



IMPLEMENTATION PROCESS

INTEGRATED GUIDELINES FOR SUSTAINABLE NEIGHBOURHOOD DESIGN

Urban Morphology & Complex Systems Institute

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INTRODUCTION

Sustainable development comprises many dimensions. It requires an integrated approach with an understanding of complex and often conflicting relationships. Cities can use different instruments to incorporate the environment into urban design: policy, processes, planning and management mechanisms. However, only about 20% of the world's 150 largest cities have the basic tools needed for sustainable and low-carbon planning¹. Moreover, cities have to tackle operational challenges encompassing aligning legal frameworks and financing. Moving forward requires the will, leadership and commitment to progress.

Key Barriers currently impede delivery of liveable, inclusive and resource-efficient neighbourhoods. Central and local governments, policymakers and specialists, developers, financiers and builders, must overcome many constraints, including

- The lack of support from national government.
- The competencies of cities to plan and regulate all dimensions of sustainable integrated projects (for example land use, housing and transport policies). In emerging economies, as a result of weak land development control, informal neighbourhoods have proliferated. For existing neighbourhoods, lack of land readjustment schemes might be a barrier to infill.
- The work in silos of professional disciplines: traffic engineers, chartered surveyors, designers, landscape architects, urban planners, economists.
- The lack of continuous public sector involvement: promoting high quality design isn't pursued consistently through planning, site assembly, procurement and investment. In emerging economies, rather than improving efficiency, services are often being privatized.
- The short-term and supply-driven characteristics of the development industry – especially in the housing sector, with focus on

quantities rather than on the creation of places, of ways of life and of communities.

- Real estate and financial sector preference for single-use projects and buildings.
- Little scaling up of design and technology innovations, such as efficient construction, and 21st-century planning and architecture.
- Conceptions of planning and control, applying quantitative standards (zoning, density, car parking, etc.) rather than providing qualitative advice and judgment.
- The absence of reliable guidelines and protocols for achieving high-quality design.

Integrated planning isn't a once for all process: it is a dynamic maturation. Planning should change over time, transformed by intensification, diversification of economic activities, and consolidation of land markets. This dynamic process requires three enabling conditions:

- **An initial urban planning** that gives room to evolution.
- **A legal framework** for implementation including provisions for adaptation.
- **A framework** to finance the plan, and feed and support the process

The involvement of cities as horizontal developers is pivotal in the success of projects². The city, its planning agency and its officials should play a key role in integrating the process. In European neighbourhoods such as Bo01 in Malmö, Hammarby Sjöstad in Stockholm, Kronsberg in Hannover, and Vauban in Freiburg, cities, as landowners, had legal responsibility and jurisdiction for project production. They created special development committees, usually with their planning agencies, which received planning leadership over projects. All were interdisciplinary, with representatives from internal departments, external consultants, citizen groups and utilities. Using their statutory authority, the cities charged the utilities – energy, water, sewage, and waste – to draw up an

¹ World Bank 2013.

² Fraker 2013.

integrated strategy to meet the project objectives. Cities produced detailed design and engineering plans for public spaces: streets, parks, public transportation systems and all infrastructure – energy, water, stormwater and waste. The four cities divided the developments into small plots. These plots were then sold to several teams of architect developers. By maintaining uninterrupted monitoring of the projects, the cities included objectives, planning and inspection procedures in the land sales agreements.

This chapter explains the continuum of actions needed for delivering projects from policies, to planning and delivery. Those involved in the different

stages can find the advice they require. However, each player should understand the bigger picture. Those who develop the design policy and control should recognize where in the process they are most influential and where to focus resources. The chapter comprises five sections.

- ADOPT ADEQUATE POLICY INSTRUMENTS
- DEFINE INDICATORS TO EVALUATE PROJECTS
- INTEGRATE PLANNING AND DESIGN INSTRUMENTS
- DEVELOP PROCESS INSTRUMENTS
- IMPLEMENT MANAGEMENT INSTRUMENTS

ADOPT ADEQUATE POLICY INSTRUMENTS

Fast-growing cities largely have to build up their infrastructure stocks. They have thus opportunities for leapfrogging. For rapidly growing cities, the most efficient policy options encompass shaping their urbanization and infrastructure development towards lower carbon pathways. Integrated land use planning with public transportation, and urban containment, are effective strategies. ‘Key mitigation strategies include co-locating high residential with high employment density, achieving high land use mixes, increasing accessibility and investing in public transit and other supportive demand management measures. Bundling these strategies can reduce emissions in the short term and generate even higher emissions savings in the long term.’³

Defined policies offer more certainty for developers and their design teams. They provide a basis for a shared, collaborative process. Cities that make permanent improvements do so because they have political leadership, appropriate policies, and a sustained determination to raising standards. Their authorities look to the long term. They demonstrate a commitment to excellence in urban design. They implement environmentally friendly systems with a contextual approach enhancing the unique identity of the place. Those who assess planning policies must have the confidence and skills to evaluate development proposals and demand high quality design.

Delivering sustainable neighbourhoods requires bundling plans and investments tailored to the political, economic and social contexts of each city. These instruments can be grouped into three main areas.

1. Planning urban growth

- Strengthening the role of spatial planning and land-use regulation at city level
- Providing the framework for efficient planning of land use, transport and urban infrastructure.

2. Pricing congestion, sprawl and pollution

- Reforming subsidies and pricing negative externalities associated with poorly managed urban expansion
- Reducing and reversing perverse incentives such as inappropriate pricing of land that encourages car-dependent fringe development

³ IPCC 2014.

3. Financing infrastructure

- Unlocking funding for innovative, connected urban infrastructure
- Investing capital in infrastructure that raises economic efficiency and quality of life while mitigating carbon emissions.

The following section presents examples of policies for each of the three main areas above.

Green belts for planning urban growth and containing sprawl

The use of 'green belts' has helped to contain urban expansion in England and encouraged building on brownfield sites. Green belts restrict development on a band of countryside surrounding a town or city. Planning policy statements have also prioritized the redevelopment of brownfield sites. In England, national data show that 77% of new homes built in 2008 were constructed on brownfield land, up from 57% in 1996. The data suggest policies to limit urban expansion are succeeding⁴.

Economic instruments for sustainable road transport

There are three basic types of economic instruments in sustainable urban transport policy.

- Charges and taxes aim at increasing the price of transportation per unit or value of transport use. They should be levied as a means to reduce transport demand in general, discourage the use of certain modes of transport, or certain transport technologies.
- Subsidies aim at decreasing the cost of certain transport modes, such as public transport or multimodal transport. Here, financial incentives shall encourage switching towards the favoured transport patterns.

- Auctions and bidding schemes are used to put a price on transport in order to quantitatively restrict access to transport. For instance, in Singapore, the number of cars is administratively restricted. Auctioning can assign licenses or certificates to those with the highest willingness to pay.

Policies to attract private finance for urban green infrastructure

There are several existing financial instruments that cities have applied in order to attract private finance for urban green infrastructure.

- Private sector involvement in urban green infrastructure can take the form of public-private partnerships (PPPs), in which the long-term risk is transferred to the private sector.
- Through an alternative instrument, tax increment financing, future tax revenues are used to attract private finance.
- Real estate developers may also pay for the infrastructure that is needed to connect their new development to existing infrastructure in the form of development charges (impact fees) and value capture (taxes that capture the value increases of real estate due to new infrastructure development nearby).
- Finally, loans, bonds and carbon finance are instruments used to attract private finance in well-functioning capital markets.

Each policy must offer first, a design goal; and second, a description on how to achieve it.

⁴ Schulze Baing 2010.

An example of clear policy. Design objectives: permeability

‘Development should incorporate the retention or provision of important routes and linkages. These contribute to an area permeability. Development which results in the unacceptable loss of links won’t be permitted.

Explanation of criteria for solution: incorporate or retain and avoid loss of important routes and linkages⁵.’

Local authorities must ensure policy effectiveness in five ways⁶.

- Integrate green design concerns into all aspects of the local development policy framework.
- Treat sustainability as a cross-cutting issue that permeates all other policy areas.
- Base guidelines on an understanding of the local context and the design process.
- Use ecological design policy at various scales, ranging from sites to larger areas.
- Ensure that the design comprises social considerations, the effective use of resources, along with visual and functional aspects.

Plans should be developed with a holistic view. They should examine how urban design can help support environment, crime and safety, well-being and education. Interdisciplinary teams or partnerships should produce integrated guidelines avoiding a narrow, single-issue approach where different authorities, agencies and departments would pursue

uncoordinated programmes and initiatives. Preparing a development plan should involve many service providers: internally such as water supply, sewerage; and externally such as schools, health and transport. These providers should belong to an extended planning team, giving them an awareness of their role in neighbourhood improvement. This will make them consider the proposal implications for their future investment programme. Policies can thus evolve to be more coherent, transparent and accessible to community involvement. With such an integrated approach, planning will become part of the decision-making process. Clear leadership guarantees teams work co-operatively. Local initiatives should also support implementation at regional levels.

Plans require adequate resources and skills. Ecological principles complement the detailed design knowledge and offer many individuals the confidence to engage in discussions. Training should cover the basics of sustainable design and ensure that the team members understand their role and how they can influence good planning. A design champion can provide significant assistance at any level. Public and commercial organizations increasingly appoint them to improve the design quality. The champion may be a city officer, a local person or an expert who can bring an outside perspective. His energy and commitment can be of great help in raising awareness of sustainable design and in gathering and maintaining support for longer-term projects.

DEFINE INDICATORS TO EVALUATE PROJECTS

Clear objectives allow setting policies, measuring the effectiveness of different strategies, and monitor outcomes after implementation. Evaluation should comprise the degree of objective achievement and the broader effect (for example, projected carbon emissions per square metre, total carbon footprint, environmental impacts and use of scarce resources). A scheme aiming to reduce CO₂ emissions by 50% should

demonstrate this at the design phase by applying carbon dioxide emission factors to the estimated energy consumption. Calculation of transport carbon impacts should consider the number and length of journeys and the expected modal split. Resources and emissions modelling can inform the early project stages.

⁵ Bristol City Council, Bristol Local Plan Proposed Alterations 2003. Policy B3. Page 116. B5. Page 118.

⁶ English Partnerships and Housing Corporation 2007.

Neighbourhoods must address delivering by design significant contributions to social and environmental sustainability, and economic viability. Below are examples of five integrated indexes. A Singapore architect's office, WOHA, developed them to assess the people friendly and ecological performance of their proposals⁷. These aren't exhaustive. They constitute a

good starting point for guiding planning efforts with indicators, benchmarks, and objectives that provide multiple benefits. Calculating them at the design stage is easy – without the need for expensive and time-consuming data gathering. They allow choosing between different design options to reach the target. The following section draws on WOHA 2016.

GREEN PLOT RATIO



*Left: Garden on the 4th floor seen from the healthcare centre in Kampung Admiralty, Singapore. WOHA Architects.
Right: Communal farm on the 7th floor in Kampung Admiralty, Singapore. WOHA Architects.
Photos: ©Françoise Labbé.*

Green Plot Ratio calculates the quantity of landscaped surfaces compared to a development's site area. This measurement includes all new and preserved vegetation, vertical and horizontal landscaping, water features, lawn and trees, raised planters, and urban farms. A high Green Plot Ratio encourages biodiversity, reduces the urban heat island effect, provides shade and cooling, improves air quality, softens the harshness of the cityscape, restores wildlife habitats, and reconnects people with nature⁸. Singapore policies for

urban development have made compulsory Green Plot Ratios higher than 100%; meaning greening more than the original land area. Designing the site as a 3-dimensional porous verdant matrix with plantations on façades, on roofs, and sky gardens on intermediate levels ensures a more than 100% greening of the parcel. High Green Plot Ratios increase neighbourhoods' bioclimatic, green and social inclusiveness performance by providing a variety of community spaces for residents.

⁷ WOHA 2016

⁸ Examples of Green Plot Ratios in WOHA projects range from 1100 % in Oasia Downtown (2011-2016) to 440 % in Vertical Stacked City (2014-) to 180 % in The Met

(2003-2010) to 140 % in the School of the Arts (2005-2010) to 110 % in Kampung Admiralty (2013-) and Skyville@Dawson (2007-2015).

CASE STUDY: CALCULATION METHOD OF A GREEN SPACE FACTOR IN BO01, MALMÖ, SWEDEN



Water and green spaces are major components of Malmö Bo01 eco-district in Sweden. Photo: ©Françoise Labbé.

The green space factor is a planning instrument that guarantees a certain volume of greenery in residential courtyards. Areas of water, depth of soil and the opportunity for rainwater to penetrate the ground are encouraged. The walls and roofs of buildings are also included in the calculation by means of green roofs and climbing plants. Green roofs mostly involve a thin covering of drought-resistant plants being laid on the roof. In recent times, thicker green roofs with higher biodiversity and greater capacity to deal with surface water have also been installed.

In Bo01 Quality Programme, every building scheme had to satisfy a green space factor, calculated as an average of all the allowable elements. The factor gave a numerical rating for each surface of a proposal. The area of all surfaces multiplied by their green space factor had to average 0.5. In this manner, without specifying solutions, the green space factor encouraged the teams to rethink all building envelopes in terms of green potential and to create innovative designs. The goal was to make the properties and courtyards as green as possible and for storm water to be visible and enhance the courtyard environment. Here are the partial factors for greenery and for paved surfaces.

Partial factors for greenery

1.0 Greenery on the ground

1.0 Bodies of water in ponds, streams, ditches

0.8 Green roofs

0.8 Plant bed on joists, more than 800 mm deep

0.6 Plant bed on joists, less than 800 mm deep

0.4 Tree with trunk circumference more than 35 cm (calculated for an area of not more than 25 m² of planting space per tree)

0.2 Solitary shrubs, multiple trunk trees more than 3 m high (calculated for an area of not more than 5 m² of planting space per shrub or tree)

0.2 Climbing plants more than 2 m high (calculated for a wall area with width of 2 m per plant times the height of the plant)

Partial factors for paved surfaces

0.4 Open paved surfaces (grass-reinforced areas, gravel, shingle, sand, etc.)

0.2 Paved areas (stone or slabs) with pointing

0.0 Impervious areas (roofing, asphalt, concrete)

Partial factors for hard surfaces

0.2 Collection and retention of stormwater (additional factor of sealed or hard surfaces with joints draining into a pond or magazine holding superior to 20 l/m² of drained area)

0.1 Draining of sealed surfaces (to surrounding greenery on the ground)

Green points

To promote biodiversity, the green space factor is supplemented with 'green points.' When planning Bo01, there was a list of 35 wide-ranging environmental measures, at least 10 of which were to be implemented in each residential courtyard. The programme requires at least three bird-nesting boxes or other animal houses, two natural biotopes and visible management of service water to achieve the highest level.

The green space factor is now being used in the city's new construction projects. The aim is to contribute to good living conditions for humans, animals and plants. Ecosystem services are valued, taken into consideration and reinforced in urban planning, maintenance and management so that their values and functions do not deteriorate.

COMMUNITY PLOT RATIO



In Kampung Admiralty, Singapore, Sky Gardens at intermediate 3rd and 4th floors offer community space to residents of all generations and to visitors. Photo: ©Françoise Labbé.

Community Plot Ratio quantifies the community space allocated within a development's site area and compares it to the site area. Sustainable neighbourhoods should encourage human socialization and facilitate gatherings. This measurement assesses the surface area of socially interactive space, accessible to the public and the neighbourhood occupants. It

comprises public areas, semi-private communal spaces, care centres, libraries, restaurants, cafés, and community centres. The quantity and quality of these community spaces largely determine the amenity of a precinct. A high Community Plot Ratio fosters human scale, convenience, and inclusivity, and is crucial to the success of people integration⁹.

⁹ Examples of Community Plot Ratios in WOHA projects range from 340 % in Vertical Stacked City (2014-) to 300 % in Oasia Downtown (2011-2016) to 220 % in the

School of the Arts (2005-2010) to 140 % in Skyville@Dawson (2007-2015) to 120 % in Kampung Admiralty (2013-) to 110 % in The Met (2003-2010).

CIVIC GENEROSITY INDEX



Left: In Kampung Admiralty, Singapore, the entire ground floor of the block is ground level open public space, shaded and protected from the rain. WOHA Architects. Right: In Kampung Admiralty, Singapore, the entire first floor of the block is a food court open to all. WOHA Architects. Photos: ©Françoise Labbé.

Civic Generosity Index is the extent to which a development encourages and facilitates the public life of a neighbourhood. The index quantifies the value of a development public attributes, such as urban connections, shared relaxation areas, sheltered walkways, gardens, and artworks. Fulfilling one of the following five criteria obtains a rating of 20%, so that satisfying all achieves a classification of 100%¹⁰:

1. Ground-level shelter, services and amenities
2. Ground-level accessibility and activity
3. Visual pleasure provided by horizontal and vertical landscaping
4. Public access to spaces and facilities within buildings
5. Spatial engagement and connection with an urban network

ECOSYSTEM CONTRIBUTION INDEX



In Kampung Admiralty, Singapore, the multiple gardens at intermediate levels and the community farm on the stepped roofs offer expansive habitat for flora and fauna. WOHA Architects. Photo: ©Françoise Labbé.

Ecosystem Contribution Index is how much a development supplements a city's biosphere. The index rates a development's capacity to maintain connections between natural habitats; its ambition to

provide food, water and shelter for local wildlife, and settings for native plants; its implementation of an environmental strategy for water management. The following assessment procedure is proposed¹¹.

¹⁰ The Civic Generosity Index reaches 100 % in five of the WOHA projects assessed above.

¹¹ WOHA 2016. Examples of Ecosystem Contribution Index in WOHA projects range from 80 % in Kampung

Admiralty (2013-) to 60 % in Oasia Downtown (2011-2016) to 40 % in Vertical Stacked City (2014-), the School of the Arts (2005-2010), Skyville@Dawson (2007-2015) and The Met (2003-2010).

- *Twenty percent*: supplying a basic urban habitat for flying birds and insects, without deliberately providing food.
- *Forty percent*: offering diverse habitats with mixed plantings, specifically intended to supply food for flying birds and insects.
- *Sixty percent*: presenting vertically and horizontally interconnected habitats, which include territories for non-flying animals, and for birds and insects.
- *Eighty percent*: providing interconnected habitats, designed to support and feed many species throughout the year with breeding spaces. Wildlife can live within the neighbourhood.
- *One hundred percent*: offering a diverse and interconnected habitat. It functions as a wildlife sanctuary within a wider network of similar environments. The natural food chain is maintained with the protection and nurturing of rare species.

SELF-SUFFICIENCY INDEX

Self-Sufficiency Index measures a development's capacity to provide its energy, food, and water.

Sustainable neighbourhoods must aim at achieving a high level of self-sufficiency. They should generate as much energy as they consume, and preferably more, to compensate for embedded energy in their construction. The index rates the success of a development's energy, food and water production compared to its intake. This involves a twofold approach:

- **Reducing the resources demands** with bioclimatic design, passive techniques and circular economy practices
- **Increasing the local supply** with surfaces allocated to solar collection and urban farming.

The Index comprises the following 3 Sub-Indexes¹².

- **Energy**: The Sub-Index measures a development's capability to generate renewable energy. The sources may be solar, wind, geothermal, biomass, tidal, and vegetal. The rating quantifies renewable supply in percentage of the development's annual energy requirements.
- **Food**: The Sub-Index determines a development's ability to provide food for its occupants. The rating evaluates locally produced food in percentage of the residents' annual food consumption.
- **Water**: The Sub-Index measures a development's capacity to collect and re-use water. If a neighbourhood is in a region that has a self-sufficient water recycling system, this larger scale is considered. The rating assesses locally collected and reused water in percentage of the development's annual water usage.

INTEGRATE PLANNING AND DESIGN INSTRUMENTS

Core strategies define priorities. They are the starting point for setting requirements for sustainability. Planning should establish frameworks for energy, addressing density, layout and neighbourhood heat and power networks. Planning instruments need also

co-ordinate other activities on accessibility, retail, community amenities, affordable housing and employment. Area action plans incorporate targets for sites, tailored to local conditions and aspirations. They can draw attention to the relationships between

¹² WOHA 2016. An example of Self-Sufficiency Index in WOHA projects is 60 % for water and 44 % for energy in Skyville@Dawson (2007-2015).

different aspects of sustainable growth and facilitate resolving all possible conflicts—between climate change mitigation, adaptation, space and recreation, and biodiversity, for example.

Planning requires sequencing, coordination and integration of infrastructure investments with land use. A metropolitan strategy can be a link between land-use planning at the municipal and neighbourhood levels. Spatial planning is effective when employed as a broad tool of development. Sustainable design helps to shape the place as a whole with all its economic, social and environmental impacts. To bring about change, planning must define a long-lasting vision and a series of phased targets focusing on short-term goals. Coordination among local government departments (planning, transportation, housing, real estate) is a prerequisite for sustainable urban design, which by nature is interdisciplinary. The objectives must be clear, specific and measurable or testable and technically feasible.

Sustainable schemes require people engagement to reflect local aspirations. This lays the foundation for further project streamlining. A collaborative design exercise can involve the community in the design itself when developing the vision.

Projects need a robust management structure with different layers. A Project Steering Group will elaborate strategic decision-making for the scheme as a whole. This group will check that the design incorporates the outputs from other stages of the process: master planning, community engagement and land disposal.

Integration of plans across sectors and scales comprises four steps.

- Set an integrated vision
- Develop local area statutory plans
- Develop land use regulations, revise zoning, and elaborate form-based design codes
- Develop a hierarchy of planning instruments

SETTING AN INTEGRATED VISION

Setting a vision must begin by a thorough investigation of the context, the character and environment of the area.

- its natural and urban geography and its human history
- its forms of settlements, buildings and spaces
- its ecology and archaeology
- its location and the lines of movement that cross it and link it to the city.

This site assessment is the start for designing a unique neighbourhood. High-quality places will emerge only if the approach is cohesive and equitable. The contextual analysis is a springboard for defining a vision.

A vision describes the community objectives and provides a long-term goal for project participants. It embodies a strategy for the future. It is the encounter of a reality to transform with a series of aspirations. The vision should include

- What do we want?
- How will we get there?
- Who will be involved and take responsibility?
- Where will the money come from?
- Who will defend the strategy?
- What are the delivery mechanisms

Examples of cities' planning visions¹³

Stockholm

Through Vision 2030, the City of Stockholm has clarified its long-term ambition and aspiration to become a world-class city by 2030, one that is versatile and offers a range of experiences, that promotes innovation and growth, and that is safe, accessible, and inclusive for all citizens.

Sydney

Sustainable Sydney 2030 expresses the community's vision for and the city's commitment to a green, global, connected city:

- Green implies a modest environmental impact, as well as trees, parks, gardens, and linked open spaces.
- Global relates to economic orientation, knowledge exchange, and open-minded outlook and attitude.
- Connected means physically connected – through walking, cycling, and high-quality public transport – but also 'virtually' connected by world-class telecommunications, socially connected by communities' sense of belonging and social well-being, and connected to other spheres of government and to those with an interest in the city.

A vision unites all the stakeholders around three key beliefs.

- **Creating value is possible.** A poor physical fabric or social issues may have stigmatized an area, but history shows transformative potential. Many 'problem places' have become 'places of opportunity'. This has resulted from a radical improvement in their planning.

- **Overcoming constraints is feasible.** Market often inhibits creative proposals for brownfield sites. However, it is possible to create with strategy new markets, new futures and added value.
- **The situation is dynamic.** Flexible design envisions prospective changes – such as household size and composition, lifestyles, and movement patterns. A master plan should be a framework for adaptation over time.

¹³ This box draws on: Global Platform for Sustainable Cities, World Bank. 2018.

The initial context assessment stage may include two key outputs

- **A SWOT analysis** (Strengths, Weaknesses, Opportunities and Threats).

DEVELOPING LOCAL AREA STATUTORY PLANS

Planning authorities have the legal responsibility to plan their neighbourhoods through local area plans. Non-statutory framework plans and site development briefs can complement but not replace the function of statutory plans. Widespread consultation can ensure understanding of, and support for evolution objectives such as the fulfilment of housing strategy aims and the promotion of sustainability. These plans and documents should reflect high-level goals. Key questions early in the process are¹⁴:

- Relationships and connections between neighbourhoods, community amenities, and cycling and pedestrian networks.
- Available existing public transport capacity within a reasonable development time scale.
- New housing needed in the broader area, including the provision of affordable housing with different types and sizes, and work-life units.
- Need for a sequential approach to residential land zoning, extending from the centre to the outside.

- **Foundational concept ideas and strategic options.** These outline the vision and enhance the flexibility of the project as it unfolds. They ensure that the process is participatory and capable of incremental implementation. They balance long-term aspirations with short-term improvement initiatives.

- Benefits that mixed-use can bring.
- Need to create a comprehensive framework for the (re) development, and the possibility that non-statutory guidelines – such as design briefs – will supplement the local plan.
- Size, location and type of public realm.
- Definition of appropriate density levels.
- Protection and enhancement of biodiversity and green infrastructure.
- Adaptation to the impacts of climate change.
- Avoidance of natural hazards such as flood risk for downstream areas.

Local plans may also contain three-dimensional layout proposals for buildings and the spaces between them, and design codes. The latter seek to ensure a consistent approach within a development up to the detailed design of public realm elements such as streets and open spaces. 3D computer modelling may provide a useful tool.

Check list for assessing the sustainability of development plans

—Does the proposed development plan, local plan, or planning scheme for the neighbourhood contain policies and objectives that underpin the creation of sustainability?

—Do they include clear guidelines on execution, particularly regarding the phased and coordinated provision of physical infrastructure, public transport and amenities?

—Has an implementation team been envisaged with a project manager to oversee the construction?

¹⁴ Adapted from: Department of Environment, Heritage and Local Development 2009.

Land-use rules, such as zoning ordinances and building codes, are necessary to make sustainable neighbourhoods a reality. Because private actors on their own won't prevent market failures in land allocation, regulations must be clear and their enforcement predictable. Plans should identify the sequence of construction for the zoned lands to avoid a random and costly approach to the provision of social and physical infrastructure. Zoning should stimulate infill opportunities within undeveloped land. It should give priority to land which is closest to the core and to transit routes. Areas to be zoned for growth must be contiguous to existing zoned development lands. Zoning capacity should be fine-tuned to transit accessibility and discourage housing construction faraway from transit. Planning authorities should link the provision of water and sewerage investment programmes to the sequencing of residential land. They should also integrate phasing with the delivery of public transport, schools, community and recreation facilities, etc. This involves maintaining close contact with other agencies.

Traditional zoning procedures must be revised to guarantee sustainability¹⁵. Most cities in low- and middle-income countries, which use zoning codes, follow the conventional zoning format. Typically, these zoning formats favour automotive-oriented practices. Regulations manage the impacts of certain land utilizations by spatially separating them. This has led to sprawl, limited connectivity and accessibility. The poorest communities have suffered from segregation and lack of jobs.

A form-based code is a land development regulation that fosters predictable built results and a high-quality public realm by using physical form (rather than separation of uses) as the organizing principle for the code. A form-based code is a regulation, not a mere guideline, adopted into city, town, or county law. It offers a powerful alternative to conventional zoning bylaw. Form-based codes address the relationship between building facades and the public realm, the

form and mass of buildings in relation to one another, and the scale and types of streets and blocks. The regulations and standards in form-based codes are presented in both words and clearly drawn diagrams and other visuals. They are keyed to a regulating plan that designates the appropriate form and scale (and therefore, character) of development, rather than only distinctions in land-use types.

This approach contrasts with conventional zoning's focus on the micromanagement and segregation of land uses, and the control of development intensity through abstract and uncoordinated parameters (e.g., FAR, dwellings per ha, setbacks, parking ratios, traffic), to the neglect of an integrated built form. Not to be confused with design guidelines or general statements of policy, form-based codes are regulatory, not advisory. They are drafted to implement a community plan. They try to achieve a community vision based on time-tested forms of urbanism. Ultimately, a form-based code is a tool; the quality of development outcomes depends on the quality and objectives of the community plan that a code implements¹⁶.

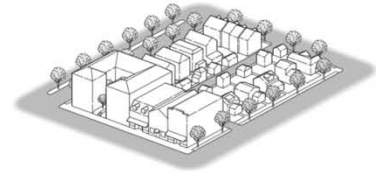
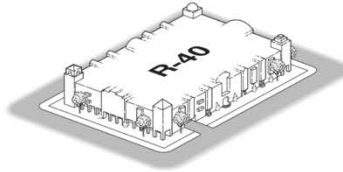
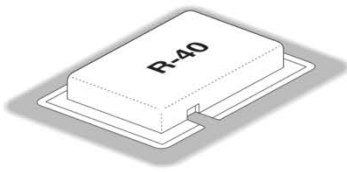
Form based codes for sustainable neighbourhoods comprise five main elements

- **Regulating plan:** a plan or map of the regulated area designating the locations where different building form standards apply.
- **Public standards:** they specify elements in the public realm: sidewalk, travel lanes, on-street parking, street trees and furniture, etc.
- **Building standards:** they control the features, configurations, and functions of buildings that define and shape the public realm.
- **Landscaping standards:** regulations controlling landscape design and plant materials on private property as they impact public spaces.

¹⁵ World Bank 2018.

¹⁶ Form-Based Codes Institute n.d. <https://formbasedcodes.org/definition/>

- **Environment resource standards:** regulations controlling issues such as storm water drainage and infiltration, development on slopes, tree protection, solar access, etc.
- **Administration:** a clearly defined and streamlined application and project review process.
- **Definitions:** a glossary to ensure the precise use of technical terms.



*Left: **Conventional Zoning.** Density use, FAR (floor area ratio), setbacks, parking requirements, maximum building heights specified*

*Middle: **Zoning Design Guidelines.** Conventional zoning requirements, plus frequency of openings and surface articulation specified*

*Right: **Form-Based Codes.** Street and building types (or mix of types), build-to lines, number of floors, and percentage of built site frontage specified¹⁷.*

DEVELOPING A HIERARCHY OF PLANNING INSTRUMENTS

Design Frameworks

Frameworks are strategic plans developed by (or adopted by) local authorities. Their content will depend on each site circumstances. They can transcend land ownership and encompass components at different timespans. They can cover a range of geographical scales from an entire city to a site. The document should explain what it aims to achieve and how many evaluations and analyses were necessary for its preparation. Frameworks are above master plans, design codes and site briefs. They define the key principles for subsequent master plans to develop ideas in three dimensions and with greater precision.

A design framework is the bridge between policy and execution. It describes how sustainable design should be implemented and how to monitor, guide and promote change. It coordinates more detailed master plans for separate sites. Frameworks give residents and investors the assurance that the project will use public and private funds for a common purpose. It is usually the responsibility of local authorities to produce them. However, consultants can contribute to elaborating the

document. Required skills will typically comprise planning, urban design, transportation, economic development, property, energy efficiency, environment and resources. Inclusive leadership is the key to success. Stakeholders should be engaged. The project team should involve the community in the preparation of the framework, preferably through collaborative design workshops.

Master Plans

A master plan specifies the intended layout of an area. It presents proposals for buildings, spaces, movement and land use, and links them into an implementation strategy. Master plans define development plots, massing, heights, relationships between buildings, streets and traffic in enough detail to deliver predictable results. Flexibility should allow for various responses. Many different architects should refine smaller scales of a master plan. Generally, master plans are formally adopted. They are often two-dimensional planning documents structuring instructions for uses, heights, setbacks. They can be more design-oriented and contain three-dimensional features such as shapes

¹⁷ Source : Form-Based Codes Institute n.d. <https://formbasedcodes.org/definition/>

and views. They should be open and flexible enough to avoid narrowing design options left to the designers. With the growing popularity of form-based code over use-based code, master planning has become increasingly a matter for architects. They also can include non-physical components such as funding, scheduling or phasing.

Quality Programmes

A quality programme is a set of guidelines that shape the project and its environmental profile and targets. It might be illustrated with principles for developing blocks and green spaces.



Left: Hammarby Sjöstad quality programme illustration plan. Source: Stockholm City planning Administration, "Quality Programmes for design".

Right: Following the quality program, multiple small green spaces are inserted within every block in Hammarby Sjöstad. Photo: ©Françoise Labbé.

CASE STUDY: BO01, MALMÖ, SWEDEN, QUALITY PROGRAMME



The Quality Program fostered a variety of waterscapes in Bo01 Malmö, Sweden. Photo: ©Françoise Labbé.

The Bo01 project began in 1995 following a comprehensive visioning process undertaken by the city of Malmö. With the selection of Malmö as the first European Millennium Housing Exhibition, the city bought the site and appointed an organization of planners and architects, whose principal architect was Professor Klas Tham. Innovative methods coordinated the collaboration of government, designers, and developers. 'Creative dialogues' produced consensus on what to accomplish under a time constraint. Dialogue fostered an atmosphere of teamwork and innovation.

In 1999, the collaborative process culminated in the Quality Programme elaborated between the City of Malmö and the developers. It was the driving instrument for achieving the sustainability goals and ensuring high-quality environmental profile, technology and services. It illustrates a holistic approach and gives criteria, detailed objectives and directions for solutions on energy efficiency, source separation of waste, greenery, biodiversity, etc. while allowing invention, creativity and diversity.

The Quality Programme outlines the minimum standards for architecture, landscaping, energy, water, waste management, and biodiversity. It includes an emphasis on greening space, which reinforces the master plan and generated diverse landscapes¹⁸.

The 20 developers selected for the project committed to material, technological, environmental, and architectural quality measures before any parcel was sold. Although time-consuming, the process resulted in rapid approval of the plans submitted by developers to the city¹⁹. The primary landowner, the city of Malmö, became the 'horizontal developer', in charge of the planning and building of all public spaces and infrastructure, while the private sector was responsible for all construction within each plot boundaries.

Design Codes

A design code provides clarity over design quality for a site or area, with certainty for developers and the local community. Design codes principles aim at delivering better value places. They comprise requirements for streets, blocks, massing and so forth. They may focus on the landscape, architectural or building performance such as increasing energy efficiency²⁰.

Design coding isn't new. Some of the most beautiful cities, such as Siena in Italy, have employed design coding over centuries to give them their distinct and unified form and appearance. In the U.K., codes were introduced into the 1667 Act for the Rebuilding of the City of London. Among design requirements for new buildings, they linked building types to street types.

Design codes are different from the conventional land-use zoning bylaws that underpin many planning systems in Europe, the United States, and elsewhere. Zoning regulations aren't informed by urban design and place making. They typically map land uses and comprise formal written rules prescribing permitted uses and development density, building heights, floor space ratios. By contrast, design codes are spatial in

spirit and seek to enhance place making. They integrate land use with other policies influencing the nature and function of areas. Design codes are a proactive tool. They help embed the community aspirations for a location, with greater consensus, transparency, speed, quality and certainty.

What are Design Codes²¹

- Design codes are an approach to delivering improved design quality. They support investing resources upfront to streamline later processes.
- They are a type of detailed guidance comprising a set of written and graphic rules. They establish precisely the two – and three – dimensional design elements of a development or area.
- They instruct the user upon the physical components of a place.
- Design Codes are also delivery tools. Extensive evidence demonstrates their contribution to improving design quality, and to a more certain, streamlined and coordinated process.
- Design codes support the planning culture change and the transition to a spatial approach.

¹⁸ City of Malmö 2002.

¹⁹ Austin 2013.

²⁰ Department for Communities and Local Government: London 2006.

²¹ Department for Communities and Local Government: London 2006.

Normally, it is impossible to produce a design code without a master plan. However, under certain circumstances, a design code may express general design guidelines (on building heights for example) over a wider area associated with an urban design framework. Design codes establish design 'rules' for streets, squares, and open spaces before the buildings' design. They enable several architects to work on a part of the neighbourhood so that each parcel is coherent and contributes to the whole. The design code should accommodate a diversity of building forms. It should also detail the rules of scale and character for making harmonious, visible connections between new and old uses, buildings, and activities. It takes more than excellent architects to create good cities; it needs strong rules that help prevent design disasters. Design codes are an approach to planning with a more coordinated development process established on consensus. They should include a set of mandatory and optional design requirements, and a regulatory plan to specify where the provisions of the code will apply. They should contain the following key elements.

- Appreciate the context
- Create the urban structure
- Build relationships
- Detail the location and manage the investment.

Besides supporting quality, codes must encourage variety. In many neighbourhood projects, such as for example Hammarby Sjöstad described in a case study below, design codes have supported the creation of a harmonious place with a variety of architectural styles. They provide design guidelines to interpret in diverse ways, while maintaining common principles. Large sites where delivery is phased over time or between different design teams benefit most from using them²². They help keep a consistent quality along the whole process. They identify elements that are fundamental to establishing a unique sense of place and translate them into a set of detailed design instructions²³.

²² UCL 2006.

²³ English Partnerships and Housing Corporation 2007.

²⁴ Department for Communities and Local Government: London 2006.

A team usually produces the codes on behalf of a landowner, with local authorities and stakeholders. A consensus on the specifications ensures that the codes meet the technical and planning requirements. Skilled personnel should be available throughout the process. Those preparing the codes should inform developers, landowners and local authority staff as needed. This secures compliance of the designs with the codes and makes it easier to judge whether suggested amendments will improve the codes. The codes are provided to developers for each parcel, often with a brief describing in detail the constraints. To ensure that the project quality defined in the codes is delivered on the site, a development agreement or planning requirements can enforce the code.

Who is responsible for the production of design codes?²⁴

The following stakeholders in the design coding team will be active at various stages of the design code advancement.

- **Land** – Landowner, Master-developer, Funding Agency
- **Design** – Master-planner, Design and Development Framework Designer, Design Code Designer
- **Development** – Parcel Developers, Registered Social Landlords, Parcel Designers
- **Public** – Planning Authority, Highways Authority, Environment Agency, Building Control

The seven stages of a design coding process are²⁵

- **Stage 1: Initiating the design code** – thinking through and defining an agreed method for preparing and operating the code, and establishing leadership arrangements.
- **Stage 2: Coordinating inputs into the design coding process** – bringing together the skills, funds, and the roles and relationships that will create and implement the design code.

²⁵ Department for Communities and Local Government: London 2006.

- **Stage 3: Appraising the local context for design coding**—assessing the policy and guidance framework and any consents already covering the site or area, its character, and any existing physical vision such as a master plan.
- **Stage 4: Designing and testing the design code.** This encompasses first devising, structuring, writing and developing the content of the design code. This then involves challenging the design code robustness, market viability, capacity to deliver quality, and ease of use.
- **Stage 5: Formalizing the design code**—giving the design code status by adopting it for planning, highways or other purposes, or through other means.²⁶
- **Stage 6: Implementing the design code**—employing the design code to select design and development teams for land plots, to inform the parcel design process itself, and for the assessment and regulation of the proposals.
- **Stage 7: Managing design code compliance**—monitoring and enforcing its implementation; evaluating its success to refine it; and, using the code for project aftercare.

CASE STUDY: CONTENT OF HAMMARBY SJÖSTAD DESIGN CODE

The Project Team prepared a detailed Design Code document to represent the design quality for each sub-area. The design code sets out principles in the following domains²⁷.



Specified in the Design Code, Hammarby Sjöstad district character is a combination of inner-city built form with modern architecture integrated with the natural environment. Photo: ©Françoise Labbé.

- **District character.** Combination of inner-city built form with modern architecture integrated with the natural environment. Key to the character is a mix of uses and businesses, density, built form (blocks built around courtyards or play areas), public spaces, and relationship to water.

²⁶ Such as through development control powers or control over freehold rights.

²⁷ Stockholm City Planning Administration, “Neighborhood Planning Quality Guidelines” (Stockholm: City of Stockholm 2005)

- **Layout, form and structure.** Creation of parameters for each block with the opportunity for innovation including landmark buildings, public spaces, and pedestrian routes.
- **Architectural style.**
- **Stockholm inner-city block form as a model.**
- **Sjöstad local distinction** – larger units, greater variation in height and form, and greater emphasis on outdoor spaces, balconies, terraces and flat roofs.
- **Building form to respond to its related open space.**
- **Scale, order and variation** – density guidelines to be met but with emphasis on quality and variation.
- **Building types.**
- **Building design principles.**
- **Building elements.**
- **Apartment standards.**
- **Standards for additional services.**
- **Building colour and material**
- **Design of courtyards.**
- **Design of public spaces parks and streets.**

Site Briefs

A planning authority should prepare design briefs for sensitive or large-scale development areas. A site brief defines the requirements of each site within a framework, master plan or design code. The brief highlights opportunities and constraints. It should

- describe the site and its context
- summarize relevant development plans or local area plan objectives and policies
- identify any planning constraints
- give some indication as to the type, design and layout desired by the planning authority

A design statement from the developer or design team should address the brief.

Design Statements

The planning process should encourage developers to produce design statements. These short documents allow the applicant to explain why a design solution is the most sustainable for an area. The declaration usually consists of text and graphics. It shouldn't duplicate planning application documentation. It must address all relevant policies and objectives of the development plan and link them to the site.

DEVELOP PROCESS INSTRUMENTS

The integrated design process is multidisciplinary and iterative. It requires coordination raised to a level of 'orchestration'²⁸. Transdisciplinary work should foster an understanding of how design decisions in one field can affect other areas and of the synergy between the

plan components. Such an integrated process differs from leaving each department develop and approve its silo. It needs many more design iterations until finding the optimal solution.

²⁸ English Partnerships and Housing Corporation 2007.

INTEGRATING THE PROCESS

The crucial challenge is in transforming practices and methods. Lessons from case studies demonstrate that this requires leadership and commitment, innovative project management, financing strategies, engaging citizens in design and planning. Integrating the process involves the following dimensions

- **Governance with vision and risk taking.** Without a strategy, it is impossible to draw together the wide range of objectives, policies and technologies into a unified direction. The visioning statement outlines the guiding principles. This overarching statement indicates how much the area will be sustainable. A strong vision and long-term commitment raise investor confidence and community buy-in.
- **Partnership building.** Cross-cutting solutions need broad alliances, for strategy, budget, innovation and communication. Different purposes require a variety of partners: city financing leverages private sector funding; technical groups can tackle research challenges; a city agency can convey a common message, etc.
- **Establishing clear, ambitious and measurable goals backed up with policy instruments and verification.** They should include provision of physical and social infrastructure, design detailing such as the layout, range of appropriate density, diversity of uses, housing mix. They should consider the environmental and ecological context. Targets and building standards are crucial for setting the direction. They require to be matched with regulation (for example, at the national level) and contractual obligations (through city leasing and sales) to control construction.
- **Phasing.** Sustainable neighbourhoods are constructed over long periods. The phasing should ensure the provision of the physical and social infrastructure alongside growth. The phasing programme will indicate the number of stages proposed and the enabling work needed for each step before proceeding to the next one. The programme will also specify the advancement expected to occur at each phase, integrated with the delivery of the appropriate social premises, such as childcare, health facilities, and transport access.
- **Engagement of homeowners and residents.** Controlling brownfield sites for developing eco-neighbourhoods provides strong policy power over environmental and economic outcomes. This is useful for testing innovative policies, technologies and infrastructure. However, solutions for existing boroughs will require processes that can't rely only on municipal land ownership. Eco-districts are more likely to be a success if they have grassroots buy-in through early involvement.
- **A mix of national regulation and city land contracts.** Building codes and standards for new buildings are powerful regulatory instruments. Alongside national rules, contractual obligations placed on developers by municipal governments can drive even more demanding energy and other building criteria for eco-neighbourhoods.
- **Pooling city, state and national funding to increase the potential for leveraging large-scale private finance.** Partnerships of city administration, national government and the private sector can provide the extent of investment needed to kick-start and develop ambitious solutions.

The process should also integrate from the outset the different lifespans of urban components. Some planning parameters will be adaptable throughout the planning and design stages, while others won't. The most resilient parts of a master plan should be streets and related infrastructure. Long-term design decisions about them should allocate for sufficient resources and flexibility to last for generations. Within this long-

lasting infrastructure, buildings can be replaced over time, either gradually or on a larger scale. Buildings capable of modifying to changing uses allow for more efficient utilization of resources. An approach ensuring long building life and adjustable capacity with a loose fit of built form to present functional needs is more adaptive than building only for the short-term.

Lessons Learnt from Case Studies²⁹

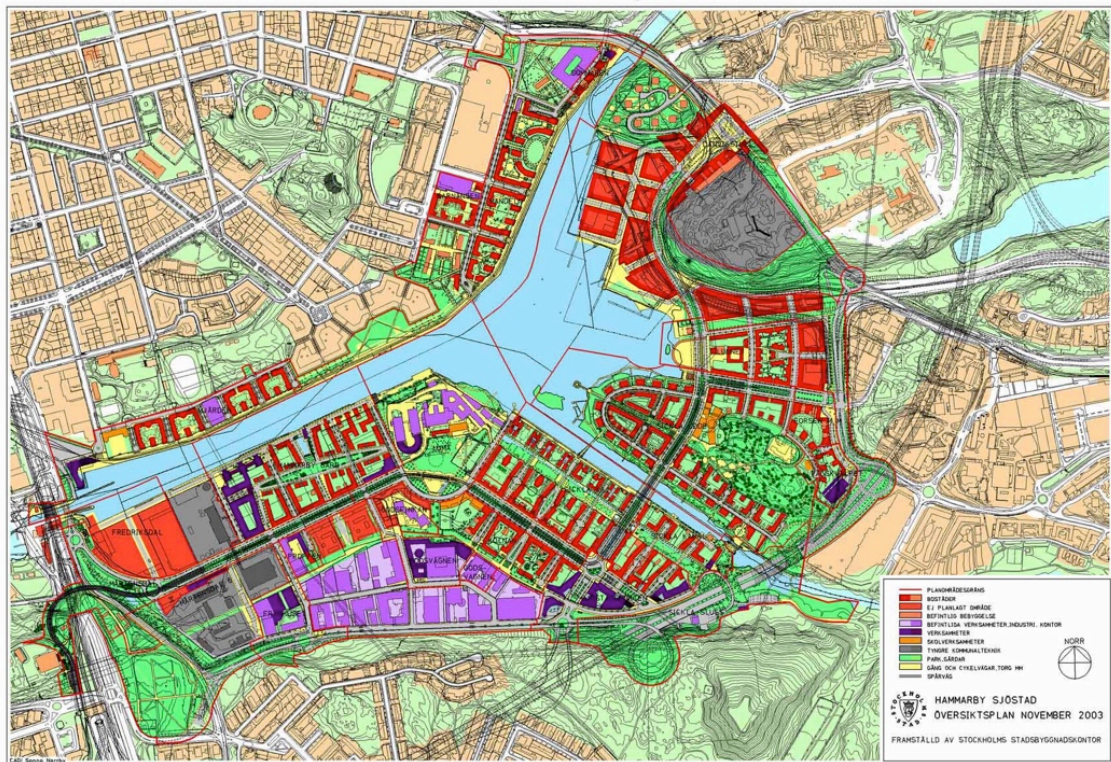
- The city, its planning agency and its officials played a key role in the process integration. As landowners, cities had the legal obligation and the power to develop projects.
- Cities could raise outside seed funding from federal agencies, use their budgets and, if necessary, borrow funds at low interest rates.
- Cities created special development committees, which received planning authority and project leadership. These committees were interdisciplinary and included representatives of internal agencies, outside consultants, citizen groups and responsible public services. They defined goals and performance criteria that proved critical to drive innovative planning and design.
- Utilities produced integrated plans to respond to project objectives, while cities created comprehensive master plans with external consultants. Cities established detailed design and engineering plans for public spaces, streets, parks and landscaping, transit systems and all infrastructure – energy, water, storm water and waste.
- Cities acted as ‘horizontal developers’, bidding and contracting for the construction of public

infrastructure and paying for it with a combination of municipal funds and construction loans, assuming the operation risks. The financial role of cities has been rewarded. Profits from land sales subsidized later development phases. Sustainable neighbourhoods created their continued financial viability.

- Cities divided the construction into small parcels, which were sold to several architect-developer teams. Cities maintained ongoing control over projects with requirements and inspection protocols legally incorporated into land sale agreements.
- Engaging the citizens in the design and building process ensured quality construction and sustainable resident behaviour. In Vauban, inhabitants were involved in setting stricter standards, selecting the architect, designing and managing the construction. Vauban’s higher performance demonstrates the higher value that can be achieved with early and heightened resident participation.
- In Moravia, Colombia, the proposal included several home upgrade workshops aimed primarily at homeowner residents. They learnt how to improve their homes through sustainable architectural techniques. They first would need to become aware of how to improve natural lighting, waterproof roofing, increase ventilation, install green roofs and walls, and realize criteria to receive a title for their houses. This knowledge would then be directly transferable to their fellow community members, and these new skills could result in employment opportunities.

²⁹ Bo01, Malmö, Sweden; Hammarby Sjöstad, Stockholm, Sweden; Kronsberg, Hannover, Germany; Vauban, Freiburg, Germany; and Moravia, Colombia.

CASE STUDY: DEVELOPMENT PROCESS OF HAMMARBY SJÖSTAD³⁰, SWEDEN



The 2009 version of the official master plan for Hammarby Sjöstad and its 12 sub-districts. These have been detailed by different architectural teams and are the result of both a phasing strategy and a diversity strategy. For consistency, the design authority for the master plan is the responsibility of the urban planning department and not of the private architectural firms acting as temporary consultants.

A holistic approach created market potential in a run-down industrial area. It is grounded in transit connectivity, high-quality design, and **strong** environmental goals. These principles should be adopted as early as possible and integrated into every part of the infrastructure upstream in the planning strategy. Achieving architectural coherence and a high level of complexity and diversity requires a participatory method that engages all stakeholders with a discussion of options and their results.

The first step in planning was the strategic master plan, led by architect Jan Inghe-Hagström, at the Stockholm City Planning Bureau. The plan is divided into 12 sub-neighbourhoods built in phases. In a process called ‘parallel sketches’ the city selected three to four private **sector** architects/planners to draw up detailed proposals for a sub-neighbourhood. The city evaluated each of the schemes and combined the best features to create a master plan. The city planning and design team then prepared a design code for each sub-neighbourhood in partnership with the developers and architects. The agreement between the developer and the city included the design code. The local authority used the design code to grant planning permission. The code provided an overview of the layout, form, and structure of each block, with key landmarks, public spaces, and pedestrian routes.

To foster variety, and inspire higher standards of design through competition, a consortium of developers and architects were invited to design each plot or building inside the sub-neighbourhood, according to the code. More than

³⁰ This box draws on Salat and Ollivier 2017.

60 developers and 30 architects were **involved** in the process³¹. The project achieved a high level of diversity and complexity within a coherent master plan.

The city of Stockholm joined forces with twenty-five construction companies to construct the neighbourhood, with the latter contributing 80% of local cost. Other financing comes from two government agencies – the Swedish Rail Administration (rail transport) and the Swedish Road Administration (routing of the Southern Link ring road). Several features **ensured** an efficient development process with a good balance between planning and market.

1. Single ownership: Almost the entire site was in a single proprietorship from the start. This meant that no competing interest unsettled the plan.

2. Long-term vision of the master plan.

3. Massive early infrastructure: Major public funding was key to delivery – with power, water, recycling – all put in place initially.

4. Collaborative method: Developers and architects looked at how they could achieve a workable solution for each development area. Many different developers produced each zone with variations and changes to the design, while remaining under the same wider master plan.

5. Clear delivery mechanisms: Developers had to pay for each site on a per-square-meter-of – development basis. This narrowed down the range of bidding, because of the restrictions enforced by the master plan – enabling a greater focus on the design and quality to meet end-user needs.

6. Flexible mix of uses: The master plan envisaged a blend of non-residential uses but didn't impose constraints on them. Ground floor areas in certain key frontage zones had to be active, while being flexible for the end tenant. The market made the decision as to what eventually works.

CATALYSING CIRCULAR ECONOMY PROCESSES

Local governments can play a catalytic role in bringing the parties together for implementing circular economy. They should remove barriers and actively encourage and challenge the market. They can push forward the circular city objective by

- adjusting tendering conditions.
- stimulating innovative research and start-ups.
- establishing financial incentives, for example through different tax rates.
- investing in good infrastructure to increase the exchange of resources

Cities can provide companies with technical knowledge, connecting firms with unused or residual resources such as materials, energy, water, assets, logistics and expertise. This enables businesses to³²

- Cut costs and increase profit
- Improve operational efficiency.
- Create new revenue streams.
- Learn from each other.
- Operate more sustainably.
- Divert industrial waste from landfills.

Connecting enterprises across the city, 'Circular Glasgow', for example, helps them to open up new revenue streams, increase competitive advantage and realize financial savings using a range of practical initiatives. In Cape Town, South Africa, the programme identified more than 4,000 potential synergies between the 486 companies. The cumulative impact of the Western Cape Industrial Symbiosis Programme (WISP) over the last five years is impressive: 27,436 tons of waste diverted from landfill; 46,700 tons greenhouse gas emissions saved (equivalent to nine 2.2MW wind turbines installed in South Africa)³³.

³¹ Foletta 2011.

³² C40 Cities 2019

³³ C40 Cities 2019

Innovative models of resource and waste management can help cities rethink their need for traditional collection and disposal infrastructure. For example, community composting factories in Dhaka employ citizens to collect waste door-to-door by rickshaw bicycle systems and separate organic waste from other items, providing income for poor residents, especially women. Compost is sold to fertilizer companies and contributes to soil health for regional agriculture³⁴. In Kolkata, a similar waste separation project employs local residents and improves air and water quality by reducing the number of mismanaged burning and dumping. Since the launch of the programme, the city reported a decrease in illnesses associated to air and water pollution, such as liver disease and malaria³⁵.

Cities should set mechanisms to monitor resources. Amsterdam recognized construction organic waste as having the greatest potential for added value and job creation; identifying opportunities for reusing materials reduced CO₂ emissions by 500,000 tons per year³⁶.

Cities can explore financial instruments such as the municipal bond market and the emerging field of green bonds. In 2014, Goldman Sachs launched a green bond offering to the Washington, DC, Water and Sewer Authority to help fund new infrastructure: the maturity of the 100-year bond corresponds to the life of the asset³⁷. Although currently no green bond is dedicated

to the circular economy, municipal governments could strive to establish such a market.

Cities play a key role as regulators. They need to engage citizens and the private sector to make their voices heard in policy and regulatory development. They should stimulate the free flow of materials. They should ensure mechanisms for testing, repairing and maintaining goods throughout the product life cycle. In Vancouver, the Green Demolition by-law requires homes built before 1940 to be deconstructed rather than demolished. At least 75% should be reused or recycled. Cities can take advantage of Extended Producer Responsibility (EPR) to encourage manufacturers to innovate.

Procurement can promote circular economy practices. In the Netherlands, Utrecht committed to increasing its share of circular purchases from 4% of annual expenditure to 10% by 2020. The city asked entrepreneurs to suggest circular solutions to the development of a bike path: the winning answer proposed 100% recycled asphalt on the lower layer of its road³⁸.

Cities can incentivize businesses to adopt circular practices, through subsidies or tax breaks. They should remove subsidies that encourage the use of resources or non-renewable energy consumption, and consider tariffs that incorporate externalities in pricing mechanisms.

³⁴ 40 Cities, November 3, 2011, c40.org.

³⁵ "Cities100: Kolkata—Segregating waste leads to a better quality of life," Cities100, November 15, 2016, c40.org.

³⁶ Choho 2017.

³⁷ Burckart and Butterworth 2017.

³⁸ Choho, 2017.

CASE STUDY: A SMART NEIGHBOURHOOD ENGAGING THE WHOLE COMMUNITY FOR TESTING INNOVATIVE TECHNOLOGIES AND APPROACHES IN HELSINKI, FINLAND³⁹



Smart Kalasatama, a new district of Helsinki.

The Helsinki region is growing rapidly and will accommodate 490,000 more people in the next 35 years. To promote sustainable urban solutions, the city of Helsinki decided in 2013 to make one of the new districts under construction, Kalasatama, a model of smart city development. A former harbour and industrial zone on the waterfront, located to the north-east of Helsinki, this 175-hectare district will include, after project completion in 2030, 25,000 inhabitants and 10,000 employees, for 1,000,000 m² of housing and 390,000 m² of offices. To build it, the City of Helsinki committed 600 million euro of public funding, which leveraged 5 billion euro of private investment.

This eco-district will meet the most demanding standards in terms of energy efficiency and a sustainable city. Photovoltaic panels equip each building. The Kalasatama smart grid, pools the electricity produced and consumed by all the buildings. The goal, upon realization, in 2030, is for every construction to achieve carbon neutrality. The district heating and air conditioning network connects all edifices. It is supplied by gigantic heat pumps recovering energy from the city's wastewater: the underground power station of Katri Vala, the largest in the world is directly next to Kalasatama.

The programme took an original approach. Usually, the City procures a service or a product. In this case, the City used inventive pilot projects to generate as much learning as possible and add value to all stakeholders. The solutions could significantly influence emissions in the future. This opportunity allowed new businesses to develop the idea with citizens.

Kalasatama is a public-private-population partnership. Each project and each invention aim at improving the well-being of the inhabitants, and are designed with them. This spirit of co-creation drives the conception of this smart district, differing from smart cities that develop platforms and aggregate data, without thinking about uses. The district supports start-ups, facilitates their experiments, puts them in touch with city services and research centres, but always including citizens, who are co-creators and testers of all innovations. The principle is to present users the possibility to

³⁹ This box is adapted from C40 Cities 2019.

experiment solutions invented by start-ups in real conditions: energy management Apps, food-sharing platform to avoid waste, sports coaching App, car sharing of vehicles.

In Smart Kalasatama, the whole neighbourhood functions as an innovation platform. This 'living lab' features key infrastructure, such as the Kalasatama school, the vacuum-based pipeline waste collection system, the energy station and the health and wellbeing centre. A co-creation space provides a site for meetings and networking. Smart Kalasatama and its partners facilitated and participated in 20 pilot projects between 2015 and 2017. Many of them related to circular economy, including

1. Yhteismaa (Nifty Neighbour and *Mesenaatti.me*) – a map and location-based social web service. Nifty Neighbour explored how the service can help residents to generate and test ideas to improve the district and to enable initiatives by crowdfunding. Besides, the platform empowers inhabitants to offer or request the sharing of goods and services.
2. Link Design Oy, Foller – reducing food waste by making use of Internet-of-Things technologies and sharing food with neighbours.
3. Witrafi Oy, Rent-a-Park – a peer rental service for parking space that connects space providers with drivers. Parking space owners can rent their spaces to others when they don't need them.
4. Innogreen's vertical outdoor solution – tackles with greywater and supports biodiversity in the area under construction with modularity.

A modular housing stock offers tenants the opportunity to develop their own project. The design of the building programme aims at appropriation by its inhabitants. Each apartment building has flats of varying sizes and standards, to ensure social and generational diversity. Between each edifice, the block **cores** are collective gardens and playgrounds, open to all neighbourhood residents. The city even left a certain number of plots free and reserved them for local cooperatives, so that they could jointly define their own project.

The entire neighbourhood operates on the principle of sharing spaces, public or private. A digital key system or App allows access to many places according to one's needs. Thus, non-residents can use all the car parks. The spaces and the electric vehicles are shared. Common kitchens, multipurpose rooms, co-working spaces equip the majority of residential buildings on the ground floor. Tenants can reserve them, by the hour or by the day. Sharing could quickly affect public facilities. Some areas of the school, for instance, will soon become available to residents outside teaching hours.

This new way of looking at the neighbourhood and the relationship to town planning, in a sustainable and collaborative approach, is exemplary of what a smart city must offer the community and its inhabitants. The programme is a model to engage the whole urban community in the development of everyday better outcomes for the future.

IMPLEMENT MANAGEMENT INSTRUMENTS

Projects must be economically viable, well managed and maintained. This means understanding the market considerations of developers, ensuring long-term commitment from the community and the local authority, defining appropriate delivery mechanisms and seeing this as part of the design process. The feasibility of a neighbourhood scheme requires an evaluation of

- the community needs.
- the market supply and demand.
- the funding sources.
- the site capacity.
- the land ownership, assembly and tenure.
- the integration with the surrounding context.
- the construction costs.
- the engineering constraints.
- the local planning policy.

Projects must be location and context specific and will vary by type whether infill, brownfield, extension or regeneration. Relevance is key: a highly urban solution

won't be appropriate on a suburban site, and vice versa.

ESTABLISHING PARTNERSHIPS AND ENSURING SUSTAINABLE PROCUREMENT

Utilities, property owners, transportation suppliers, financial institutions, citizens, non-governmental groups and other stakeholders all have a role to play in achieving the targets of increasing liveability, inclusiveness, and economic vitality. Municipal authorities will have to take decisive action to obtain the support of investors. Mayors and elected officials will have to use their convening power, provide incentives for private investment, demand changes beyond their jurisdictional boundaries, and share and apply approaches from cutting-edge projects around the world. Sustainable design isn't the sole responsibility of a professional group; it should engage working together with stakeholders representing different interests. This means that a full range of skills must be involved at every stage of the process.

Cities should support innovation and private-sector participation for developing solutions. They can reserve their funding for public goods provided by the government. It makes sense to identify areas where municipal agencies can step back and leave room for private sector companies, state-owned utilities, universities, foundations and non-profit organizations. Introducing more actors to the mix is positive, as it increases adoption and leverages more creativity. Cash-strapped municipal administrations may need to recruit

multiple partners, but the owner should add value, such as expertise and capacity, not just capital. When private sector innovations emerge organically, the role of government may encompass regulating, bringing together key players, offering subsidies, or changing purchasing decisions. Rather than adopting a master plan approach, some cities are positioning themselves as ecosystems, creating consortia and even spaces for physical collaboration. Amsterdam Smart City, for example, is a public-private alliance that involves municipal agencies, educational institutions, non-profit

organizations, private sector companies and start-ups⁴⁰.

The market for construction products and services is diverse. Suppliers range from local SMEs, including specialist operators, to multinational contract suppliers. The contribution that effective supplier and stakeholder engagement can make to sustainable procurement should not be underestimated. It must be conducted in an open and transparent manner. Early engagement on sustainability both with relevant internal staff and the supplier market will help to ensure that risks are averted and that opportunities to secure sustainability benefits (for instance, reduced energy costs and carbon emissions, targeted recruitment and training) can be planned for and integrated into the procurement process. Engagement with suppliers will help to ensure that buyer requirements are feasible and also helps to provide an early alert to the market place of the buyer's intentions.

The procurement process should drive resource efficient construction and capture local opportunities for more sustainable approaches. Supplier engagement is essential to allow the market to understand and prepare for sustainability requirements. Procurement should contribute to a more productive, inclusive and circular economy. Applying circular economy principles to construction (for example through recycled content, reuse, design for deconstruction as well as potentially innovative solutions, which may involve new business models) requires early consideration of opportunities, costs and engagement. Key environmental impacts include

- The choice of products used and their origin, including hazardous materials.
- The efficient use of resources, including energy and water.

⁴⁰ McKinsey Global Institute 2018.

- The generation and management of construction waste, including reuse where practicable.
- Carbon emissions arising from use of energy and fuel.
- Potential impacts on biodiversity and heritage as a result of construction activity.

In addition, there may be a range of potential socioeconomic risks and opportunities which may include

- education and skills (e.g. apprenticeships, other training).
- opportunities for local employment.
- economic regeneration.
- health and wellbeing.
- community impacts and opportunities.
- enabling SMEs and third sector to compete and be involved in the construction supply chain.
- equality and gender issues.
- fair and ethical trade.

These environmental and socio-economic risks and opportunities should be reflected in procurement objectives. Public sector procurers will need to consider how sustainability priorities are clearly articulated in their organization's policies and strategies to ensure that the sustainable procurement of construction products and services supports wider sustainability targets.

Thinking through the whole life impacts and costs of the products or services will help shape the procurement option that best meets the requirements and reduces sustainability risks. These options may include procuring a service rather than a product, hire or lease of equipment, closed-loop systems and end of life options. An important consideration will be the extent to which the supplier market may currently be able to respond to buyer requirements and the opportunities for improvement. The extent to which suppliers may be prepared to adapt their offer is likely to be determined by the level of influence exercised by the procuring organization. Buyer influence may well

be greater if the procurement is undertaken collaboratively and this option should also be considered, either through the use of existing framework arrangements or through a specific collaborative procurement exercise.

A direct correlation exists between the brief quality and the relevance of the received bids. Many sustainability benefits can be achieved through the effective evaluation and selection of a 'sustainable' supplier. Sustainability requirements should be detailed in the specifications and evaluated as part of the tender process. They must also include any 'end of life' requirements. A positive balance between quality and price must seek to optimize the best value for the programme and society as a whole. Procurement presents the following challenge: how to secure a partnership that will share the objectives and vision and has the capabilities, skills and commitment to achieve these aspirations effectively? A good procurement process maximizes confidence that both parties understand goals and how the project will be executed while minimizing resources and risks. A comprehensive brief should include a clear methodology on how the responses to the requirement will be evaluated and delivery monitored. It should define the financial and legal obligations of each partner. Potential partners must be convinced that they are bidding on a fair and level playing field⁴¹. It is essential that a weighted scoring mechanism is designed reflecting the criteria to evaluate the responses against and that this is shared with potential suppliers as part of the tender documentation. Ongoing improvement and innovation can be built into the management of the contract to further develop the products and services required by the contracting organization. Capturing the outcomes from the delivery of contracts will be an essential process to not just determine whether contract requirements are being met and opportunities for further improvement are possible, but also to highlight whether the procuring organization's sustainable outcomes are being achieved.

⁴¹ English Partnerships and Housing Corporation 2007.

The approach to establish the partnership will depend on

- the scale and objectives of the project.
- the level of commitment of each partner.
- the resources available.

Partners will be involved for different reasons. A public sector agency may look for affordable housing, jobs, mixed uses and lasting economic, social and physical regeneration with environmental quality. If a private sector partner can support these goals, it will be more interested in optimizing its return in the short and medium term, with minimal risk to its shareholders. The private developer may also need partners to share risks or help deliver the necessary infrastructure.

A clear agreement on the roles and responsibilities ensures effectiveness. Besides the local authorities and landowner, the main players may be the developer, the plot developer (for phased projects), the infrastructure providers and the utilities. All stakeholders should take part in the objectives and vision of the project. They should understand the resources, skills and commitment needed. Success depends on reconciling ambitious goals with expectations by all parties. When partners enter a joint venture, they should agree on a conflict resolution process. The public sector often assumes the leadership in coordinating stakeholders. Sustainability added value may consist in reducing CO₂ emissions and environmental impacts but also raising design quality standards, and creating affordable housing and jobs. This may encompass working with

the private sector to explore issues related to risk, innovation, efficiency gains and supply chains.

The public sector must decide how to share risks and returns with partners. The required degree of long-term quality control determines in part the alliance structure. The role of the public sector may involve undertaking site preparation work such as site assembly and remediation works, master planning, design coding, and initial investments in infrastructure and the public realm. Developers are more likely to commit to designing sustainably on sites with reduced risk. For large-scale projects, the sponsors may retain quality control during construction by acting as promoter and releasing phases to plot developers. This requires a long-term determination from the landowner. He will doubtless benefit from higher values in later stages.

When a landholder proceeds on its resources towards securing a planning permission and making an area ready for development, he usually obtains higher values and lowers the risks to development partners. The operation sponsor can have confidence in ensuring high-level sustainability if he remains the coordinating partner. The degree of supervision that the project sponsor stipulates on the design quality may determine the amount of resources that he is willing to engage. Maintaining a high degree of control over a development will help achieve high quality design, but it also requires a high level of resources and commitment. However, by reducing the risk for the developer and ensuring quality, the final reward should be greater.

CASE STUDY: PUBLIC PRIVATE PARTNERSHIPS: ECO-DISTRICTS AND BUILDINGS IN STOCKHOLM

Much of eco-districts successful implementation in Stockholm has been a result of effective public-private alliances, between the city, private sector and research institutes such as the Royal Institute of Technology (KTH). The key partner has been the City itself. It has supplied strong leadership, direction and master planning, finance and platforms for partnership. This has given the private sector the confidence to invest, innovate and deliver solutions. The national government has also played a crucial role, particularly in providing finance for R&D, setting nationwide energy efficiency standards and encouraging knowledge-sharing alliances. Supportive actions undertaken by key stakeholders to implement eco-neighbourhoods in Sweden are as follows⁴².

⁴² Based on LSE Cities 2013.

City Government

–**Leadership and strategy.** Driving new green solutions through leadership and master planning of Hammarby Sjöstad. Giving business the confidence to invest in 5-10-year research programmes through a long-term commitment to eco-districts.

–**Finance.** Public endowment with US\$ 910–1,060 million for Hammarby Sjöstad from the City’s budget. Major costs included land decontamination and compensating existing on-site companies to clear the area.

–**Regulation.** Owning the brownfield sites provides strong policy control over environmental and economic outcomes. Setting energy efficiency objectives of 55 kWh/m² for all buildings on land designated by the City and working closely with partners to develop solutions for delivering on the target.

–**Partnership assembly.** Creating a platform at the Royal Seaport Innovation Centre where different companies can innovate.

National Government

–**Finance.** Contributing national financing for Hammarby Sjöstad and other eco-districts with the Local Investment Programme (LIP). Endowment of sustainable urban projects through a SEK340 million fund managed by the Delegation for Sustainable Cities. Supplying 50% of R&D project capital through VINNOVA (Sweden’s R&D funding agency) for some private sector green innovation projects at Royal Seaport. Leveraging 50% private sector finance. Supplying finance for Royal Seaport’s smart grid with the Swedish Government’s Energy Department.

–**Regulation.** Setting national energy efficiency standards of 90 kWh/m² for non-electric heating with an obligation to comply.

–**Partnership building.** Providing a forum through the Delegation for Sustainable Cities where businesses can discuss solutions and innovation for green projects.

Business

–**Finance.** Matching 50% public investment from VINNOVA with 50% private capital for various R&D projects at Royal Seaport.

–**Partnership building.** Actively participating in the city’s energy efficiency standards group, the Royal Seaport Innovation Centre, including the Smart Grid and ICT.

Research Institutes

–**Partnership building.** Providing R&D expertise for Hammarby Sjöstad and Royal Seaport. e.g. in construction, transport, energy, ICT.

ENSURING DESIGN QUALITY AND PLANNING CONTROL

Achieving a high-quality outcome will require the support and commitment of many people. This involves

- Understanding what is required when and by whom.
- Grounding design work by sound practices through a collaborative, well-managed process.
- Ascertaining how to protect the design quality of the scheme and to ensure the place created will reflect stakeholders’ aspirations.

Planning control processes must address the following⁴³.

- **Project vision and goals.** Establishing a strong vision is vital to build consensus on expectations and understanding what motivates the stakeholders. Express the vision as a set of outcomes. These become more explicit with design exercises. The concepts might be recorded in an agreed vision statement. Objectives should be developed into explicit design ideas.

⁴³ English Partnerships and Housing Corporation 2007.

- **Collaborative working.** This will enable all parties to inform and influence the evolution of a scheme, avoiding conflicts downstream. Spatial planning will draw various stakeholders together into a team, understanding issues beyond pure physical land-use planning.
- **Robust project governance.** A management structure minimizes potential delay and risk. The aim is to build confidence and consensus about the plan before producing an application and entering the formal planning process. This should clarify roles and responsibilities, identify missions, and evolve a plan and a work programme.

Sustainable neighbourhood projects that adopt a long-term quality control structure are usually those led by the public sector, and comprise a significant undertaking for transforming an area. The most practical approach is to create a statutory agency, such as an urban development corporation, with the task to deliver the programme. A project sponsor acting as the main promoter will have strong supervision over the design quality. This approach also provides opportunities to improve design by applying lessons

SECURING PLANNING AND TECHNICAL APPROVAL

Overseeing a project through its detailed steps to obtain planning and technical permission is critical in delivery. Each scheme needs the approval of many agencies, including local authority planning and management services, utility suppliers, building regulations and building codes. Securing these authorizations should enhance the original design concepts rather than compromising them. Wide-ranging negotiations may be necessary. Conflict resolution will need a robust project management process, effective collaborative work and a vision shared by all players. Consultation of all stakeholders at an early point – ideally at the design stage – facilitates

PHASING DEVELOPMENT

Neighbourhood development is a long and resource-consuming undertaking. A staged approach is the key to long-term success. Phasing consists in planning according to factors such as the time frame, availability

learned from previous stages. This requires considerable upfront resources as it needs ongoing project management and a call for tenders for each phase. However, the project sponsor can profit from increased values as later steps occur. The quality can be controlled through agreements and licensed construction. Contracts must have sufficient flexibility to allow standards to rise as the development progresses.

The landowner may consider entering a joint venture partnership. When this approach is adopted, the parties must approve in a memorandum of understanding the objectives and requirements, how to apply them and how to share the benefits.

If the landowner is looking to maximize capital receipts or minimize risk exposure to a scheme, it may be more appropriate to seek a straightforward sale on condition. He can still play an effective role through the development of a master plan and design codes. When selling a site, resources should be available to ensure compliance with legal obligations guaranteeing quality.

further detailed technical agreements. The approach must be pursued throughout the approval procedure to ensure that the required changes don't reduce the design quality. The process should deliver the priority components of transport, streets and service infrastructure to improve the quality of life in the short and long term. The concern for excellence must extend to the construction period. It must influence on-site and off-site building. It must inform the early handover of elements upon which the emerging community depends, and how this new community can live alongside construction.

of funds, priority to the city, possible risks and required responsibilities of stakeholders. 'Quick wins' are usually the first pursuits to take place, as they bring about positive change with little risk or financial/time

limitations. This allows development to improve public buy-in and reputation. Long-term planning of higher risk, financially or resource-intensive activities provides a buffer for the unexpected, potential fund delays and budget constraints⁴⁴. A scheduling strategy should

accurately represent the city's priorities, the considerations of resources at stake and the possible liabilities at each stage. An effective phasing approach must include risk management techniques that can avoid common pitfalls⁴⁵.

Phasing Methodology in Five Steps⁴⁶

Step 1. Define the activities

Identify and list operations, specifically linked to achieving the plan desired outcomes. For example, strengthening pedestrian mobility requires actions such as widening sidewalks, improving crossings, building pedestrian facilities. Recognize 'Quick Win' actions at this point. These projects involve minimal risk and are able of succeeding. They help set the scene for the next stages, fostering greater public acceptance.

Step 2. Define the steps for each activity

Define the stages that each activity should go such as planning and design, implementation and monitoring. For each phase, the resource requirements vary.

Step 3. Define the time frame and resources for each phase.

Identify the time, resource and budget needs. Plan a buffer for the unexpected, to avoid delays or cash flow problems during the next steps.

Step 4. Define scheduling and staging.

Define the programming and phasing based on the following elements:

- Priority to immediate imperatives, ease of implementation. Identification of 'Quick Win' projects.
- Resource consideration such as the availability of equipment or personnel. Plan the distribution of resources with the Critical Path Method or a similar method.
- Possibility of risks at each stage.

Step 5. Identify stakeholders who will manage each activity.

Define roles and responsibilities, including planning, execution and post-implementation. Recognize accountability mechanisms to ensure timely delivery.

The phasing of the sites has a significant impact on the success of a programme. The staging sequence of a project can raise its profile, provides facilities and amenities to inhabitants at the right time, and help create a community. The establishment of public space and the provision of essential facilities at an initial stage can define a destination and influence the use patterns. For example, early public transit and community amenities will ensure that the first residents aren't dependent on the car. However, some facilities require a critical mass to be viable. Phasing decides early

premises, their location, who will supply them, and how these will evolve with development.

In large public sector regeneration programmes, it may be beneficial to use a design-led development company to create a tailor-made programme, establishing the character of the area. The design quality is crucial because the first phase will serve as a reference for the following stages. To maintain high design level, make sure that in later stages, when larger volumes might be a priority, good design performance remains a requirement for participation in the scheme.

⁴⁴ World Bank 2018b.

⁴⁵ Carlton and Fleissig 2014.

⁴⁶ This box is adapted from World Bank 2018 c.

Consider staging options early in the planning process.

They should come after initial site surveys relating to land ownership, site conditions and constraints, and title review. The master plan should define the schedule and the timely delivery, as some elements of an area may depend on securing the pre-lettings or sales. Staging should also allow flexibility to respond to changing market circumstances. If several developers build the project, with amenities put into use in later phases, it may be necessary to obtain planning contributions or tariffs from earlier steps. This should be integrated into the business model. A staging plan comprises three main components.⁴⁷

- Construction sequence and infrastructure/utility delivery plan.
- Delivery of facilities at appropriate thresholds.

- Development parcel release structure to speed early delivery of amenities while optimizing initial revenues to offset infrastructure investment. Planned release of later sites will benefit from locational value created.

Development must secure the necessary infrastructure at the right time. This may include early endowments in mixed uses. Schools and other public amenities can be scheduled as part of an agreement between the developers and public authorities. The business model must consider the likely impact of these investment thresholds on the cost, the value of properties and land, and the pace of sales. The desire for quick results shouldn't compromise the quality of the project as a whole. Short-term gains shouldn't be achieved at the expense of medium – and long-term value creation.

⁴⁷ English Partnerships and Housing Corporation 2007.

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