Collaboration, Communication and Coordination:

Accelerating Zero Emission Bus Deployment

A Planning Guide for Cities

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Executive Summary

Cities around the world are continuing to identify the environmental, health and financial benefits of adopting zero emission buses (ZEBs) and demand is starting to surge – with ZEBs estimated to make up 83% of the global bus fleet by 2040 (BNEF, 2021). However, despite the growing number of cities committing to the transition, many still struggle to understand the systemic changes needed and the landscape of new and existing actors necessary to facilitate and accelerate large-scale deployment.

This report shares the experiences of four cities who were supported by the CFF to deploy the first zero-emission buses in their cities. The aim is to present these case studies in a way that will be helpful for other cities and practitioners to learn from to accelerate deployment elsewhere.
Several effective methods of coordination were identified from these four case studies, which utilised both new and existing mechanisms and processes. These included:

- *Understanding the needs of key stakeholders and formulating robust strategies to collaborate with them.*
- *Developing long-term city roadmaps.*
- *Working with other partners to develop a better enabling environment.*
- *Creating or refining standardised processes.*
- *Understanding and analysing the decision-making process and steps.*

1 INTRODUCTION

Zero emission buses (ZEBs), whether battery-electric or hydrogen fuel-cell, are strategic elements in the transition to sustainable and clean mobility. They offer considerable public health benefits and advantages: a significant reduction of greenhouse gases, air pollutants and noise.

Despite recent considerable interest and growth in the ZEB market, their deployment is still limited in scale and geographically irregular, mainly concentrated in North America, East Asia (with China constituting approx. 98% of the market) and Europe (Li, Castellanos, & Maassen, 2018), with a small number of high-profile cases in Latin America. In many urban areas the deployment of ZEBs is still a technological innovation that necessitates significant variations to how cities and transport agencies plan, finance and operationalise their bus services.

First of all, the deployment of ZEBs entails a systemic change that requires the recognition of a whole new range of skills and resources. The process will involve a range of new and existing actors including national and subnational entities, utility providers and energy suppliers, manufacturers, and different capital providers.

Deploying ZEBs requires coordination at different levels. Now more than ever, public transport projects need multisectoral support from both the private and public sectors to deliver. For example, the transportation department – in charge of structuring, managing and operating transport projects – needs the support of:

• The environment and energy departments and energy utilities for buses to utilise an extensive, reliable low-carbon electricity grid to maximise their impact.

• The commerce and industry departments to play a fundamental role in opening and balancing the market for clean technologies.

• Legal departments and private operators and financiers to adopt policies and regulations to implement new business models and commercial arrangements to make the project feasible and scalable.

While multi-sectoral coordination and implementation has the potential to deliver large-scale holistic benefits, the challenge lies in coordinating actors, institutions and other stakeholders, their resources, particular interests and goals, to converge around a common target, which otherwise could significantly delay deployment. Thus, new structures, coordination mechanisms and guidance to deal with more complex multisectoral arrangements are necessary.

2 OBJECTIVES

This report aims to compile and share practical knowledge and outline key steps illustrating how cities can more effectively coordinate and communicate between institutions, actors and other stakeholders to deploy a ZEB project. It is based on the experience of four ZEB projects supported by the CFF, located in Jakarta (Indonesia), Monterrey (Mexico), Guadalajara (Mexico) and Quito (Ecuador). Sharing key insights allows other cities worldwide to replicate good practices that contribute to accelerating ZEB deployment projects and activating a broader e-mobility transition.
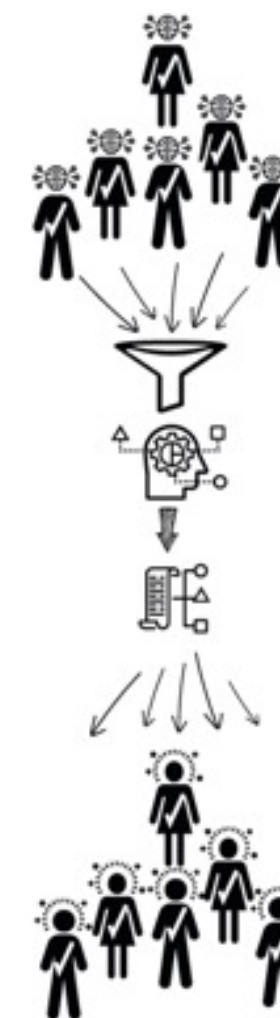
3 METHODOLOGY

This report is primarily based on information collected from the four ZEB projects noted above.

Approximately 30 key actors and stakeholders were interviewed with diverse profiles and roles to obtain a broad range of perspectives. Executives, advisors, and technicians from private and public institutions at national, sub-national and city levels, energy supplier companies, consultancies, financial institutions, and manufacturers, among others, shared their knowledge, experiences and concerns about ongoing coordination and communication practices arising from ZEBs projects.

The knowledge harvesting[1] methodology was used to collect, analyse, assemble and release the information in this report (Figure 1). The work is also grounded in a theoretical framework relating to coordination mechanisms, which are discussed in the next section.

• Select key actors and stakeholders in ZEB projects to interview. Review existing support information.

• Collect data from interviews and documents.

• Identify patterns and organise knowledge into different guidance topics.

• Elaborate on topics and release key insights to share with other projects.

• Now similar projects can use this information to accelerate their projects!

1 - Knowledge Harvesting is a means to draw out, express, and package tacit knowledge to help others adapt, personalise, and apply it; build organisational capacity, and preserve institutional memory..." (Asian Development Bank, 2010).

Figure 1 - Knowledge harvesting methodology.

COORDINATING AND COMMUNICATING BETWEEN ACTORS

ZEB projects are developed within complex institutional organisations, with multiple actors relatively autonomous but still interdependent in the pursuit of their goal to deploy ZEBs. The interdependencies mainly centre on resources (knowledge, budget, and priorities), legal competencies to execute certain activities, and power to make particular decisions (technical, financial, and political).

Coordination is defined as the effort to manage these interdependencies between actors/institutions and other stakeholders. It is usually achieved through communication and information exchange, collective understanding, and agreements between the parties (Weigand, Poll, & Moor, 2003)

One of the main problems of coordination comes from communication inefficiency, whether it be asymmetric information or a lack of communication between actors. To deal with this, organisations can use different coordination mechanisms, which are broadly classified into three groups: standardisation, hierarchy (vertical communication) and mutual adjustment (horizontal communication) (Weigand, Poll, & Moor, 2003) (Figure 2).

- Standardisation: achieves coordination by establishing activities and schedules, specifying work processes and outputs, issuing norms to establish responsibilities, and training teams to develop relevant skills and knowledge (Figure 3).

- Hierarchy (vertical communication): achieves coordination by having someone issue instructions. This method is usually supplementary to the standardisation of processes.

- Mutual adjustment (horizontal communication): achieves coordination by an informal process of communication. It implies that communication effectively obtains understanding, a collective sense of ownership and belonging, willingness to participate, and feelings of responsibility for the outcome. This method can supplement standardisation and hierarchies.

This theoretical background is helpful to understand the coordination mechanisms used in the four case studies. It is also an example of positive practices that can accelerate the deployment of ZEBs.

Figure 2 - Coordination mechanisms. Source: the author based on Weigand, Poll, & Moor, 2003

Standardisation

of work
(strategic plans, activities, procedures, functions, responsibilities)

of outputs
(schedules, project deliveries)
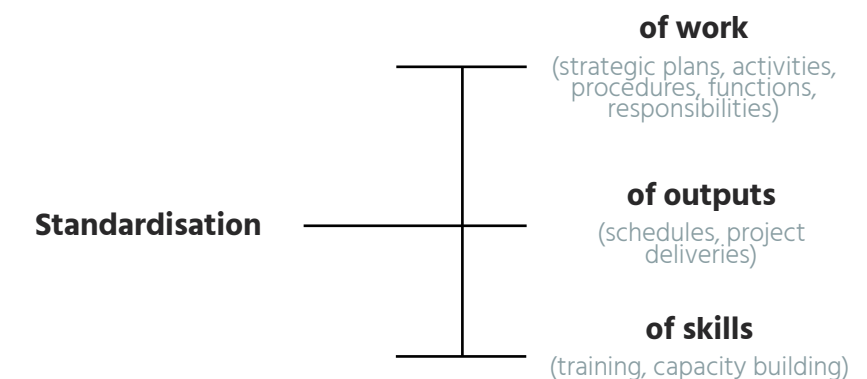
of skills
(training, capacity building)

Figure 3 - Standardisation types. Source: the author based on Weigand, Poll, & Moor, 2003

CASE STUDIES

The development of ZEB projects (similar to other infrastructure projects) can be split into three phases (Figure 4). The CFF has supported the four cities in question to develop finance-ready project proposals for their ZEB projects (Figure 4 – part B). This support includes the provision of technology studies, feasibility studies, business case development, legal advice and the creation of financial models. A brief summary of each project follows (further details available on our website), with a short description of the institutional framework, governance features, and coordination mechanisms.

a. The conceptualising phase

Cities or subnational urban areas realise the problem and develop a proposal to deploy ZEBs.
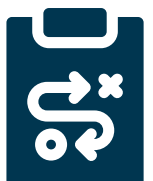
b. The technical feasibility study and business case

Technical, technological and financial aspects for the deployment of ZEBs are evaluated, and crucial decisions are made.

c. The implementation or operational stage

The activities defined in the feasibility study are executed: contracting, procurement and operation of ZEBs.

Figure 4. Phases of Zero emission bus (ZEB) deployment.

Case Study: Quito, Ecuador

The city intends to construct and electrify two BRT corridors with the procurement of 273 e-buses and 69 e-trolley buses and infrastructure such as stations, depots and terminals. The municipal actors in charge of delivering this project are the Secretaria de Movilidad (SDMQ, – Transport Department) and the Empresa Metropolitana de Transporte de Pasajeros de Quito (Public Transportation Company for the Quito Metropolitan area).

Case Study: Guadalajara, Mexico

The state of Jalisco plans to electrify the 'Mi Macro Periférico' bus rapid transit (BRT) feeder route with 38 buses, providing connections with Guadalajara's international airport and the Public State University CUT Tonalá campus. The Secretaria de Transporte de Jalisco /(Transport Department of Jalisco) leads this project with support from the Officina de Coordinación Territorial (Territorial Coordination Office) from Jalisco's state cabinet.

Case Study: Jakarta, Indonesia

The city will trial a fleet of 100 e-buses. In parallel, a road map for electrification of the public transport system is being produced by the United Nations Environment Programme – Climate Technology Center and Network (UNEP/CTCN). The governor of the province is the political head of the project, and Transjakarta is the public transport manager for the BRT system, in charge of delivering it in coordination with the Badan Pengelola Transportasi Jabodetabek (Transport Agency of Jakarta province).

Case Study: Monterrey, Mexico

The city is implementing three new e-bus corridors as feeder routes for the new line 3 of the Monterrey light metro system. The Secretaria de Desarrollo Sustentable (Sustainable Development Department) from the state of Nuevo Leon leads the project and reports to the state governor.

Institutional framework, governance, and project ownership

The ZEB case studies are multisectoral governmental projects developed within the urban mobility sector to operate public transport services, interdependent upon other portfolios (i.e. energy and environment, industry and commerce, finance) and levels of administration (i.e. metropolitan, state-wide, provincial, national).

The primary owner of a ZEB project is typically the mayor or governor from a city, state, or province, whose political commitment is crucial in delivering the project. There is also usually a secondary owner, a senior official who should assume the executive management role – often the director of a government agency or public bus company. In turn, they can appoint a technical project manager – a senior leader from the same institution, who coordinates the project's technical and business analysis efforts. An illustration of the project ownership structure and its complexities can be found in Figure 2.

Coordination mechanisms

In the cities explored in these case studies, two main institutional frameworks were used as coordination mechanisms. These gave different results.

I. 'Simple' institutional framework

This coordination mechanism is mainly based on the hierarchies and jurisdictions of public institutions as defined by law. It relies on the public sector's institutional capacity and the ZEB project owners' and managers' ability to activate or generate vertical and horizontal communication channels and coordinate efforts between actors, institutions, and stakeholders. It also depends on the decision-makers' responsiveness and political will. The use of this mechanism demonstrated two insights:

a) Although there is a structure of hierarchies and jurisdictions, there is no consistent practice of vertical communication or clarity in the decision-making process (levels and competencies). Neither is there efficient horizontal coordination nor collaboration between actors to advance the project.

b) In conjunction with the project manager's ability to coordinate, a robust institutional capacity allows the project to evolve within the institutional framework's existing patterns and dynamics.

II. 'Reinforced' institutional framework

Specific coordination structures in some of the case studies complement traditional jurisdictions and hierarchies among institutions. The core of this coordination mechanism is a multisectoral team attached to the mayor's/governor's cabinet, specifically in charge of coordination affairs, to help manage the general government plan's projects with a transversal and integral vision. It operates between the governor and the secretaries, whom the team interact with to propel prioritised project delivery. The team's main tasks are:

-Standardisation: establish regular meetings. Reports to keep all actors informed.

-Mutual adjustment: coordinate and promote inter-institutional and inter-sectorial collaboration.

-Actor involvement: engage new actors according to needs.

-Surveillance: continuously participate as observers alongside the process, identifying obstacles, barriers or delays and acting opportunely to solve issues or manage crucial topics.

-Technical advice: simplify technical debates, present feasible scenarios to the mayor/governor, receive instructions and revert to the technical team with adjustment requests.

Overall, the multisectoral team facilitates the decision-making process.

These complementary institutional structures are the backbone that simplifies communication, promotes coordination and shortens gaps between decision-making levels.

There are also other strategies implemented within the institutional contexts, aiming to strengthen existing coordination mechanisms. An example of this is the Project Implementation Unit (PIU), referred to in detail later on.

5

Key Insights

Mapping and monitoring the landscape of actors

Mapping and monitoring the landscape of ZEB actors is crucial to identify the variety of roles, resources, and interests the project manager has to align in order to promote cooperation between actors/institutions and stakeholders from different sectors and decision-making levels (municipal, provincial, national). This task includes:

- Characterising the institutions/individuals that are needed or can influence the project delivery. This includes analysing their roles, power, and interests in the deployment of ZEBs.

- Identifying actors' resources and how these can support the project evolution (political, economic, legal, knowledge/information relationships), and recognising which actors are relevant at each stage of the project.

- Identifying the owners, managers, promoters (whom the project depends on), allies, opposers, or gatekeepers (who can stop the process).

- Setting up an actors' engagement plan, establishing coordination and communication strategies to collaborate with actors, utilising independent mediators if this would be beneficial.

- Monitoring and updating this analysis alongside the project evolution to track variations that could require adjustments in the actors' involvement plan.

Some of the most relevant new actors and stakeholders that appeared in the landscape of ZEB deployment in these four case studies were:

- National or subnational entities who lead and develop strategic policies and regulations to create a supportive enabling environment for the e-mobility transition.

- Utility providers and energy suppliers who are essential to identify the current capacity of the existing energy network and to develop expansions to cope with the ZEB deployment

- Bus, batteries and charging manufacturers who develop technologies that fit the technical standards and operational requirements for clean, safe, reliable vehicles.

- Capital providers who are also vital to overcoming the financial barriers in delivering projects and scaling-up zero-emission initiatives, assuming the upfront cost of e-bus components.

Promoting actors' engagement

Engaging diverse actors, institutions and stakeholders and bringing together multiple resources (knowledge, data, financial, political) helps to overcome barriers to adopting ZEBs. It allows project managers to consider differing perceptions, requirements, or concerns, explore diverse initiatives, anticipate issues, mitigate disagreements, and avoid misconceptions, overlaps of tasks, and setbacks.

Key actors should be involved consistently in all the project stages, whether as observers, active or strategic players, and they should be provided with apt opportunities to take part.

E-suppliers' involvement

A vital step in the deployment of ZEBs is interaction and cooperation with suppliers and other stakeholders: utility providers, energy suppliers, charging and buses manufacturers, capital providers and operators. This can come from the initiative of either the public or private sector:

1. Initiative of the private sector

In this model, suppliers assume the role of transforming the bus market from conventional combustion engines vehicles into electric ones. They take the initiative to contact the public administration asking for meetings to share information and coordinate the actions needed in the project's evolution.

In Jakarta, zero-emission bus manufacturers initiated a pre-trial phase in collaboration with the city, with TransJakarta testing and monitoring their vehicles' operation and compatibility with the city's unique traffic characteristics. This allowed the suppliers to display their vehicles' performance, and provide useful information to the public, and opened the path to change regulations, create procedures and obtain permission to make feasible the introduction of e-buses into the local market.

2. Initiatives of the public sector

In this model, the public sector takes the initiative to convene individuals or groups/roundtable meetings with suppliers.

The public sector shares the system's vision, operational and technical requirements and receives technical feedback about the market's technological availability. At the same time, the public actor(s) pursue opportunity windows for strategic business alliances between private actors and possible innovative initiatives.

Guadalajara convened bus manufacturers and energy suppliers in order to better understand the Mexican and Latin American market, the technical features,

complementary services, financial alternatives and business model options for the procurement scheme. This model also represents good practice for transparency and plurality in interactions between the public and private sectors.

TransJakarta, in coordination with the CFF, shared with private operators the project's vision and its technical and operational characteristics. They also carried out a survey to identify operators' perceptions, interests and concerns. This allowed TransJakarta to start exploring private operators' interest and capability to assume the investment required.

Cross-sector and national support

Despite different cities and subnational organisations starting to walk the path of technological transition to ZEBs, still, there is often neither a national environment nor cross-sector support that contributes to the deployment of ZEBs locally. On the contrary, there are many unfavourable conditions (WRI, 2019):

• Although some national governments have issued policies towards clean mobility, there are no clear instruments (road maps or strategic plans) to implement them.

• Leadership and sense of ownership are sometimes missing from the national level. This leads to ineffective coordination between institutions to enact the regulatory transformation required for establishing technical standards and regular procedures to introduce ZEBs.

• Some national governments are still not aware of their role in furthering the deployment of e-vehicles. Although some countries have implemented incentives for using e-vehicles, in others disruption in the 'status quo' of the market is necessary. For example, in many countries around the world (including all of the examples presented in this report), fuel subsidies, the high cost of energy and large upfront costs outweigh any fuel taxes, thus favouring the continued existence of combustion engines over zero-emission alternatives. More flexibility and support for engaging new capital providers and enabling new arrangements between actors is vital to overcome the financial barriers in delivering projects and scale-up initiatives (e.g. the upfront cost of e-buses).

Many local actors understand these challenges and the changes needed at the national level to allow a feasible, sustainable, and scalable ZEB transition (subsidies on ZEBs or energy supply, differentiated taxation, vehicle standardisation). Therefore, it is essential to consider national-level and cross-sector actors and their possible roles as strategic allies or gatekeepers, defining structural aspects in the technical, financial, or legal spheres.

On this subject, Jakarta has taken action analysing the whole roadmap, identifying and approaching key national-level actors from different sectors and opening paths to perform decisive transformations in public policy and regulation for a broader ZEB technological transition.

Traditional transport operators

The relationship between private operators and transit authorities can cause tension when the transformation of public transport requires them to move out of their comfort zone into a new operating environment. Operators can move quickly from being allies to opposers, delaying the implementation of the project. Therefore, ensuring operators also 'buy into' the zero-emission transition is a very important challenge that cities cannot take lightly. Quito provides interesting example.

The Transport Department of Quito and the SDMO realised the importance of a consensus-building process after years of institutional attempts to force bus operators to reach certain expectations, mainly related to improving drivers' labour conditions, workers' rights and levels of service. The CFF aimed to structure a consensus-building process between the public administration and private operators, using an impartial mediator to develop a neutral space for dialogue and problem-solving to help resolve this long running dispute. This experience was enriching because it generated a space for cooperation between parties, and because the public sector recognised that

they also needed to change in order to achieve mutual understanding and collect the expected benefits for Quito, its citizens and transport operators. You can find further information on how to overcome conflict in transport systems in our case study.

Infrastructure suppliers

'Infrastructure supplier' can refer to any actor involved in developing the physical environment to deploy a ZEB project. These actors plan, design, build and maintain the bus depots and charging infrastructure, and sometimes are also responsible for developing the roads the ZEBs will traverse.

In the cases studies that were evaluated, infrastructure suppliers were not informed or included in the development of the project. This is common during the early development phase or piloting for a technology new to a country. However, in order to more rapidly scale up deployment and implementation in the future, it is recommended that these suppliers are engaged in the early stages of project development, in order to generate well-timed feedback on aspects of their responsibilities. The involvement of infrastructure suppliers is important because of their contribution to the definition (and possible execution) of resources and time required for developing essential infrastructure for zero-emission technologies.

Other relevant actors

Project managers should recognise relevant actors willing to cooperate or those with enough power to stop the project.

The University of Guadalajara offered its campus for building ZEB project infrastructure (a depot, a terminal and charging equipment). An opportunity like this can accelerate project delivery, considering that one significant barrier is often a lack of space and land to install infrastructure (WRI, 2019). Therefore, authorities must be open to identifying and pursuing these kinds of alliances. In return, the university benefits from integrating its energy engineering programme and its solar farm into the project. This opens professional doors for its graduates, establishing and maintaining use of the technology in the long term and builds knowledge and capacity for e-mobility implementation for the future (UNEP, 2020).

SDMQ also identified the city council as another relevant stakeholder, not only at the political level, but as a 'gatekeeper' with the power to veto the project due to its role in the final budget approval. To mitigate the risk that this represents, the Secreteriat of Mobility planned to keep council members informed about the project's progress and take on board their feedback to react rapidly, adjust what was necessary, and avoid setbacks.

Citizen participation

Public authorities and governments should not be the only ones leading the transition to clean mobility. Civil society groups have significant influence and potential to accelerate these projects (UNEP, 2020). The participation of civil society groups brings different consumer views into the project and ensures the development of user-centred services.
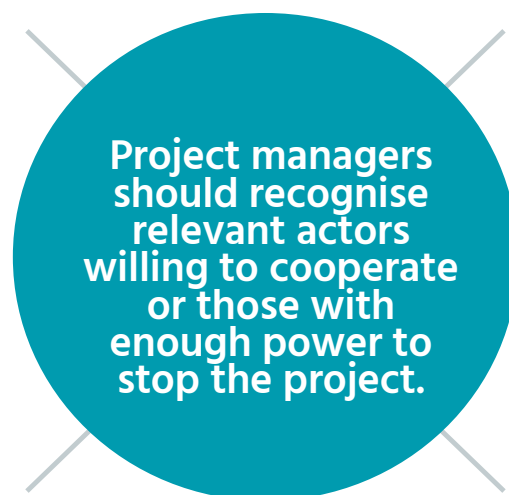
Guadalajara has standardised the involvement of the community, keeping them informed through the Coordination Office of Communication of Jalisco state, which regularly reports on the advancement of all the

strategic projects in the metropolitan area as well as general information.

However, the role of civil society can be even more impactful. UNEP (2020) found in many Latin American and Caribbean countries the existence of groups dedicated to clean mobility promotion, education information exchange, and policy development. Therefore, the authorities' role can and should go further than simply informing citizens, like in Guadalajara, and should actively look for partnerships, listening to and supporting initiatives that come from the public and that have the potential to strengthen and accelerate the transition.

A balance between plurality and efficiency

Although project managers must engage and keep informed actors from both technical and executive levels, public and private sectors and civil society, project managers should balance plurality in involving actors with efficiency in the decision-making process and ensure that all actors are willing to remain engaged.

Project managers should recognise relevant actors willing to cooperate or those with enough power to stop the project.

Complementing or creating coordination mechanisms within the institutional framework

The standardisation of regular processes, the exercise of hierarchies to lead (vertical coordination), and mutual adjustment and commitment to collaborate (horizontal coordination) are fundamental for achieving efficient and effective coordination and communication.

Standardise

City officials leading the ZEB project development must define plans, activities, responsibilities, schedules, or procedures that need to be performed regularly.

A specific implementation plan to guide ZEB adoption is one useful tool missing in some cities or national contexts and lack of one constitutes a barrier towards implementing ZEBs (WRI, 2019).

Jakarta embodies good practices of standardisation as a coordination mechanism. First, as mentioned previously, the city produced a roadmap for a broader technological transition, identifying key national-level actors from different sectors and steps and paths to perform decisive transformations in public policy and regulation. In this project, the provincial government by decree assigned the International Cooperation Office, the Economic Affairs Office, the Transportation Agency and TransJakarta (the public bus operator) to:

1. Coordinate the implementation of zero-emission bus projects in Jakarta.

2. Supervise, evaluate, and provide direction to the activities of the CFF and CTCN-UNEP-UNIDO.

3. Report regularly to the regional secretary of DKI Jakarta.

These bodies perform as a steering committee with decisional power for ZEB deployment in Jakarta and meet once a month.

This example of standardisation has benefited the project's coordination, facilitating participation, interaction, and communication. It has enabled the project's traceability through written reports that the International Cooperation Office, as the committee coordinator, produces with the CFF's support. These reports are systematically shared with a wide range of actors to keep them informed. The decree has also helped manage the support provided by both CFF and CTCN/ITDP, coordinating each work scope to achieve complementarity and avoid task overlaps.

In institutional coordination, to standardise also means to stimulate a shared understanding by homogenising skills and knowledge about any useful topic supporting the process, and strengthening institutional capacity. Several means of transferring knowledge, such as webinars, workshops, courses, reports, and alliances with cities with similar projects, can be used to provide this stimulus.

Using hierarchies to endorse leadership

One of the main institutional barriers to deploying ZEBs is a lack of leadership and institutional authority (WRI, 2019). Project owners should be aware of the importance of leadership and authority in guiding and providing instructions to drive the ZEB project's evolution.

Therefore, according to a strategic plan, project owners and managers of ZEBs should lead the project (vertical coordination), promote shared understanding to achieve cooperation between actors/institutions and stakeholders (horizontal coordination), and build capacity for the future.

For using hierarchies as a mechanism of coordination based on jurisdictional authority, mayors or governors must designate an executive manager with enough knowledge and power to take responsibility for the outcomes, issue instructions and delegate tasks across the sector (usually the director of the head Institution of the mobility sector or the director of the public transport company). While the project manager has to lead the coordination and communication process, the project owner must be open to listening and supporting the project manager.

These leaders and their collaborators should acknowledge that their roles include engaging institutions inside and outside the sector for exerting horizontal coordination, both in the technical and executive level and in the local, provincial or national context.

There are several examples of cities exercising vertical and horizontal coordination.

1. Guadalajara created the Territorial Coordination Office, a multisectoral group that works under the governor's instructions, surveying prioritised projects (among them ZEBs), providing guidance, coordinating actors, solving critical issues, and accelerating decision-making. This group is above all the multisectoral institutions empowered to provide instruction, but also in charge of promoting cooperation.

2. In Jakarta's case, the governor has assigned an advisor to follow the project's progress, representing an extra communication channel between the technical and decision-making levels and between the different entities. They operate as a facilitator of the interaction, coordination, and collaboration between entities to solve issues and prompt the decision-making process.

3. The CFF has used horizontal coordination through what it terms project implementation units (PIU), an additional mechanism of inter-institutional coordination at the technical level. A PIU is formed by a project manager and its technical team, one representative member from the sector institutions' technical level, and other supporting actors such as the CFF or CTCN.

Conversely, in one case, the executive and team manager lacked formal designation, the definition of functions, decisional power, and political support. There

was no interaction between executives in different hierarchical levels, neither between them and the technicians and consultants. This implied the absence of standardisation and vertical coordination, which added to the institutional framework's weak technical capacity. In turn this made it considerably more difficult to achieve effective coordination between actors/institutions and stakeholders, resulting in little progress being made in the project.

Sense of ownership of and belonging to ZEBs projects

Collective intelligence and institutional memory are crucial for smoothing the transition across project phases, guaranteeing continuity in the process and avoiding setbacks.

The basis for a sense of ownership, belonging, and collective responsibility for ZEB projects' outcomes are long-term mutual commitment and integration between interdependent actors, particularly between institutions from the mobility sector. It helps to reduce uncertainty and to make better decisions.

In Jakarta's ZEB project, central institutions from the urban mobility sector, TransJakarta, the Transportation Agency, and the government's advisor, who cooperated and participated actively from the conceptualisation stage, are still supporting the process and assuming outcome responsibilities.

In this project, ownership, leadership, and management along the whole process, from the conceptualisation phase until the ZEBs' actual operation, have been clearly defined. At the same time, other institutions, such as the economic affairs office, the PLN-State Electric Company, and the manufacturers, supporting actors (CFF and CTCN), collaborate to pursue the same goal.

The described scenario facilitates knowledge transfer, technical succession planning, and institutional memory. In this case, the sense of ownership among institutions from the mobility sector provides stability and coherence in the analysis and decisions made across the whole process, preventing delays, setbacks, or structural changes in the project.

Nevertheless, the transition between the conceptualisation, the feasibility analysis, and the implementation phases, in some cases, have implicated changes in the champion institution and team responsible for leading or managing each stage of the project. This scenario should not be a problem as long as the champion institution allows and promotes other sector entities' active support with knowledge and expertise throughout the project formulation and development.

Being aware of 'newer' actors, legal arrangements, and risk allocation

The deployment and operation of ZEBs have entailed the emergence of new actors, legal arrangements, and financial models that differ significantly from the traditional ways of bus contracting. These make it easier to face barriers such as the upfront cost of vehicles and the operational risk of switching to a new technology (Li, Castellanos, & Maassen, 2018).

Stakeholders in ZEB initiatives should be aware of these new actors, their roles and responsibilities. They include energy and charging infrastructure suppliers, battery and bus manufacturers – as both lessors (an entity who leases products or services) or providers. It is essential to

open communication channels from the earliest stages to ensure the viability of small initiatives and the scalability of this kind of project. Santiago de Chile is an excellent example.

The deployment of ZEBs in Santiago has changed the operational business model in the city (Figure 5), splitting the ownership and operation of assets by having fleet suppliers and bus operators while the transport authority manages depots (Zebra, 2020). In this case, the buses' ownership is transferred to new players who have the capital available to assume the upfront cost of e-bus components, and operators lease the bus to the capital providers. Further information of Santiago's business model can be found in the further resources section.
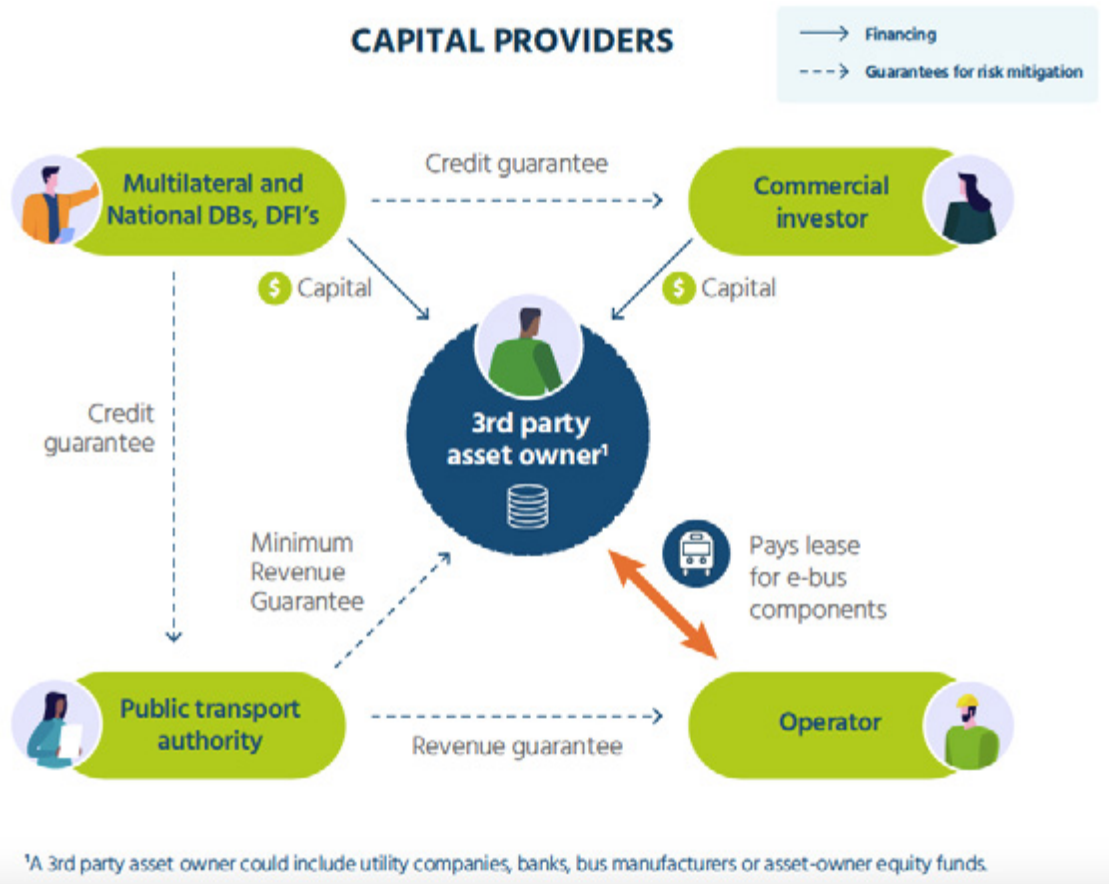

Figure 5. Alternative business models to re-allocate implementation risks and minimise acquire suitable capital investment.

CONCLUSIONS & RECCOMMENDATIONS

Effective coordination and communication practices between actors, institutions and stakeholders are critical to accomplishing sustainable ZEB deployment.

Although coordination and communication may seem like natural processes in any project development, the institutions leading ZEB deployment should not take them for granted. Instead, they must make substantial efforts to include these elements when planning the course of action within complex institutional and sociotechnical contexts.

Recognising and applying coordination mechanisms, such as standardisation, hierarchies (vertical coordination), and mutual adjustment (horizontal coordination) are starting points from which to improve existing structures and processes of coordination. It can go further, formulating more robust strategies to promote collaboration between actors and stakeholders, continuous flows of information, knowledge, and resources, and suitable decisions for reaching ZEB deployment effectively and guaranteeing the business model's scalability.

The steps noted below are an essential roadmap of practices to achieve an effective process of coordination:

1. **Understand the existing governance scheme and coordination structures** and how the project takes place within the organisational context.

2. **Characterise the new landscape of actors**, by identifying their roles, resources, interests, and decisional power, and how to align them towards the same goal.

3. **Develop a strategic plan of action for the project delivery and a roadmap for a broader transition**. These have to be progressive, actionable and accompanied by supportive policies (WRI, 2019). Include strategies to reinforce the institutional framework or for capacity building if needed.

4. **Identify the phases of the project and the actors required to advance them**. Produce an engagement plan of actors defining the strategies to involve them and the right moment to do it. Consider keeping relevant actors informed.

5. **Plan how to engage the 'newer' actors** (battery and bus manufacturers – as lessors or providers – energy and charging infrastructure suppliers), especially to overcome financial barriers, distribute risk allocation and ensure wide-scale deployment. Roundtable meetings have proven to be useful.

6. **Involve national actors and foster cross-sector support** to create an enabling environment for ZEB deployment.

7. **Regularly monitor the landscape of actors** and detect how their interest, resources and power changes. Adjust your plan if needed.

8. **Analyse the decision-making process**, the type of decisions (technical, financial, political, others), and the steps required to reach each decision level, as well as coordination mechanisms, additional strategies, and communication channels that allow for being more effective.

9. **Identify the manager(s) in each phase**. Prefer having the same manager from the beginning. If that is not possible, the manager(s) defined for each step should actively participate in all the stages, even when their roles are different in each one.

10. **Define the project management team**: which actors/institutions work together, which roles and contributions are expected throughout the different phases.

11. **Formalise the team manager leader and members in each phase** (actors profiles/institutions), as well as their roles and responsibilities, pursuing clarity and stronger commitment. This can be done by administrative decree, formal letters or other organisational tools, preferably executed by the project owner (mayor or governor)

12. **Establish regular meetings and procedures** for tracing progress and building institutional memory of the process. After each session, reports and e-mails help follow up on activities, compromises, decision-making process and institutional memory.

Although coordination and communication may seem like natural processes in any project development, they should not be taken for granted.
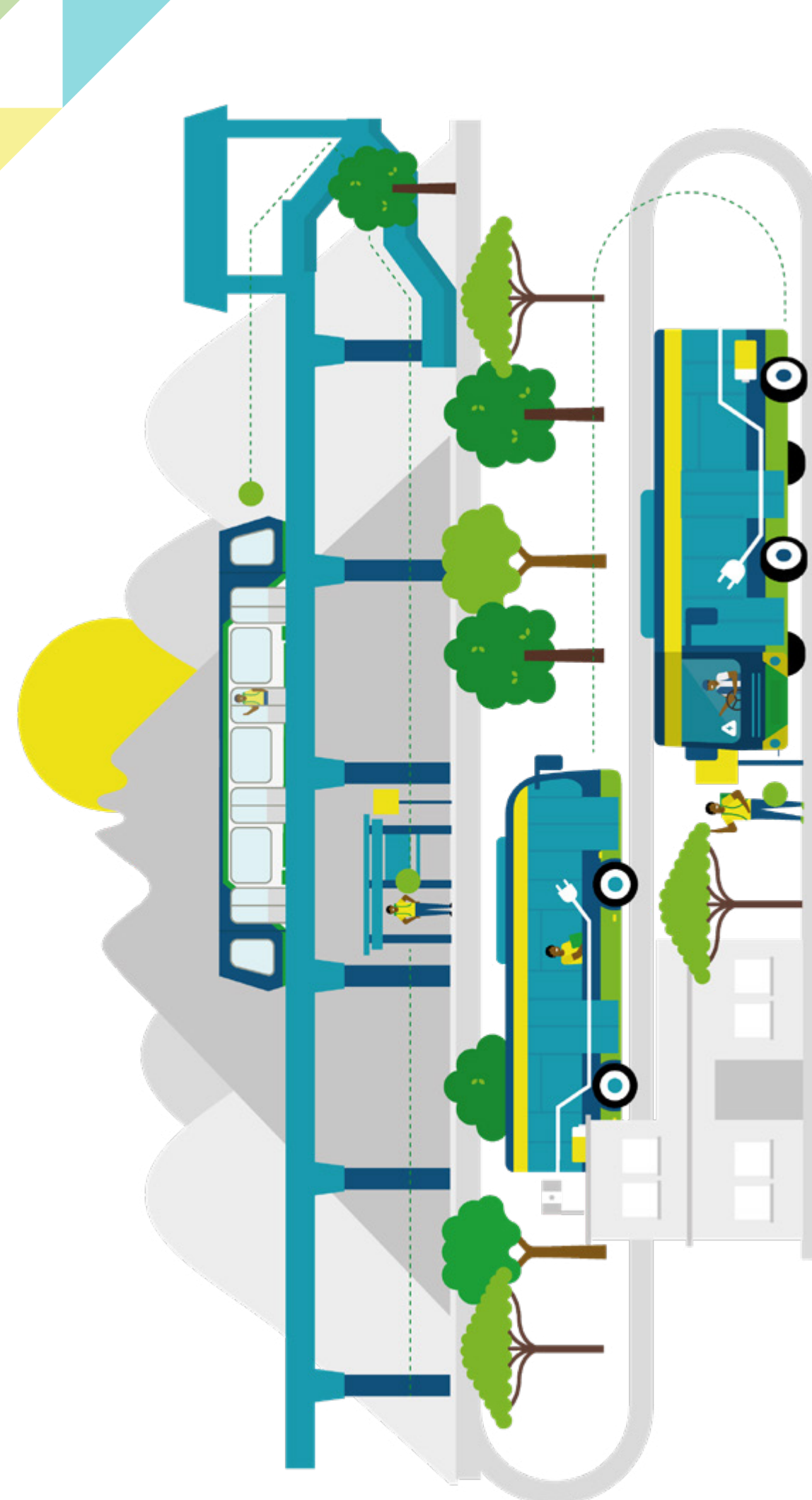
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