a hyperlocal level, enabling residents to access them without the aid of the mobility system. For connecting people and goods across neighborhoods, Lisbon will work to create the most sustainable mobility system possible, centered on the strategic visions of integrated & intermodal passenger transport and connected & zero-emission urban freight.

These two elements will serve as a high-level strategy guiding the design, regulation, and investment of all subordinate system components. Achieving this strategy calls for collective deepening of these two elements and a shared sense of responsibility across boundaries and areas of concern.

Coherence, in the form of alignment to the vision among the many subordinate policies, regulations, and the investments emerged as the leading principle for the theory of change (Coherent policy, regulation & investment). A myriad of decisions — about where to locate transfer stations, how to devise pricing incentives, or how to regulate electric charging providers — are interdependent.

Besides these areas of responsibility, coherent policy will also cross geographic boundaries. The cross-municipality policy alignment intervention reflects the stakeholders' desire to see enhanced coordination between Lisbon and the surrounding municipalities that make up the functional metropolitan region.

Additionally, stakeholders identified that, when compared to their targets, Lisbon's current mobility system delivers a mode share dominated by personal cars. Space allocation proportional to impact could be a powerful lever in bringing the mode share in line with targets, as is access-based policy for cars.

Finally, the private sector can contribute to a consistent planning and regulation by collaborating with local businesses to create a shared Mobility as a Service (MaaS) platform and design and adopt employee mobility plans and policies that align to the planning and regulations of the city.

Mobility data

Sharing, analyzing and providing insight based on a wide range of data sources

With **shared & useful SUM data** positioned at the core of several reinforcing feedback loops in the system, many of the interventions highlighted in the Lisbon Theory of Change are targeted at enabling this important variable.

Mobility data is created in many points throughout the system. Largely, this data remains with the operator that created it. These sources include connected cars and other vehicles, fleet operators, navigation apps, smart infrastructure and traditional mobility research.

Merging the data from many disparate sources requires, first, that it is shared or made accessible by those that own and control it. Challenges related to the privacy and security of personal data, or perceived or real competition currently form barriers to data sharing.

Work is underway in Lisbon to identify the right mix of governance, data-sharing incentives, and regulations to encourage data sharing. Stakeholders identified that this may require the passage of data sovereignty legislation to bring data into the country.

Once data is available, both the urban freight and passenger transport systems will require information technology systems—governed by adapted governance of mobility data—that allows to collect, store and analyze mobility data, providing it back to users in the form of useful data products and information: driving route optimization, asset deployment and other responsive actions. In the passenger transport space, this will be enabled by a MaaS operator.

Emerging mobility interfaces, including apps, that unite transport information (user information, integrated ticketing & subsidy delivery) are key to integrated & intermodal passenger transport, enabling users to find the most efficient, comfortable and cost-effective route with ease.

Building on the success of smart card systems, including Lisbon's Navegante, ticketing can be integrated into these apps, benefiting from the seamless delivery of relevant user subsidies, incentives and education designed to nudge passengers into more sustainable mobility behaviors.

Commercial logistics operations

Providing the infrastructure and new models required for efficient urban delivery at every scale

Shared logistics assets (vehicles, depots or fleet management systems) provide operators with access to vehicles and infrastructure that enable efficient and clean deliveries in dense urban environments.

This intervention may include the deployment of smaller delivery vehicles and require that logistics providers have transfer centers near urban center thresholds, allowing freight to be efficiently transferred from one vehicle type to another. The intent is for shared vehicles to achieve high utilization and lower ownership costs for each member company.

Unlike personally-owned electric cars and scooters that can recharge slowly during hours when the vehicle is not in use, fleet operators control costs by keeping the utilization of their capital assets high.

Therefore, rapid charging infrastructure should be deployed around the needs of commercial fleet vehicles (fleet oriented charging). In Lisbon, the stakeholders recognized that they had not yet established a clear pricing model & concessions for charging infrastructure to encourage such development.

Public space, including curb-access provided in the public right-of-way, could be reallocated (space allocation proportional to impact) away from parking for privately-owned vehicles in order to support the efficient pick up and drop off of urban freight. Providing additional space for these activities reduces the likelihood of delivery vehicles being forced to stop in driving lanes, or needing to cruise to find an appropriate loading zone creating additional traffic in the process.

Lisbon's mobility system stakeholders recognized the importance of this action due in part to the city's limited urban space. Allocating and managing access to this public space dynamically will require policy and regulatory action in addition to aligning infrastructure and data management to support it.



③ Conclusion

For this group in Lisbon, the stakeholders quickly identified and united a number of disparate elements into the key strategic vision for passenger transport, defined by its degree of integrated-ness and intermodality.

Areas for collective action

The exercise reaffirmed the importance of cross-boundary collaboration including between policymakers in the public sector, leaders in the private sectors and representatives of citizen associations.

Making mobility data universally available and useful requires policy, incentives and processes, all of which rely on a clear definition of relationships and governance among many actors. Lisbon reaffirmed the importance of collaborative action in this area. This is due to both the complexity in achieving this goal and due to its importance in closing the feedback loops that influence everything from operational efficiency to providing the automotive industry clear direction on the type of vehicles required to realize sustainable mobility. There is a clear framing around the need for data to be governed in the best interests of the entire city while establishing a favorable environment for the companies that will serve as MaaS operators.

Charging infrastructure was identified as another action domain requiring robust collaboration. Though new legislation has already established important concessions for operators in exchange for complying with interoperability requirements, our group reflected that a clear pricing model is required to further spur investment.

Through the workshop, the group also reaffirmed the importance of the private sector in its role in shaping the mobility behavior of its workforce, noting this was an area of potential leverage, notably through the [Corporate Mobility Pact](#).

Finally, the group acknowledged that the city could take action to open up public obligations funding, working with the private sector to share subsidies to the operators of shared mobility regardless of whether they are privately or publicly operated.

Areas for further engagement

This initial systems map has helped to make explicit the mental models of key mobility leaders in Lisbon's. This represents an important first step and suggests potential for further work. However, it was well-understood that the stakeholders involved in the workshop did not represent the totality of Lisbon's mobility system. While the stakeholders did represent a range of functions and organizations across the public and private sector, there were notable exceptions. This was most evident in the absence of representatives of the surrounding municipalities that form Lisbon's functional metropolitan region.

Miguel Gaspar, Deputy Mayor for Mobility at the time, recognized the map's value for its ability to efficiently communicate this core group's Theory of Change. This is an important step for opening up future conversations with a broader range of stakeholders. Should Lisbon's stakeholders decide to take this mapping further, any future work would likely involve engaging the next layer of mobility managers responsible for delivering the strategy, disaggregating the maps' relationships to identify areas key systems traps that may not be visible in this high-level view.

Other cities interested in identifying the right sustainable solutions for their local mobility system and mapping a theory of change are welcome to reach out to [WBCSD](#).

ACKNOWLEDGEMENTS

Developing a holistic view of complex systems requires broad participation from many stakeholders, something that would not be possible without the leadership of a convener with the ability to bring together their peers. WBCSD would like to thank Pedro Machado for his stewardship of this exercise. We would also like to thank each of the mobility system stakeholders that participated were open-minded and enthusiastic participants in the workshop: Bernardo Alves, Inês Amorim, Tiago Farias, Ricardo Ferreira, Nuno Inacio, Paulo Martins, Rui Miguel Velasco Martins, Pedro Pinto, Henrique Sanchez, Sofia Tabora, Manuela Carvalhão Tavares, José Viegas and João Vieira.

The original systems map that formed the basis for this stakeholder workshop was made possible by the generous contributions of time and expertise from the world's leading mobility experts including: Segio Avelleda, Christopher Bertraux, Jonathan Ehsani, Wolfgang Forderer, Victoria Hills, Peter Hogg, Barbara Lenz, Iain Macbeth, Sebastien Marinot, Jeff Michael, Robin North, Luke Rust, Jean de Saint Victor, Jos Streng, Gil Tal, Geetam Tiwari, Karen Vancluysen and José Viegas.

DISCLAIMER

This report has been developed in the name of WBCSD. Like other WBCSD publications, it is the result of a collaborative effort by WBCSD staff, experts and executives from member companies. A wide range of members reviewed drafts, thereby ensuring that the document broadly represents the perspective of the WBCSD membership. Input and feedback from stakeholders listed above was incorporated in a balanced way. This does not mean, however, that every member company or stakeholder agrees with every word.

ABOUT WBCSD

WBCSD is the premier global, CEO-led community of over 200 of the world's leading sustainable businesses working collectively to accelerate the system transformations needed for a net zero, nature positive, and more equitable future.

We do this by engaging executives and sustainability leaders from business and elsewhere to share practical insights on the obstacles and opportunities we currently face in tackling the integrated climate, nature and inequality sustainability challenge; by co-developing "how-to" CEO-guides from these insights; by providing science-based target guidance including standards and protocols; and by developing tools and platforms to help leading businesses in sustainability drive integrated actions to tackle climate, nature and inequality challenges across sectors and geographical regions.

Our member companies come from all business sectors and all major economies, representing a combined revenue of more than USD \$8.5 trillion and 19 million employees. Our global network of almost 70 national business councils gives our members unparalleled reach across the globe. Since 1995, WBCSD has been uniquely positioned to work with member companies along and across value chains to deliver impactful business solutions to the most challenging sustainability issues.

Together, we are the leading voice of business for sustainability, united by our vision of a world in which 9+ billion people are living well, within planetary boundaries, by mid-century.

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