

Executive Summary

Challenges and Opportunities

Urbanization in developing countries may be the single greatest change in our century. It is projected that developing countries will have tripled their entire built-up urban area between 2000 and 2030—from 200,000 square kilometres to 600,000 square kilometres.¹ These 400,000 square kilometres of new urban built up area, which are being constructed within just 30 years, equals the entire world's total built up urban area as of 2000.² One could say we are building a 'whole new world' at about 10 times the speed, in countries with severe resource constraints (natural, fiscal, administrative, and technical). We are doing so in an increasingly globalized context with many new, constantly fluctuating, interlinked, and uncontrollable variables.

So what is driving the massive rates of urbanization described above? Historically, and across most regions, urbanization has propelled the growth of national economies. On average about 75 percent of global economic production takes place in cities, and in developing countries this share is now rapidly in-

creasing.³ In many developing countries, urban shares of GDP already surpass 60 percent.⁴ In most regions of the world, the opportunities provided by urbanization, have enabled large segments of the population to lift themselves out of poverty.

However, urbanization at this rate and scale is certain to be accompanied by unprecedented consumption and loss of natural resources. Calculations already show that if developing countries urbanize and consume resources as developed countries have, an ecological resource base as large as 4 planet earths would be needed to support their growth.⁵ But, of course, we have only one Earth. As the underlying resource base required to sustain such a transition does not exist, cities in developing countries, as well as ones in developed countries, must find more efficient ways to meet the needs of their populations.

It is clear that if we are to absorb and sustain this powerful wave of urbanization, while continuing to manage the existing built stock, we will need a paradigm shift. Fundamental questions to be addressed are: How can cities continue to effectively harness the opportuni-

ties for economic growth and poverty reduction offered by urbanization, while also mitigating its negative impacts? How can cities do so given the speed and the scale at which this urbanization is progressing, and given their own capacity constraints? How can ecological and economic considerations be dovetailed, so that they result in cumulative and lasting advantages for cities? How do we go from ‘Eco vs. Eco’ to ‘Eco² Cities’?

Innovative cities have demonstrated that with the appropriate strategic approach they can greatly enhance their resource efficiency by realizing the same value from a much smaller and renewable resource base—while simultaneously decreasing harmful pollution and unnecessary waste. By doing so, they have improved the quality of life of their citizens, enhanced their economic competitiveness and resilience, strengthened their fiscal capacity, and created an enduring ‘culture’ of sustainability. At the same time, many of their interventions have provided significant benefits to the poor. Urban sustainability of this kind is a powerful and enduring investment that will pay compounding dividends. In a fast-paced and uncertain global economy, such cities are most likely to survive shocks, attract businesses, manage costs, and prosper.

What is most encouraging about the efforts made by these innovative cities is that many of the solutions are affordable—even when budgets are limited—and they generate returns, including direct and indirect benefits for the poor. At the same time, much of the success can be achieved using existing and well proven methods and technologies, and by focusing on home-grown localized solutions.

The challenge that lies ahead is to take full advantage of the many opportunities created by the rapid rates of change and by successful innovations. Inappropriate institutional structures and mindsets are commonly cited as the single greatest challenge when cities try to implement such opportunities. Best practices do exist for long term planning and regional

growth management, and an emergence of new tools for systems analysis and mapping offer potential for more integrated, practical, and rigorous analysis and planning. Methods for collaborative design and decision-making among key stakeholders have also proven effective. Realizing that successful cities are often fundamental to successful nations, higher levels of government are increasingly key partners in helping cities take initiative.

There is also growing concern and commitment at the international level for supporting cities and for financing longer-term investments within cities. New funding opportunities have emerged for cities in developing countries that are willing to implement actions to achieve sustainable urban development—particularly measures promoting energy and resource efficiency that lead to GHG emission reductions. New accounting methods for estimating the full costs and benefits of various policy, planning, and investment options are also being used (e.g., Life Cycle Costing). At the same time, accounting for all capital assets (manufactured, natural, social, and human) and the services they provide, offers a more holistic and complete incentive framework to cities. Channeling these opportunities toward the massive scale and accelerating pace of urban development creates the potential for tremendous positive impact.

It is with the purpose of enabling cities in developing countries to benefit from the promise of a more rewarding and sustainable growth trajectory while the window of opportunity is still open to them, that the Eco² Cities Program has been developed.

The Analytical and Operation Framework

The Eco² analytical and operational framework is rooted in four key principles. Cities will face challenges when trying to adopt a new approach. These challenges have been carefully

anticipated in the framework, and together with the valuable ground level lessons from best practice cities they help to frame our strategic response: the key principles that will define the Eco² Cities Program. Each of these has been elevated to status of principle, because it is widely applicable, critical to success, and frequently ignored or under-appreciated.

These four principles are 1) ‘A City Based Approach,’ which enables local governments to lead a development process that takes into account their specific circumstances, including their local ecology; 2) ‘An Expanded Platform for Collaborative Design and Decision Making’ that accomplishes sustained synergy by coordinating and aligning the actions of key stakeholders; 3) ‘A One System Approach’ that enables cities to realize the benefits of integration by planning, designing, and managing the whole urban system; and 4) ‘An Investment Framework that Values Sustainability and Resiliency’ by incorporating and accounting for life cycle analysis, the value of all capital assets (manufactured, natural, human, and social), and a broader scope of risk assessments in decision making.

The four principles are interrelated and mutually supportive. For example, without a strong city-based approach, it is very difficult to fully engage key stakeholders through an expanded platform for collaborative design and decision-making. And without this expanded platform, it is difficult to explore creative new approaches to the design and management of integrated systems, and to coordinate policies to implement through the one system approach. Prioritization, sequencing, and effectiveness of investments in sustainability and resiliency will be greatly enhanced by appreciating the city as ‘one system’ and expanding the platform of collaboration.

Through these four key principles are derived a set of core elements that further define the Eco² Framework. Cities are encouraged to operationalize the core elements into a series of concrete action items or ‘stepping stones,’

that take into account local conditions, and follow a logical sequence. Together, these stepping stones enable a city to develop its own unique Eco² action plan, called an Eco² Pathway. The Eco² Cities program also introduces cities to methods and tools that will lead to more effective decision-making through powerful diagnostics and scenario planning. These methods and tools can also be used to operationalize the core elements and to implement the stepping stones.

In this context, an Eco² City is a city which formally accepts the four key principles, applies the Analytical and Operational Framework to its particular context, and by doing so develops and begins to implement its own Eco² Pathway.

PRINCIPLE 1: A City-Based Approach

A city-based approach is the first principle, and it carries two complementary messages. Firstly, it recognizes that cities are now at the front lines of managing change and leading an integrated approach. Not only do cities now embody the engines of economy and the homes of citizens, they also are responsible for a majority of resource and energy consumption, and harmful emissions. Only at the city level is it possible to integrate the many layers of site specific information, and to work closely and rapidly with the many stakeholders whose input can impact the effectiveness of an Eco² Pathway, and who have a stake in its successful implementation. In addition, fiscal and administrative decentralisation has brought important decision making and management responsibility to local governments. Cities can exercise proactive leadership, and thereby trigger a process of change.

Secondly, a city based approach serves to emphasize the importance of incorporating within any development program the unique aspects of place—especially ecological systems. In this sense, a city-based approach responds to opportunities and constraints of local eco-

gies. How might development fit into the topography of the area so that water is provided by gravity, and so that drainage is provided by natural systems (reducing the need for expensive infrastructure investments and related operation costs)? How might a city protect its water recharge areas and wetlands, so that water capacity and quality are sustained? How do we distribute populations and design cities so that local or regional renewable energy—windy sites, forests, solar access—is sufficient to meet basic needs? These types of questions may ultimately provide urban professionals with their most exciting design challenge: how to fit cities into the landscape in ways that respect and complement the natural capital, and ensure ecological services are available for present and future generations.

A city-based approach is thus very place specific, with a focus on enabling local leadership, local ecologies, and the broader local context. In fact, one of the first stepping stones of a city will be to review and adapt the Eco² framework to the local context.

PRINCIPLE 2: An Expanded Platform for Collaborative Design and Decision-making

Cities are increasingly experiencing a splintering of infrastructure responsibilities, the overlapping and intersection of jurisdictions, and an increase in private sector ownership of key assets. If cities are to lead the process of urban development, especially in the context of rapid urbanization, it is important to get ahead of this curve.

A city can lead a collaborative process on at least three tiers of an expanded platform. At the first tier, projects may be completely within the realm of control of the city administration itself, and will entail a city getting its own house in order—for example, by supporting an energy efficiency upgrade for all municipally-owned buildings, or a ride-share program for employees, or energy and transport peak load manage-

ment by adjusting working hours. At the second tier, projects will involve the city in its capacity as a provider of services and include its formal planning, regulatory, and decision making powers—this can include water provision, land use planning, or transit development. At this level, greater collaboration is warranted with other stakeholders (including the private sector and consumers) who can influence, and who might be impacted by, the outcomes. The third tier of the expanded platform will entail collaboration at the scale of the entire urban area or region—this can pertain to issues like the development of new land or metropolitan management—and may necessarily involve senior governments, key private sector partners, and civil society.

A core element of the triple tier platform for collaboration is a shared long-term planning framework for aligning and strengthening the policies of both the city administration and key stakeholders, and for guiding future work on Eco² projects. In this way, triple tier collaboration can get everyone rowing in the same direction.

PRINCIPLE 3: A One-System Approach

The One System Approach is about taking full advantage of all opportunities for integration by learning to view the city and the urban environment as a complete system. Once we see the city and the urban environment as a system, it is easier to design the elements to work well together. This can mean enhancing the efficiency of resource ‘flows’ in an urban area through integrated infrastructure system design and management. For example, the looping and cascading of energy or water through a hierarchy of uses can satisfy many demands with the same unit of supply.

The One System Approach also includes integrating urban ‘form’ with urban ‘flows’ by coordinating spatial development (land use, urban design, and density) with the planning of infrastructure systems. For instance, new development can be directed to those loca-

tions with a surplus of water, energy, and transit. Urban form and spatial development also establish the location, concentration, distribution, and nature of demand nodes that impact the design of infrastructure system networks. By doing so, urban form establishes the physical and economic constraints and parameters for infrastructure system design, capacity thresholds, technology choices, and the economic viability of different options. This has tremendous implications for resource use efficiency.

It is a challenge, and a huge opportunity, for any city to integrate the planning of flows and forms, and operationalize initiatives. The One System Approach also focuses on how to implement projects using a more integrated implementation approach. This means sequencing investments so that the city sets the correct foundation by addressing the long-lasting, cross cutting issues first. This also means creating a policy environment that enables an integrated approach, co-ordinating a full range of policy tools, collaborating with stakeholders to align key policies, and targeting new policies to reflect the different circumstances between urbanization in new areas and improving existing urban areas.

Integration can apply to the elements within a sector, or across sectors. It can apply to implementation policies, collaboration of stakeholders and their plans, sequencing of financing mechanisms, and all of these in combination! In every case, the integration of elements tends to reveal opportunities for greater efficiency, synergy, and increased utility from a given investment, with corresponding improvements in ecological and economic performance.

By applying the One System Approach, cities, and their surrounding natural and rural areas, can strive to coalesce into a functional system that works well as a new whole.

PRINCIPLE 4: An Investment Framework that Values Sustainability and Resiliency

The simple concept of investing in sustainability and resiliency for cities has become extremely difficult to put into action. Policies, plans, and projects tend to be assessed on their short term financial returns, or on an economic valuation based upon narrowly structured cost benefit analysis, from the perspective of a single stakeholder or project objective. Investments are valued in monetary terms, and what cannot be monetarised is either ignored, or addressed on the side as ‘externalities.’ Decisions are dominated by immediate capital costs, despite the fact that often over 90 percent of life-cycle costs for typical infrastructure are expended during operational maintenance and rehabilitation.

Few cities worldwide have a real knowledge of the impact of new development on their long-term fiscal condition. Lifecycle costs are often back-loaded, which means that future generations will have a massive infrastructure deficit, as they face costs for repair and replacement of infrastructure without any prior capitalisation.

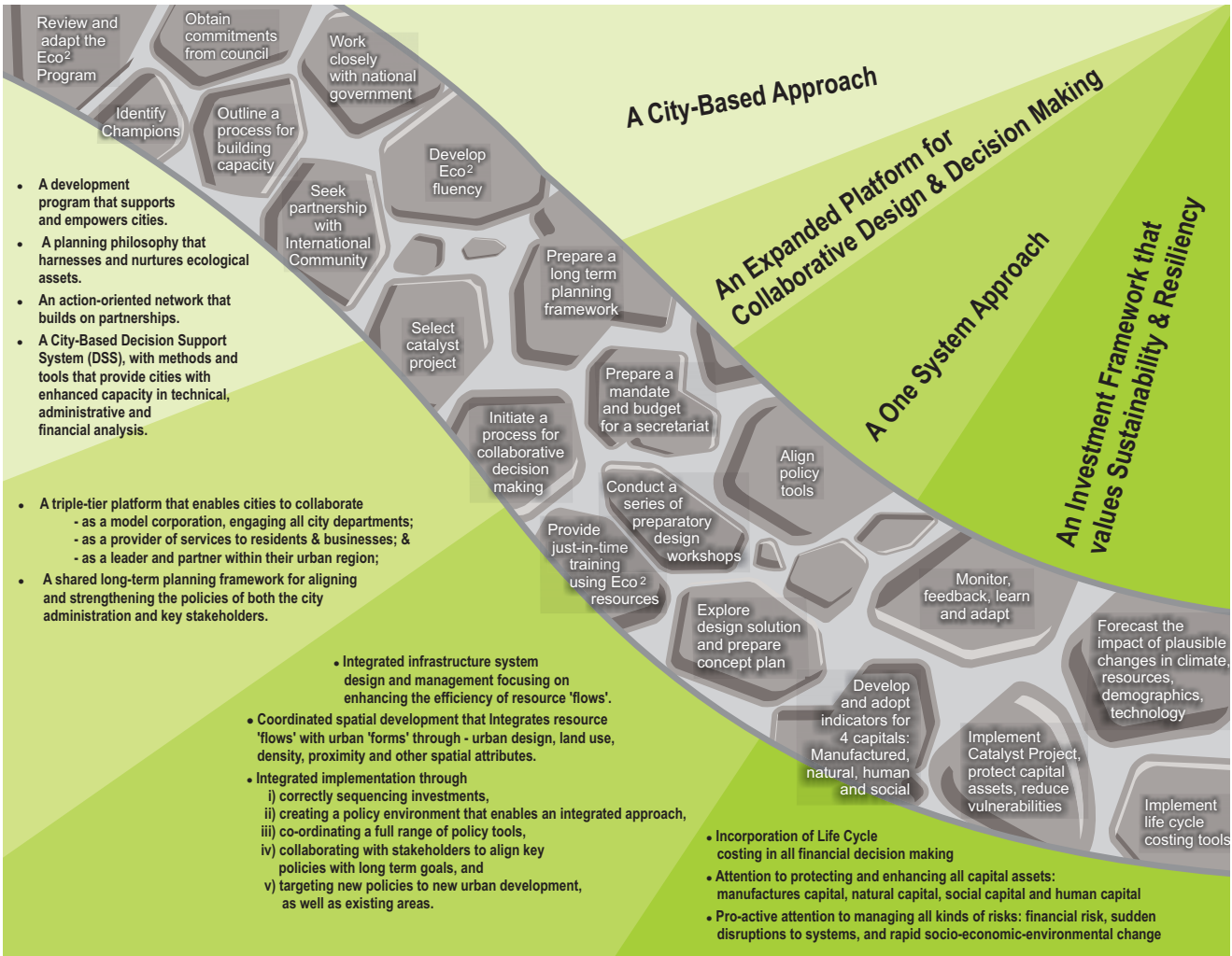
At the same time, ecological assets, the services they provide, and the economic and social consequences of their depletion and destruction are not accounted for in most government budgets. Since these assets are not measured, they are treated as zero value—and their services go unaccounted for. Principle 4 requires that cities adopt a new framework for making policy and investment decisions.

The framework has multiple elements. A new range of indicators and benchmarks must be adopted for assessing and rewarding performance of all stakeholders. The family of indicators must address the needs of different categories of decision-makers (e.g., strategy evaluation vs. operational). Longer time horizons are needed, and life-cycle cost-benefit analysis must be applied to understand full implications

of policies and investment options. All four categories of capital assets (manufactured, natural, human, and social) and the services they provide must be appropriately valued or priced—and monitored through indicators. The combination of indicators should be viewed as a whole so that the qualitative dimensions of city life (cultural, historic, and aesthetic) cannot be ignored when assessing costs and benefits.

At the same time, investing in sustainability and resiliency will entail broadening our scope of risk assessment and management to include managing the many indirect, difficult to measure risks that nonetheless threaten the viability of an investment or even the city as a whole.

These principles described above underlie the Eco² approach. Using the Analytical and Operational Framework, a city can apply the principles through a set of core elements, and use these elements to create a phased, incremental Eco² Pathway. The Eco² Pathway of each city will be designed in consideration of its own needs, priorities, and capacities. While the Analytical and Operational Framework enables a city to chart out its Eco² Pathway, the City-Based Decision Support System (DSS) introduces the methods and tools that provide cities with the capacity to undertake more integrated development—and better navigate this pathway.



A City-Based Decision Support System

The City-Based Decision Support System introduced in Part Two of this book, is part of the Eco² Program, and enables cities to better develop their capacity to operationalize some of the core elements of the Eco² Program. It comprises a few core methods that together provide cities with a greater ability to implement the core elements of the four principles listed above.

The fundamental purpose of these methods is to simplify the process of analysis, assessment, and decision-making. They provide practical ways for cities to take leadership, collaborate, and analyze and assess various ideas for Eco² projects. All methods are proven approaches to getting the work done. They are expected to remain relevant for many years.

The chosen methods support the typical planning process at different times and in different ways. Some methods can be used repeatedly. For example, meta-diagrams that summarize resource flows can be used firstly as a way to baseline how a location is currently performing, and then later to help with diagnosing, target setting, scenario development, and also cost assessment.

As an illustration, ‘Methods for Analyzing Flows and Forms’ reveal the important relationships between spatial attributes of cities (forms) and their physical resource consumption and emissions (flows). The combination of these analytical methods helps cities to develop a ‘transdisciplinary’ platform to analyze current situations as well as forecast scenarios.

One of the first Stepping Stones on the Eco² Pathway is to plan a process for capacity building. Reviewing the DSS is a good place to begin. It sets out the scope of skills and knowledge that are an essential part of Eco². While this book simply introduces the core methods, the capacity building plans of a city can include obtaining more information, acquiring specific tools, obtaining outside technical support, and applying the methods to a catalyst project.

A Field Reference Guide

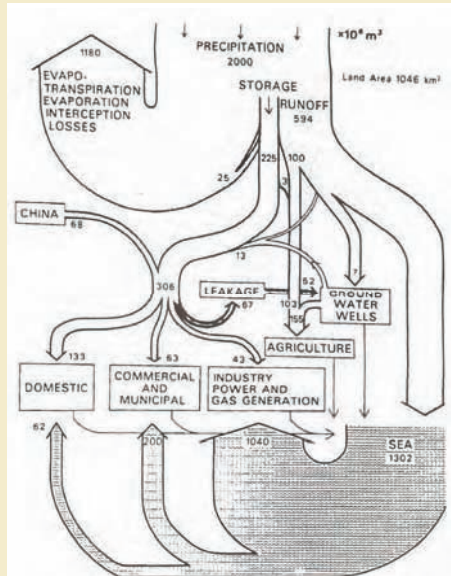
The Eco² Field Reference Guide provided as Part Three of this book, is a technical resource specially tailored to building ground level and technical knowledge. It contains background literature designed to support cities in developing more in-depth insight and fluency with the issues at two levels. It provides a city-by-city and sector-by-sector lens on urban infrastructure. It begins by exploring a series of case studies from best practice cities around the world. Each city offers the program a very different example of how various elements of the Eco² approach can be applied. Some of these cities have already agreed to be a partner in the Eco² Cities Program, and to assist cities in developing countries with their specific challenges.

The field reference guide also provides a series of Sector Notes, each of which explores sector specific issues as they pertain to urban development. As cities develop their Eco² Pathways, it helps to survey issues through the lens of each urban infrastructure sector. Ideally, this leads to a kaleidoscopic view of the city, where each perspective can be turned to the next, as we interrelate *energy, water, transport, and solid waste* with each other and with the built form of the city.

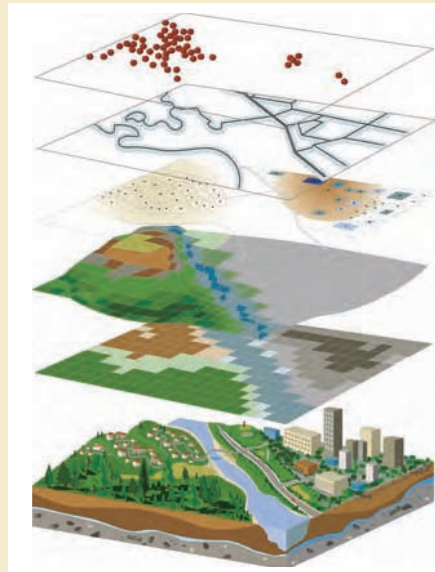
It becomes clear as we study these sectors that many of their operational and jurisdictional lines impede innovation and creativity in achieving better outcomes. What is also clear is that investments made in one sector can result in savings in another sector (for example, investments in water efficiency usually result in large energy cost savings), and that pooling scarce resources to invest in multifunctional and multipurpose common elements can benefit everyone (for instance, through single purpose underground infrastructure corridors).

The Sector Notes shed light on critical sector-specific issues that have an impact on city sustainability, but are not under direct

Combining Flows and Forms to create a Transdisciplinary Platform



This flow diagram summarizes all the water flow through Hong Kong, and is one of the first illustrations of an urban metabolism.³



Customers

Streets

Parcels

Elevation

Land Use

Real World

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FLOWS: Materials Flow Analysis and Sankey Diagrams

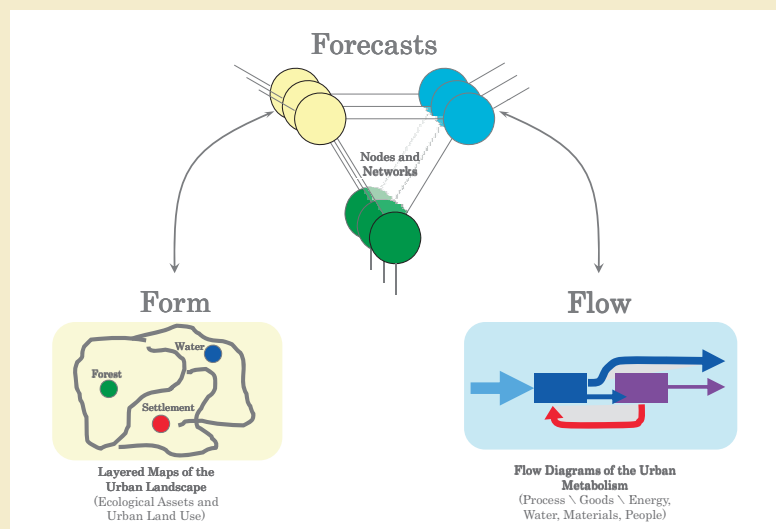
This is a method for calculating and illustrating the flow of resources through any size of urban area. Inputs and outputs are determined as a resource is extracted from nature, processed by infrastructure, consumed by home and businesses, treated by infrastructure, and finally returned for re-use, or delivered back to nature as waste. Colourful and simple diagrams are used to educate everyone on the resource flows, and how effectively they are used, all on a single page.

FORMS: Layering of Information on Maps

Maps are especially useful in collaboration, since they speak so well to so many: a picture is worth a thousand words. The layers of information make it possible to immediately interrelate the different features and qualities of the landscape, and also to easily quantify important spatial relationships. Layering is an old technique that has become more powerful as a result of computer technology and satellite imagery.

INTEGRATING FORMS AND FLOWS: A Transdisciplinary Platform

Because diagrams and maps can be easily understood and shared by a broad range of professionals and decision-makers, they help to bring stakeholders and experts together, facilitating a common understanding of integrated approaches to design and decision-making. Both forms and flows should be analyzed and understood for current and future scenarios. The methods in combination form a 'transdisciplinary' platform for understanding both the spatial dynamics of a city and its physical resource flows—elements that are interdependent but difficult to integrate because they involve such different skill sets and stakeholders.



A platform is needed to integrate the design concepts for urban form with the corresponding resource flows.

Source: Redrawn and Adapted from Baccini P, & Oswald F 1998: *Netzstadt, Transdisziplinäre Methoden zum Umbau urbaner Systeme*. Zurich, Switzerland: vdf Hochschulverlag Zurich

control of city authorities. These issues may need to be addressed on a sector by sector basis—in collaboration with key stakeholders, particularly higher levels of government. Identifying critical pressure points beyond the direct control of city authorities is also important to devising an expanded platform for collaboration.

The guide also provides a strategy for managing the spatial structure of cities, and important lessons on how spatial planning and land use regulations can powerfully impact mobility and affordability.

Moving Forward Together

As forward-looking cities in developing countries develop and implement their own Eco² pathways, support may be available from best practice cities worldwide, the international community, including development agencies, and academia. Cities are encouraged to tap into the unique resources of each of these partners. In this context, the World Bank Group⁶ together with other development partners is in a position to provide Technical Assistance and Capacity Building and Financial Support to cities that demonstrate strong political will and commitment to implement the Eco² program.