URBAN PATTERNS FOR A GREEN ECONOMY
CLUSTERING FOR COMPETITIVENESS

UN HABITAT
FOR A BETTER URBAN FUTURE

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Cover photo: Thousands of young employees work in shifts covering 24 hours at this call centre in Uberlândia, Brazil, answering customers scattered across the globe and strengthening the city's position as a logistics hub © UN-Habitat/Alessandro Scotti

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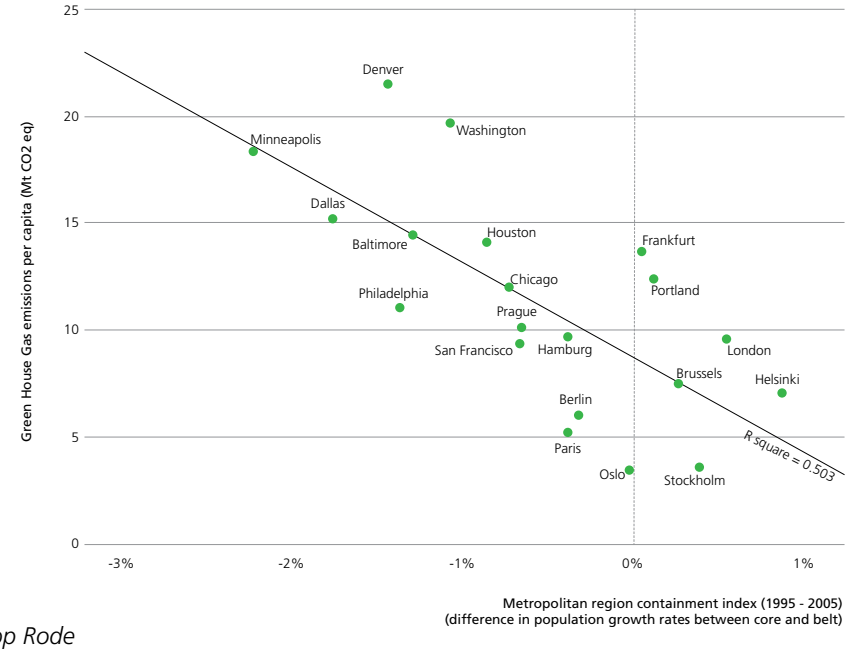
Foreword

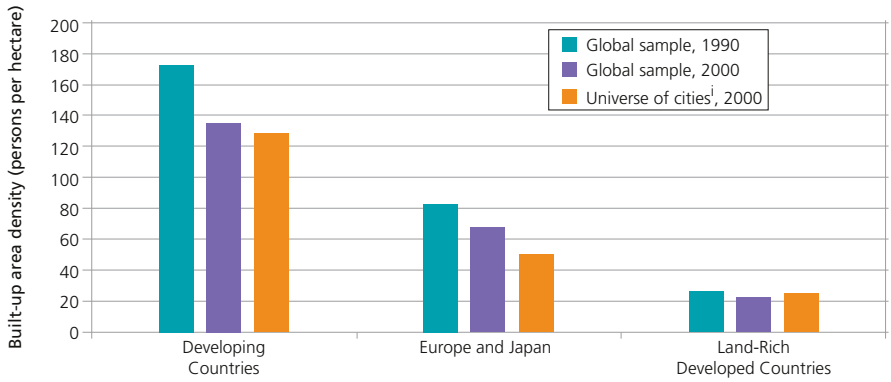
The city is one of the highest pinnacles of human creation. Concentrating so many people in dense, interactive, shared spaces has historically provided distinct advantages, that is, agglomeration advantages. Through agglomeration, cities have the power to innovate, generate wealth, enhance quality of life and accommodate more people within a smaller footprint at lower per-capita resource use and emissions than any other settlement pattern.

Figure I: **Greenhouse gas emissions and containment index for selected metropolitan regions**



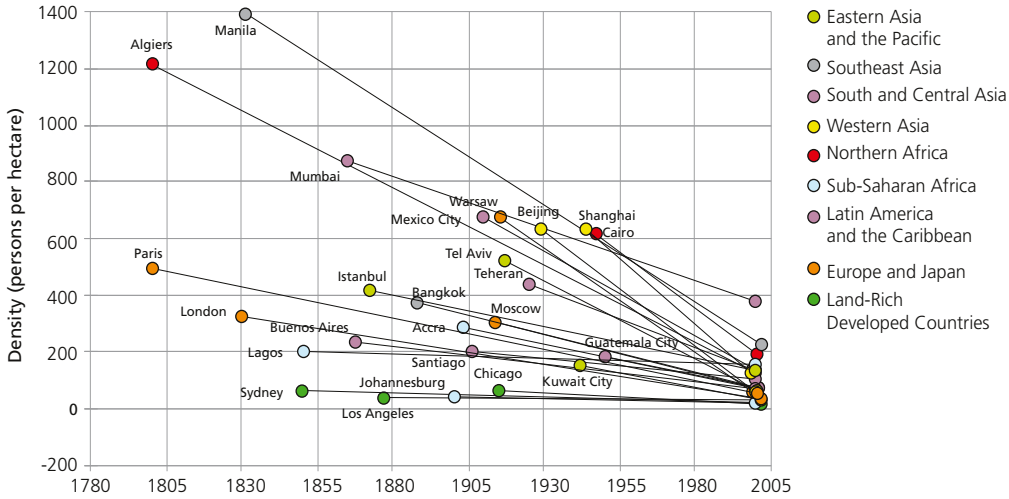
Or so they could. Increasingly, cities are forfeiting many of the benefits that agglomeration has to offer. Two meta-studies of urban land expansion have shown that over the last two decades most cities in the world have become less dense rather than more,[1,2] and are wasting their potential in ways that generate sprawl, congestion and segregation. These patterns are making cities less pleasant and equitable places in which to live. They are also threatening the earth's carrying capacity. And they are most

Figure II: **Average Built-up Area Densities in Three World Regions**



Source: Making Room for a Planet of Cites, by Shlomo Angel, Jason Parent, Daniel L. Civco, and Alejandro M. Blei. © 2011. Lincoln Institute of Land Policy, Cambridge, MA.

Figure III: **The General Decline in Built-Up Area Densities in 25 Representative Cities, 1800-2000**



Source: Making Room for a Planet of Cites, by Shlomo Angel, Jason Parent, Daniel L. Civco, and Alejandro M. Blei. © 2011. Lincoln Institute of Land Policy, Cambridge, MA.

i This refers to 3,646 large cities with a population of over 100,000 or more.

acute in fast-growing cities, particularly those with the lowest institutional capacities, weakest environmental protections and longest infrastructure backlogs.

Increasingly, city managers wish to learn by example. Rather than more theory and principles, they want to know what has worked, what has not, and which lessons are transferrable to their own contexts. There is much information available, but little time. UN-Habitat has developed these "quick guides" for urban practitioners who need condensed resources at their fingertips. The aim is to suggest patterns that can help cities and city-regions regain these inherent advantages in a time of increased uncertainty and unprecedented demographic expansion.

More than half the global population now lives in towns and cities. By the year 2050, UN-Habitat research projects that that figure will rise to two-thirds. This rapid, large-scale concentration of humanity in the world's cities represents new challenges for ingenuity, and numerous opportunities to improve the way in which human habitats are shaped. Most of this population growth will be in the cities of developing countries, which are expected to grow by an additional 1.3 billion people by 2030, compared to 100 million in the cities of the developed world over the same period.[3]

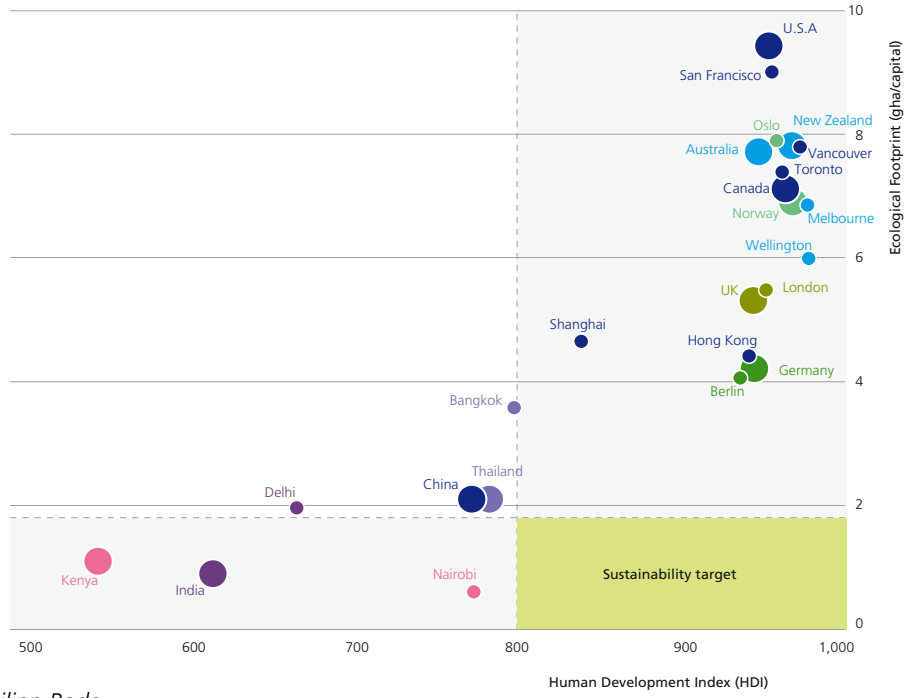
While urban population growth rates are stabilizing in regions which are already predominantly urban (such as Europe, North, South and Central America and Oceania), regions with a higher proportion of rural population (such as Asia and Africa) are likely to see exponential rates of urban population growth in the coming years.[4] Most urbanization is likely to occur in cities relatively unprepared to accommodate these numbers, with potential negative repercussions for quality of life, economic development and the natural environment.

Although the percentage of the urban population living in slums worldwide has decreased, the absolute number of people living in slums continues to grow.[5] No less than 62 per cent of all urban dwellers in sub-Saharan Africa live in slums, compared to Asia where it varies between 24 per cent and 43 per cent, and Latin America and the Caribbean where slums make up 27 per cent of the urban population.[6] If these growing cities are to be socially sustainable, new approaches will be required to integrate the poor so that the urbanization process improves inter-generational equity rather than entrenching socio-spatial fragmentation. Privatized models of service delivery that discriminate between consumers based on their ability to pay threaten to worsen inequalities,[7] and require carefully considered parameters to ensure that the poor are not disadvantaged.

According to a recent World Bank study, urban population growth is likely to result in the significant loss of non-urban land as built environments expand into their surroundings. Cities in developing countries are expected to triple their land area between 2005 and 2030, with each new city dweller converting an average of 160 metres^2 of non-urban land to urban land.[8] Despite slower population growth, cities in industrialized countries are likely to see a 2.5 times growth in city land areas over the same period due to a more rapid decline in average densities when compared to their developing country counterparts.[9] As built environments become less dense and stocks of built up land accumulate, the amount of reproductive and ecologically buffering land available for ecosystems and food production is diminished, reducing the ability of city-regions to support themselves.[10]

While international trade has made it possible for cities to meet their demands for food, water and energy with imports from faraway lands, it is becoming increasingly apparent that the appetite of the world's

Figure IV: **Ecological Footprint and Human Development Index for selected countries and cities**



© *Philipp Rode*

growing and increasingly affluent population is coming up against limitations in the planet's ability to support human life on this scale. It is estimated that our addiction to oil will result in a peak in oil extraction within the next decade, leading to dramatic increases in the costs of fuel, mobility, food and other imports. Greater demand for potable water, combined with changing rainfall patterns, the depletion of aquifers and pollution of groundwater, is likely to see increasing competition for scarce fresh water resources, raising the possibility of conflict in the near future.

The ability of ecosystems to continue providing biotic resources like wood, fish and food, and to absorb manmade wastes - commonly referred to as the earth's "bio-capacity" - is also diminishing. Comparing global ecological footprints to the earth's available capacity shows that, at current rates of resource use, we are exceeding bio-capacity by 30 per cent,[11] and approximately 60 per cent of the ecosystems we depend on for goods and services are being degraded or used in an unsustainable manner[12]. We are living off the planet's natural capital instead of the interest from this capital, and there are already signs of the devastating effect this will have on our societies and economies in depleting fish stocks, loss of fertile soil, shrinking forests and increasingly unpredictable weather patterns.[13]

The global population is reaching a size where cities need to start thinking beyond their immediate interests to consider their role as nodes of human consumption and waste production in a finite planet that is struggling to keep pace with humanity's demands. If cities are to survive, they must acknowledge the warning signs of ecosystem degradation and build their economies in a manner that respects and rehabilitates the ecosystems on which life

depends. If cities are to prosper, they must embrace the challenge of providing shelter and uninterrupted access to water, food and energy and improve quality of life for all of their citizens.

The way in which city spaces, buildings and infrastructural systems are planned, designed and operated influences the extent to which they encroach on natural ecosystems, and locks them into certain modes of consumption from which they struggle to deviate. Urban activities have direct and indirect consequences for the natural environment in the short, medium and long term, and their scale of influence typically extends far beyond the boundaries of what is typically considered to constitute "the city". Managing the indirect, distant and sometimes obscured impacts of city decision making in an increasingly globalized world requires appropriate governance mechanisms that improve cities' accountability for the resources they rely on.

As nexuses of knowledge, infrastructure and governance, cities represent a key opportunity to stimulate larger scale change toward green economies. In a world where cities are increasingly competing against each other economically, where weather patterns are unpredictable and low resource prices can no longer be assumed, cities need to proactively shape their economies and operations in preparation for an uncertain future. To manage risk in a democratic manner, a balance will need to be struck between deliberative decision making processes and centralized master planning. This can be done by empowering planning professionals to respond quickly and effectively to evolving developments without compromising longer term shared visions of a better city[14].

This guide is one of a set of four aimed at inspiring city managers and practitioners to think more broadly about the role of their cities, and to collaborate with experts and interest groups across disciplines and sectors to promote both human and environmental prosperity. The guides are based on the outputs of an expert group meeting hosted by UN-Habitat in February 2011 entitled *What Does the Green Economy Mean for Sustainable Urban Development?* Each guide focuses on one of the following cross-cutting themes:

Working with Nature

With functioning ecosystems forming the foundation for social and economic activity, this guide looks at how built environments can be planned to operate in collaboration with nature. It looks at how to plan cities and regions for ecosystem health, focusing on allowing sufficient space for natural systems to continue providing crucial goods and services like fresh water, food, fuel and waste amelioration.

Leveraging Density

This guide looks at the relationship between built and natural environments from the perspective of cities, and considers how their impact on ecosystem functioning might be reduced by making best use of their land coverage. Planning the growth of cities to achieve appropriate densities and providing alternative forms of mobility to private vehicles help to slow urban expansion onto ecologically sensitive land, and can reduce citizens' demand for scarce resources by sharing them more efficiently.

Optimizing Infrastructure

Considering urban infrastructure as the link between city inhabitants and natural resources, this guide looks at how infrastructural systems can be conceived differently in order to help all city residents to conserve resources. It introduces new concepts and approaches to the provision of infrastructural services, such as energy, water and waste treatment, and demonstrates

how infrastructure investments can act as catalysts for urban sustainability.

Clustering for Competitiveness

Taking a broader perspective, this guide looks at city regions and how they can be more optimally planned to achieve economic objectives in a manner that does not waste local resources. It looks at how competitive advantage can be achieved at a regional scale by encouraging cooperation between cities with complementary areas of specialization. It also considers how innovation for green economic development can be encouraged through the clustering of industries, and through collaborations between government, the private sector and academia.

Glossary

Agglomeration economies: Advantages that arise from increased density of economic activity.

Decentralization: The spread of power away from a major centre to other cities and regions.

Externality: Side effect or consequence of an industrial or commercial activity that affects other parties without this being reflected in the cost.

Globalization: The technological, political and economic changes resulting from the increasingly global nature of the way activities are carried out.

Infrastructure: The physical and organizational structures needed for the operation of a society or enterprise, or the services and facilities necessary for an economy to function; this includes transport infrastructure, universities, airports, ports, healthcare infrastructure.

Innovation: Innovation is the creation and successful implementation of new ideas and inventions that make a real difference through the generation of tangible outcomes with social and/or financial value.

Polycentricism: Principle of developing multiple centres within a region to be complementary in role through city specialization.

Strategic facilities: Facilities such as good harbours, an international airport, universities and a financial centre strengthen the competitiveness of a city-region and support value chains throughout the area.

Triple helix collaboration / innovation: Triple helix collaborations / innovation refer to collaborations / innovations where three helixes namely government, industry and academia play their specific roles.

Urbanization: Urbanization is the process in which the number of people living in cities increases compared with the number of people living in rural areas.

Contents

Passengers gather at Tetouan's central bus station, which is the hub for public transport in this region of Morocco © UN-Habitat/Alessandro Scotti

Introduction 1

This quick guide develops an argument that through strategic investment in physical infrastructure, in combination with the diversification of economies, cities will start to play a specialised role in polycentric urban development. It is argued that a number of green economy outcomes may be reached through efficiencies and shared infrastructure, rather than duplication. The central concepts to this strategy are city competitiveness and local and regional economic development. Furthermore, it is suggested that green economic development can be achieved through the development of green clusters and green jobs. The guide mainly grapples with the perceived trade-off between economic development and environmental protection. This is a key issue addressed in the guide and it explores pathways of how both of these goals may be achieved in union.

In **Section 2**, this guide provides a brief overview of key challenges facing city-regions and cities that are aiming to achieve competitive advantage. The forces of globalization are found to have an immense effect on the basis and level on which city-regions are competing. This increases the need for regional planning and strategic competitiveness initiatives to position regions to achieve green economic development and attract international investment.

In **Section 3**, the concept of the green economy is explained and the key risks and challenges, especially for developing nations, are clearly articulated. The section provides a rationale for competitiveness as a strategy and also highlights clusters and polycentric urban development as key mechanisms for achieving competitive advantage.

The key design principles that are developed in **Section 4** suggest a systems and network approach coupled with the adoption of supply-side, as well as demand-side considerations for the design of interventions. The key mechanisms that are suggested for the development of competitive advantage are:

- Clustering, as this will provide a framework for focused support for innovation activities and creating a competitive advantage. These clusters need to be stimulated to exhibit self-exploration activities for green economic development.

- Strengthening the knowledge infrastructure and linkages between innovation role players to support growth in clusters for economic development.

- Discovering new areas of competitive advantage through cooperation and complementary activities on a regional scale; for this purpose polycentric urban development principles should be adopted.

The design principles also provide key principles for a governance framework through which capacity will be developed and creative governance and transition management principles will be implemented.

Section 5 of the document provides a step-by-step process outline for the various phases to be implemented for developing a competitiveness and innovation strategy that is cognizant of city-level and regional interests.

The following case studies will be discussed in-depth in **Section 6** and aim to provide practical examples of the implementation of the principles discussed in this guide. Below is a short summary of each of these cases.

- In **Barcelona**, Spain, 22@Barcelona: 22@ provides a good example of how triple helix partnerships were created in the development of an innovation region.

- In **Newcastle**, England, the Newcastle Science City project approach was to focus on triple helix collaborations and supply-side interventions such as the training and mentoring of young entrepreneurs to approach their businesses from a demand-led approach.

- In **Gauteng** province, South Africa, the Gauteng Green Economy Strategy clearly illustrates the green economic development principles adopted in this quick guide as the strategy suggested a focus on non-traditional sectors and the development of green clusters for green jobs.

- The **Dezhou** Solar Valley, China, clearly illustrates the development of green clusters for green jobs in the Dezhou Solar Valley. Also highlighted is the benefit of stimulating the demand side through the implementation of solar technologies for the city's energy needs.

- In **Delhi**, India, the Delhi Commonwealth Games case study shows how, with a lack of strategy and poor planning, opportunities to build competitiveness brought about by large infrastructure investments in preparation for hosting the third largest multi–sporting event in the world were not fully realised.

- The study of the Cleantech Innovation Park explores how stakeholder conflict has affected the establishment of an innovation park in **Zurich**, Switzerland. The aim is to highlight the need for stakeholder management if new initiatives are implemented.

- The case study on **Randstad**, the Netherlands, shows that through the creation of synergies between cities in a region, the region could indeed be more than the sum of its parts through complementarity and cooperation.

- In **Kitakyushu**, Japan, the Kitakyushu Eco-Town Project's aim was to achieve zero emissions and zero waste by using all waste as materials in other industries. Close collaborations between universities, government and industry, clustering mechanisms, utilization of existing industrial infrastructure and

good communication are amongst the factors that have led to huge successes for this project.

Lastly, **Section 7** provides a short key summary of the findings and suggested approach.

Shipping containers arranged in the newly built PTP commercial harbour in Johor Bahru, Malaysia which overlooks the Malaysia-Singapore Strait © UN-Habitat/Alessandro Scotti

Green Development Challenges and Trends

2

This section provides a broad outline of global macro-trends and what their implications are for cities and regions to compete on the global stage. It highlights a range of global challenges, their impact on economic development and the implications for competitiveness strategies.

2.1. Climate change is a serious risk to poverty alleviation

Climate change and shifting weather patterns have a global impact as they may cause:

- Threats to continued food production with potential implications for creating ethnic tension, political conflict and civil unrest;
- Rising sea levels potentially causing flooding;
- Climate change-induced migration leading to displacement of individuals;
- Reduced bio-diversity in plants and animals which in turn will affect the robustness of ecological systems;
- Threats to continued economic development in those developing countries that are heavily dependent on natural resources, especially agriculture, and that have constrained capabilities to adapt to the changing climate.[15]

2.2. Urbanization, especially in developing countries, puts pressure on resources and infrastructure

The urbanization trend may result in a number of difficulties, such as: [16,17,18]

- Inadequate infrastructure and planning of infrastructure to cope with growing populations in cities;
- Emergence of slums and sub-standard housing;
- Increased traffic and commuting times;
- Difficulties with the timely access of essential services; and
- Administrative difficulties.

These difficulties may negatively impact on cities' abilities to attract investment and on new industries' ability to establish themselves in these areas; thereby negatively impacting on economic development prospects in these locations.

2.3. Decentralization policies have limited success

Many countries in the world are engaging in processes to decentralize functions from major centres. This process was originally initiated to have more equitable and efficient service delivery by spreading functions such as administration, political control and finance throughout a region or country. The intention was also to improve policy-making through increased public participation. The effectiveness of this policy may, however, be questioned because capacity building and effective management practices are lacking in many cases.[19,20]

2.4. Economic growth: The economic crisis is seen by many in the developed world as an opportunity for green growth

Many administrations in the developed and developing world see investment in a green economy as an opportunity for renewed economic growth on environmentally and socially sustainable grounds. Examples include the United States, which included energy-saving technologies and green activities as part of their stimulus package.[21] Similar measures have been implemented in countries such as South Korea and South Africa, where economic development strategies increasingly include sustainability practices and the establishment of non-traditional sectors for a green economy.

2.5. Globalization has had profound impact on the role of cities in regional development

Globalisation has resulted in increased interconnectedness of cities across the globe and is increasing economic competition between cities and regions. Cities need to react to the trend by effectively managing and mitigating risks associated with globalization.[22,23]

2.6. Implications of global trends for green economic development

The combination of urbanization and globalization and increased pressure for accountability means that local governments have additional responsibilities. Questions are asked about how to develop economically in relation to the international community, while governments are pushed to think about social justice and equity.[24]

The importance of location is now centre stage in the debate on economic development. Contrary to some who believe that the effect of globalization and the improvements in telecommunications will make location, and therefore the city, less important, many economic geographers, economists and policy-makers think that the importance of location has actually increased with globalization. It is generally believed that regional distinctiveness, and thus regional economic development, is increasingly seen as the focus for increased wealth creation and world trade.[25,26,27,28]

"In a global economy – which boasts rapid transportation, high speed communications and accessible markets – one would expect location to diminish in importance. But the opposite is true. The enduring competitive advantages in a global economy are often heavily localized, arising from concentration of highly specialized skills and knowledge, institutions, rivalry, related businesses and sophisticated customers." (Porter, 1998:90)

It is also increasingly acknowledged that by relying on market forces alone the world will not be successful in making the transition to a green economy. The literature widely acknowledges the various roles that will need to be played by governments, industry, financiers, academia and society. Many countries have, therefore placed balancing economic growth with sustainability practices and environmental protection on their development agendas.

Highly dense, competitive urban spaces allow for specialization, as is the case in this informal neighbourhood in Onitsha, Anambra State, Nigeria © UN-Habitat/Alessandro Scotti

Importance of Competitiveness for Green Development

3

3.1. The importance of transitioning to a green economy

The concept of the "green economy" is appealing because it aims to respond to the wide range of crises the world has faced recently, namely climate change, food crises and economic crises.

Although the perception may exist that the developed world has a large focus on technology for developing green economies; it has been increasingly acknowledged that green economic development need not only focus on high technology. Possibilities are also progressively being sought to consider low technology and high job creation industries. The frameworks for planning green economies therefore now aim to include not only a focus on skills and technology development, but also on factors for poverty alleviation.[29,30] The World Economic and Social Survey 2011[31] provides insight into this line of reasoning:

"A global green technological transformation, greater in scale and achievable within a much shorter time-frame than the first industrial revolution, is required. The necessary set of new technologies must enable today's poor to attain decent living standards, while reducing emissions and waste and ending the unrestrained drawdown of the Earth's non-renewable resources.

"Staging a new technological revolution at a faster pace and on a global scale will call for proactive government intervention and greater international cooperation. Sweeping technological change will require sweeping societal transformation, with changed settlement and consumption patterns and better social values."[32]

Green economic development sets out to provide a solution to the perceived opposing objectives of economic growth and poverty alleviation, and the protection of the world's ecosystems. Core to this concept is the realization that the world needs a transition from the current systems that caused crises to an integrated system that "proactively addresses and prevents crises".[33]

Much work has been done to understand what the pathways towards the green economy may look like. Certain key enabling conditions are:[34]

- Establish sound regulatory frameworks;
- Focus government investment on areas that will stimulate the greening of economies and the further development of labour intensive industries;
- Limit government spending on industries that deplete natural capital;
- Promote taxes and market-based instruments to promote investment in innovation and the greening of industries;
- Invest in skills development and capacity development and
- Strengthen international governance.

Useful Resources

UNEP. (2011). GREEN economy: Pathways to Sustainable Development and Poverty Eradication - A Synthesis for Policy Makers. Available at: *http://www.unep.org/greeneconomy/Portals/88/documents/ger/GER_synthesis_en.pdf*

UN. (2011). Working towards a Balanced and Inclusive Green Economy: A United Nations system-wide perspective, prepared by the Environment Management Group. Available at: *http://www.unemg.org/Portals/27/Documents/IMG/GreenEconomy/report/GreenEconomy-Full.pdf* [Accessed on 27 February 2012.]

3.1.1. What are green jobs?

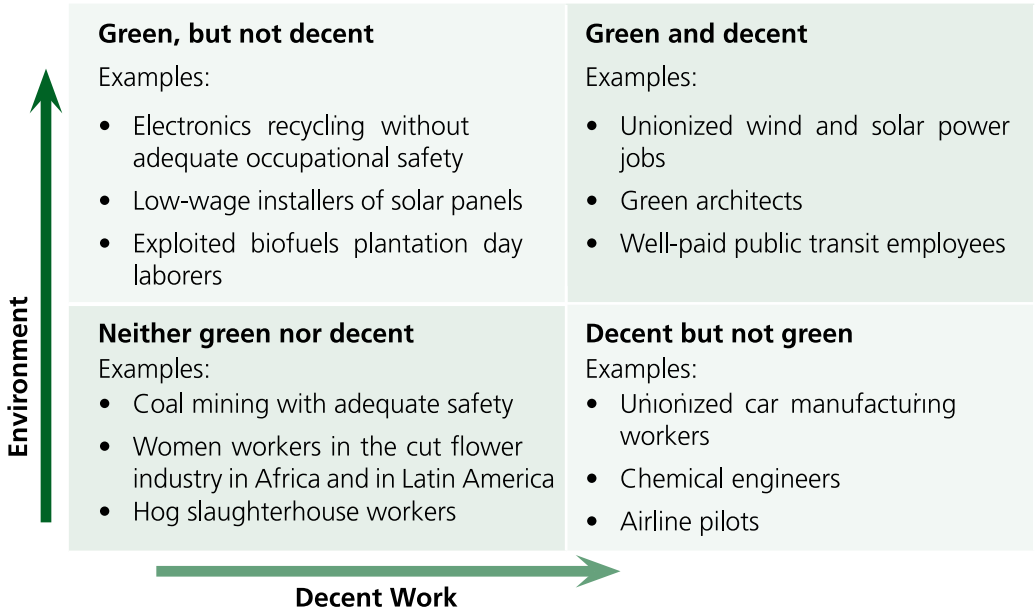
Although no single and official definition for green jobs exists, general agreement is that green jobs are those that contribute to the preservation and restoration of environmental quality. These may include:[35]

"…positions in agriculture, manufacturing, construction, installation and maintenance, as well as scientific and technical, administrative, and service-related activities, that contribute substantially to preserving or restoring environmental quality. Specifically, but not exclusively, this includes jobs that help to protect and restore ecosystems and biodiversity; reduce energy, materials, and water consumption through high-efficiency and avoidance strategies; decarbonise the economy; and minimize or altogether avoid generation of all forms of waste and pollution." [36]

A wide array of skills, educational backgrounds, and occupations comes under the heading "green jobs". They may exist in research and development; professional fields, such as engineering and architecture; project planning and management; auditing; administration, marketing, retail, and customer services; and in many traditional blue-collar areas such as plumbing or electrical wiring. Green jobs may also exist outside the private sector, for example in government offices (standard setting, rule-making, permitting, monitoring and enforcement, support programmes, etc.), in science and academia, professional associations, and civil society organizations (advocacy and watchdog groups, community organizations, etc.).[37]

The quality of these jobs is emphasized with a focus on adequate wages, safe working conditions, limited travelling time to and from work (time, money, fuel and emissions) and access to organized labour.[38] Although no precise definition for green jobs exists yet, the United Nations Environment Programme (UNEP) provides some guidance on these. (See Figure 3.1).

Figure 3.1: **Examples of green and decent jobs**



Source: Figure copied from UNEP[39], (2008). Green jobs: Towards decent work in a sustainable, low carbon economy.

As far as green jobs in the developed world are concerned, analyses has focused on factors such as changes in the total number of jobs, underlying job movements from one job category to another (e.g. change in job specifications) and the quality of jobs through the transition to a green economy.[40]

There is a lack of this kind of information for developing countries, which poses difficulties for developing effective policy to transition to a green economy. This problem forms the basis of projects such as the International Labour Organisation's Global Green Jobs Programme that is currently also investigating what the policy options for transitioning to a green economy will mean for developing countries.[41]

3.1.2. Challenges for transitioning to the green economy

Green economic development also entails risks and challenges, particularly for developing countries. For these countries economic development is feared to become more challenging. They are concerned that green economic development would be used to reinforce protectionist trends, it would have additional restrictions and conditions for international financial cooperation, and it may unleash new forces that could reinforce inequalities.[42]

A key risk for this approach is also that a "one size fits all" strategy may be adopted. Care should be taken to identify and deal with trade-offs that need to be made in various stages of development for a country. Environmental endowments and challenges differ widely between countries and should also be considered.[43]

The risks associated with the trade regime include using the environment for trade protection; gaining market access under the guise of green economic development;

and subsidized production in the industrial world without corrective measures for developing countries. Other fears are that developing countries may find it difficult to promote domestic green economy sectors, or that technical standards are too high for domestic exporters to meet.[44]

3.2. Is competitiveness important and what plays a role in achieving a "sustainable competitive advantage"?

As globalization and the transitioning to a green economy is causing cities and regions to increasingly compete with each other, much academic and policy attention has been focused on the notion of "competitiveness"[45,46].

Attempts have also been made to grapple with the perceived trade-off between economic development and environmental protection.[47] The paradigm of competitiveness has also seen a marked shift over the past few decades. Sustainability considerations in industrial policy and economic development have been highlighted by some authors; for example, with the introduction of frameworks for "sustainable competitive advantage".[48,49]

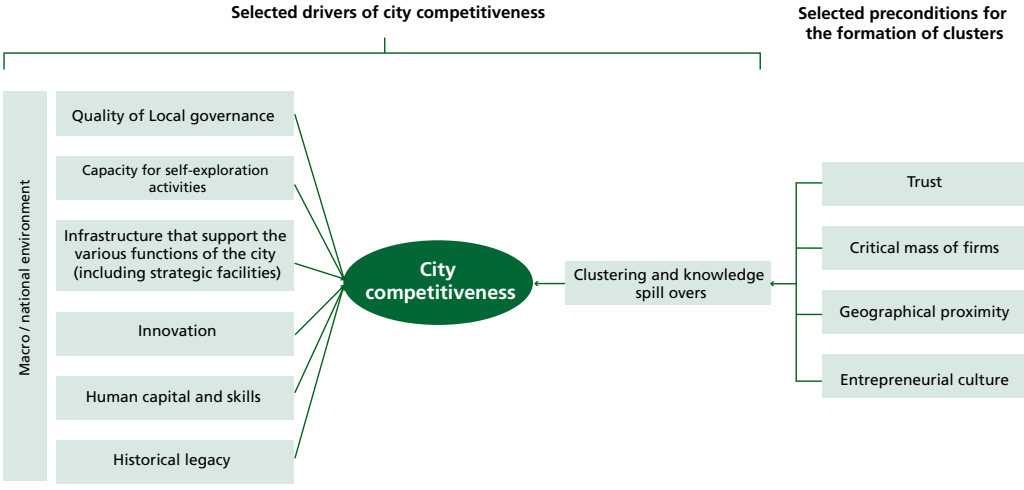
The literature treats the definition of competitiveness from two points of view:

- The spatial scale: This treats competitiveness on the geographical scale, for example city, regional or national competitiveness; [50,51,52,53,54] and
- The specialized functions space: This focuses on the competitiveness of cities or regions in terms of their functions, such as tourism, agriculture, finance or technology.[55]

Factors that contribute to a location's competitiveness can be referred to as "location factors". The following figure provides an overview of a synthesis from the literature of selected factors that have been identified as playing a role in the development of a location's competitiveness.

The literature acknowledges the central role that innovation, human capital and

Figure 3.2: Key factors that play a role in city competitiveness



the existence of competition on the local market plays in establishing competitive advantage. The same could be said for local governance. Globalization and the openness of economies have also resulted in a situation where these key drivers have become more important.[56,57]

History also matters because historical legacy and agglomeration economies (i.e. advantages that arise from increased density of economic activity) play an important role in driving competitive advantage. Two ways an agglomeration advantage could be achieved are:[58]

- Clustering of companies and businesses in the same industry (localization economies); and
- Clustering of firms and businesses in different industries (urbanization economies).

There is widespread acknowledgement of and interest in the adoption of clustering strategies and policies to overcome internal shortcomings to enable firms to join efforts and resources with other firms, universities, research councils and other public sector organizations. Mostly due to the growing appreciation of the importance of innovation by academics and policymakers, there exists a belief that clusters may be one of the most effective means of creating an environment where innovation can be stimulated.

Infrastructure is also an important factor driving competitiveness. Strategic facilities such as universities, harbours, ports etc. are widely believed to play a role in the competitiveness of a city. Infrastructure has a large impact on the cost of doing business and the quality of life that, in turn, play a role in attracting skilled labour and firms to the region. Strategic planning of facilities in cities may also feature in a more coordinated approach towards development on the regional and national levels.[66,67]

A stable macro environment is also important in establishing conditions for growth and competitiveness. Also, it is important to ensure that synergies between cities and neighbouring cities are planned for, because synergy must form part of an overarching national development plan. Therefore, the roles of national governments and provincial governments may also be important irrespective of how effective local policies are.[68,69]

When poor countries become richer the tendency is for their economies to become more diversified.[70] This expansion of activities carries on up to a relatively advanced level of development. A country's ability to expand the number of activities in the economy is, therefore, key to development success in developing countries, that is, its ability for self-exploration.[71]

Localization of economic growth: basis for the argument to develop clusters

Criticisms of the cluster approach by some academics address the pitfalls of blindly applying this mechanism without proper understanding of its limitations. It is, however, widely recognized that cluster-like processes and structures play a major role in shaping and reshaping regional competitive advantage.[59]

There are few who do not acknowledge the positive feedback about the existence of clusters in a region and their ability to attract more firms to the area.[60] The literature is also clear on the need to establish new, specialized facilities and infrastructure to satisfy cluster participants. Much work is being done on how clusters emerge and on what determines their long run evolution.[61,62,63,64,65]

Case study: Delhi post Commonwealth Games: world–city or urban fiasco?

The hosting of mega sporting events can provide opportunities for strategic investments in infrastructure that allow cities to cater for increased visitors in the short term while delivering ongoing benefits to permanent residents over the longer term. Delhi's hosting of the Commonwealth Games in 2010 was not fully realized as an opportunity to build its competitiveness; and a combination of poor planning, mismanagement and corruption resulted in delays, cost overruns, ecological damage and transgressions of human rights. While some strategic facilities, such as the upgraded airport and the extension to the Delhi metro, have strategic benefits, the vast sums of money spent on the games have largely failed to address the severe and chronic gaps in the provision of basic services to ordinary residents. (Full case study in Section 6.)

In developing countries however, it is often the case that the returns on new activities are difficult to gauge and therefore investment in new industries or businesses is limited. Information externalities and coordination externalities are usually the main reasons for this problem.[72]

Governments, therefore, could support the process of self-discovery and, to make this workable, a carrot and stick strategy by government is suggested. The carrot will be to support new activities and the stick will be the processes to phase out bad projects; it is suggested that support is subject to performance requirements and the close monitoring of these projects.[73]

3.3. The importance of inter-city networks and polycentric urban development in achieving competitive advantage

As competition has shifted from the level of the nation-state to the city-region level, attention has also shifted towards understanding spatial configuration and linkages between cities within a region. It is widely believed that the strategic planning and development of synergies and linkages between cities may contribute to finding new areas of competitive advantage and to marketing city-regions internationally.[74,75,76]

Policymakers and planners have also started to recognize that the coherent configuration of polycentric urban regions (PUR) may be an important focus area for policy making and planning. If these activities are engaged in on a city-region level, this may counter balance the negative impacts of cities competing with each other for high-level services, hi-tech industries, skilled labour, tourists and a marketable image. There may be opportunities within the larger system that will be unused or wasted through, for example, duplication.[77]

The explicit design and planning of PUR has become a feature in regional development strategies in many European countries through the inclusion of the polycentric urban regions concept in the European Spatial Development Perspective.[78,79] These regional clusters of cities are not always referred to as PURs but are sometimes called "urban networks" or "city networks". The network metaphor is often used to describe the complex nature and strong relationships that exists between centres in PURs.[80]

The polycentric urban region concept and emergence of polycentric urban regions is described by the following characteristics:[81,82]

- Clustering and the existence of a set of urban centres, i.e. within a region a number of cities will exist with a number of industry clusters concentrated in and around these centres.

- Interaction among centres, the level of economic interaction or linkage among a given set of centres.

- Centre specialization; the centres have specialized economic structures.

A number of potential advantages may arise with the emergence of polycentric urban regions:[83]

1. Greater agglomeration or external economies for businesses may be achieved from the potential to effectively pool assets spread across the region.
2. Functional specialization may arise from encouraging interaction between centres in a region. If such specializations are complementary rather than competitive, the polycentric urban region may benefit because the region could host a broader range of higher quality, metropolitan services to businesses, households, consumers, workers and tourists. This larger variety of services available to businesses and universities and other stakeholders may create further favourable conditions for innovation and would be an advantage in competing for investments in the region.
3. Regional planning may also result in an improvement in the quality of open space and improved spatial diversity. Through planning, uncontrolled urban sprawl could be avoided and the "green (and blue) networks" may be protected. This however requires a co-ordinated policymaking process from a regional rather than a local perspective.

Key challenges to this approach

Care should be taken with the potential advantages mentioned above that may result in attractive outcomes but may also have certain drawbacks. For instance, even though the coordination of the development of complementary facilities may result in higher variety of services, it may also require individual cities or centres to make some sacrifices by subordinating their own interests to the greater regional good.[84] An example of this is that a city may be asked from a regional level to lose a vocational training institute or specialized medical service to a nearby city. The risk is that the city will not be compensated for the loss of this service.[85]

This makes the development and existence of a regional framework for cooperation and coordination very important in dealing with these kinds of trade-offs. Without such a process or framework, local interests will prevail over the regional good which will block the exploitation of regional potential advantages.[86]

Recommended reading

Meijers, E. (2007). Synergy in Polycentric Urban Regions Complementarity, Organising Capacity and Critical Mass. PhD thesis. Delft University. Available at *http://repository.tudelft.nl/view/ir/uuid%3A983e9c4b-1cce-447d-bc56-9ca21ac46c21/*

The market area of Onitsha, Anambra State, Nigeria is strategically located at one of the only bridges crossing the Niger River, in this case the Transafrican Highway
© UN-Habitat/Alessandro Scotti

Achieving Competitive Advantage

4

This section provides recommendations on the approach, mechanisms and governance framework that need to be implemented to develop a competitive advantage and/or find new areas of competitive advantage.

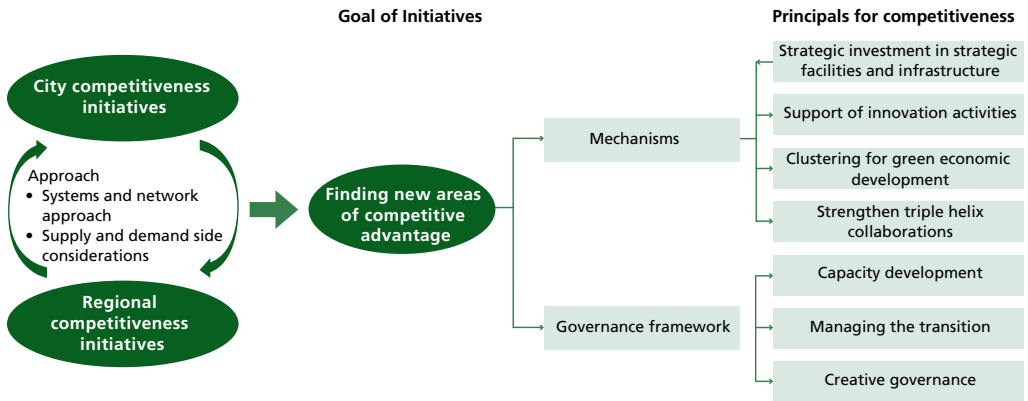
Approach: This section provides guidance on the analytical framework and approach to be adopted in designing initiatives to develop and find new areas of competitive advantage.

Mechanisms: A number of mechanisms to achieve a competitive advantage are developed. These include polycentric urban development, the implementation of green jobs for green clusters and strengthening of knowledge infrastructure and linkages between helixes to support innovation.

Governance framework: Governance of these measures is important as this addresses the framework from which government will stimulate and coordinate such activities. Capacity development, creative governance and transition management principles are suggested.

The following sections now carefully unpack these principles and provide guidance on concepts for planners and strategists.

Figure 4.1: Framework for principles



4.1. Approaching the design of initiatives for green economic development

4.1.1. The systems and network views should be adopted as an analytical framework

The systems and network views have been widely adopted in current academic literature on economics. This is also true for the literature on local economic development (LED) or local and regional economic development (LRED). A wide range of academic disciplines have influenced this field of study and ideas have been adopted from disciplines such as economic geography, urban planning, economic sociology, public administration and decentralization, systems thinking and regional economics.[87,88,89]

The development of thinking along these lines shows how the understanding of local and regional economic development has evolved; it now acknowledges that an economy consists of networks and dynamic systems of linkages that shape how people that operate in these systems make decisions and act. This has given rise to the concepts of "systemic competitiveness" and "systems of innovation", which have become prevalent in innovation and economic development thinking and practice.[90,91,92]

Of particular importance is that the systems approach aids in directing the analysis and determining what type of support needs to be set up at which level (local/regional/national/transnational) and what the possibilities for inter-regional cooperation are. This approach also helps to develop an analytical framework for identifying and analysing systemic weaknesses.

Illustrating the concept: Systems of innovation

According to Blanchard and Fabrycky,[93] systems consist of components with attributes and relationships between them. By using the systems view of innovation, the elements of a system of innovation can be defined by the following:

The systemic approach of innovation is based on the perception that innovations are ultimately brought about by the various organizations and the relationships between them.

Recommended reading

Rücker, A., and Trah, G. (September 2006). *Local and Regional Economic Development (LRED) Conceptual Framework, Challenges and Principles.* Available at http://led.co.za/sites/led.co.za/files/documents/204.pdf

Table 4.1: Defining the elements of an innovation system

Elements	Generic systems definition	Innovation system
Components	Operating parts of the system and consists of input, process and output	Organisations e.g. firms, government departments, research councils, universities
Attributes	Properties of the components which characterise the system	Institutional environment - the character and properties of the organisations e.g. absorptive capacity, R&D capacity
Relationships	The links between components and attributes	Linkages between organisations

4.1.2. Demand-side and supply-side considerations are important to design interventions

The systemic view also goes beyond the linear view in that it acknowledges the case for government intervention not only on the supply-side but also on the demand-side.[94]

In the process of developing and designing policies for driving green economic development, it is important to have a systematic analysis of demand side (for example, firms and their global competition challenges and consumer innovation needs) and the supply side (for example, technology development, skills development, technology transfer) to develop a robust and balanced regional competitiveness strategy. Interventions need to be designed to ensure that both the demand-side as well as the supply-side is stimulated. With the included focus of demand-side interventions the ability of the region to support self-exploration activities may be stimulated, thereby fostering a diversified economy.

Case study: Fostering innovation at Newcastle Science City, England

The Newcastle Science City is an example of how innovation can be stimulated by focusing on supply-side as well as demand-side measures. Its approach to creating new high technology companies was to focus on the training and mentoring of young entrepreneurs (i.e. a supply side intervention) to seek new technologies to meet identified market needs (i.e. a demand-led approach). The programme, entitled the "Newcastle Innovation Machine", has achieved great successes and resulted in the formation of many new companies. It is, however, an expensive model and it will take some years before the long-term success can be evaluated. (Full case study in Section 6.)

Although historically most countries have been more focused on supply-side interventions, the tendency worldwide is also increasingly to develop strategies and mechanisms to support the demand side of the equation. As an example, countries such as the United Kingdom have explicitly included it in its innovation strategies. Measures such as public procurement are effectively used to stimulate demand for innovation outputs.[95]

4.2. Mechanisms for developing competitive advantage

4.2.1. Regional competitive advantage: Generate synergies between centres through cooperation and complementarity

The key rationale for polycentric urban development is that in regional development, one city could not provide a complete range of economic functions, urban facilities or residential and business environments. This could be better achieved through strategic design and the coordination of development of specialized facilities within a region, thereby creating synergies between centres.

Synergy in polycentric urban regions is generated through:[96]

- Complementarity: The interplay of regional demand for more specialized services through the differentiation of economic and functional roles of cities for facilities.

- Co-operation: The development of a regional organizing capacity through which co-operation in the development of polycentric development can take place (discussed in more detail in the governance framework section).

It is argued that through the development

of complementary functions in the cities in a region, citizens will be able to have access to a wider range of functions. This is because the demand market for such services is the region, which is larger than the city, and will therefore give rise to a situation where more specialized, diverse and higher quality services and functions could be developed. Because of the physical separation of urban centres and firms, such advantages could be described as "regional externalities". Through this, new areas of competitive advantage may be discovered as complementarity is strongly linked to agglomeration economies.[97,98]

Although complementarity is a vague concept, (Meijers, 2007; Camagni and Salone, 1993), it is often cited in academic writings and policy documents. It can be defined as a result of supply and demand. For a number of centres to be considered complementary, two preconditions need to be satisfied (Meijers, 2005):

- **Differentiation:** The cities or centres need to be differentiated in terms of urban functions or activities.

- **Overlap of geographical markets of demand:** The geographical markets of demand for these urban functions/ activities or places must at least partly overlap. Urban functions/activities in one centre or city should provide services to business or households also making use of functions/activities in other centres.

Examples of complementarity.[99]

- "Two universities are complementary if they offer different academic education, while at the same time they recruit students from more or less the same region."[100]

- "Two hospitals are complementary when they provide for different medical specializations, or specialize in different kinds of treatment – for instance, standardized routine operations versus specialized knowledge / intensive care while serving more or less the same region."[101]

- "Two or more residential areas are complementary when they offer different residential milieus, thus providing alternatives to match the different preferences of a regional population."[102]

In order to achieve synergistic relationships between centres or cities in a polycentric region, connectivity between specialized centres is important because the success of such a strategy hinges on the ability of citizens to gain access to the services.

The following key design principles for polycentric urban development can be summarized (Grant Thornton, 2010):

- **Functional specialization:** For each centre a specialization needs to be developed based on its key competences;

- **Ease of accessibility:** Free flows of people and goods between centres are important. Therefore connectivity in terms of transport and information flows between nodes in the polycentric network needs to be established;

- **Cooperation and interaction:** A regional cooperative capacity is of high importance as key planning and design decisions needs to be coordinated between many parties. Cooperation, complementary in existence and synergy need to be carefully defined and fostered through the development of a regional cooperative capacity on many levels.

Case study: Randstad, the Netherlands

The Randstad case study shows that through the creation of synergies in a region, a polycentric urban region could indeed be more than the sum of its parts through complementarity and cooperation. The case study shows that:[103]

- The first mechanisms through which synergy could be achieved (namely cooperation) is increasingly prevalent in the Randstad region. Through formal and informal networks, a regional organizing capacity has been established;
- The second mechanism through which synergy could be created (namely complementarity) reveals that key cities each perform distinct roles within the region specializing in commercial services, manufacturing and transport, public administration, or trade and education. (Full case study in Section 6.)

4.2.2. Clusters provide a framework for focused support for green economic development

Through the systems view, clusters of innovative activity that may have competitive potential can be distinguished. If potential strong inter-firm clusters can be identified, public authorities are presented with a framework for focussed support efforts, alongside generic support actions.[104]

The following key readings may provide detailed overviews of various approaches and policies available to cluster policy makers and implementation professionals.

Recommended reading

Andersson, T., Serger S., Sörvik, J., Hansson, W. (2004). The Cluster Policies Whitebook, International Organization for Knowledge Economy and Enterprise Development (IKED). Available: *http://www.iked.org/Publications%20-%20Cluster%20Policies%20Whitebook.html*

Solvell, O., Lindqvist, G., Ketel, C. (2003). The Cluster Initiative Green Gook. Stockholm: BrommaTryck. Available: *http://www.cluster-research.org/greenbook.html*

Each cluster is unique and the concept can be applied differently in various situations. However, the White Book of cluster policies outlines seven elements for the notion of clusters. Not all the elements need to be present in each cluster, nor are they necessarily desirable. The central theme, however, is the importance of innovation and the stimulation of such activities:[105]

- **Geographical concentration:** Hard factors, such as external economies of scale, as well as soft factors, such as a learning region and processes and social capital, make firms locate in a geographic location;
- **Specialization:** There is a specialized core activity to which actors in the cluster are related;
- **Multiple actors:** Apart from firms, a wide range of actors form part of a cluster, such as public authorities, academics, financiers, and institutions for collaboration;
- **Competition and co-operation:** The actors in the cluster are related to each other through competitive and cooperative activities; for example, they compete in the market place but collaborate on product development;
- **Critical mass:** This is needed to achieve the inner dynamics of cooperation and competition;
- **The cluster life cycle:** Cluster initiatives are not temporary phenomena but have

a life cycle and a long term survival goal; they continuously have to adapt and change;

- **Innovation:** Innovation is key to the survival and continued existence of clusters as there is continued technological, commercial and/or organizational change.

The following key principles for cluster formation for green clusters for green jobs is extracted from the literature:

1. **Achieve consensus with stakeholder groups and investors:** Robust stakeholder management and consultation needs to be done to ensure that consensus is achieved regionally on what is required for a fundamental transformation of the regional economy to a green economy.

2. **Base strategies on robust calculations:** Robust cost-benefits analysis need to be done to understand the concrete costs and benefits of pursuing a green economy agenda in the full sense of the term. This step is key towards achieving consensus and to motivate implementation projects.

3. **The stimulation of self-exploration activities:** It is important to keep in mind that history matters and it takes considerable sustained investment for clusters to develop. For this reason it is suggested that to establish green clusters for green jobs, existing clusters in regions should be assisted to perform self-exploration activities to find new areas of competitive advantage.

4. **Consider development of non-traditional sectors:** A strategy for green economic growth may consider cluster development drives in non-traditional sectors to the economy for deep structural transformation towards green economic development.

5. **Green finance and attraction of investment into green clusters:** Through attracting investment from local municipalities, as well as large financiers, clusters may be developed to feed into wider industrial supply chains as a progressive conversion towards the green economy.

6. **Stimulation of demand-side for green products:** Illustrated through the Dezhou Solar Valley case study, the demand for solar products within the city provided the solar cluster with valuable opportunities to test and implement their products for demanding customers.

Clusters initiative designers and managers also need to be cognisant of the risks and pitfalls with clusters. The following summarizes some of the key areas of concern and problems that may arise:[106]

- **Vulnerability:** Through cluster specialization, vulnerabilities may be invoked because technological changes, shifts in the economy or customer needs may undermine the competitive advantages of clusters.

- **Lock-in effects:** Risks may arise if there is excessive reliance on existing contacts and networks and external linkages are not maintained or developed. This may result in lock-in effects and a lack of new ideas and practices into the cluster.

- **Rigidities:** Dense existing networks and structures make it more difficult to re-orientate the cluster and make structural adjustments.

Case study: Clustering solar energy industries in Dezhou, China

The development of the Dezhou Solar Valley is an example of city scale clustering around green technology – in this case solar energy. Driven largely by Himin – the world's largest manufacturer of solar thermal tanks – the development has transformed the local economy from agriculture to research, manufacturing and education in solar technologies. It is currently the largest solar thermal research and development centre in China, with over 120 solar energy enterprises and annual renewable energy sales revenues of USD 19 billion. As a showcase for solar technologies, the city has also stimulated demand for the products it manufactures; for example, 95 per cent of new homes in Dezhou's urban communities have solar water heaters installed. (Full case study in Section 6.)

Case study: Building a recycling industry at the Kitakyushu Eco Town Project, Japan

The Kitakyushu Eco-Town Project is an industrial park that has become known for its expertise in waste minimization. Since 1997, the park has aimed to achieve zero emissions and zero waste by using all waste as materials in other industries, thus closing resource loops within the park. Taking advantage of the fact that the eco-town is a cluster of different recycling and reuse factories, residue from one factory is, in turn, used as inputs for other factories. Unusable industrial wastes are processed for re-use or used to generate electricity. The eco-town is characterized by strong collaboration between government, industry and academia, and is used as a site for research and product development in waste treatment and recycling technologies. (Full case study in Section 6.)

- **Decrease in competitive pressures:** Through cooperation between firms, the level of competition may decrease, which may result in social inefficiencies or that stakeholders may block the entry of newcomers.

- **Self-sufficiency syndrome:** If actors in a cluster become accustomed to past successes they may fail to notice changing trends.

- **Inherent decline:** Because social capital may be the driving force for shaping a cluster, it may also be the factor that destroys it. When a successful cluster generates higher factor costs, the neighbourhood may experience increased property prices and outsiders may be excluded.

4.2.3. Adopt the principles of knowledge creation and continuous learning to stimulate innovation

Regions are increasingly under pressure to adopt the same principles of knowledge intensive firms namely:[107]

- Pressure for continuous improvement;

- Demand for knowledge creation and new ideas; and

- Support of organizational learning.

In order for regions to adopt these principles they need to in effect become "learning regions" and develop a series of infrastructures to support the flow of knowledge ideas and learning.

Recommended reading
Rutten, R., Boekema, F. (2007). *The Learning Region*. Cheltenham: Edward Elgar Publishing Limited

Figure 4.2: **Infrastructure design principles for a learning region**

	Traditional mass production region design principles	Learning region design principles
Basis of competitiveness	Comparative advantage based on: • Natural resources • Physical labour	Sustainable advantage based on: • Knowledge creation • Continuous Improvement
Production system	Mass production • Physical labour as a source of value • Separation of innovation and production	Knowledge-based production • Continuous creation • Knowledge as source of value • Synthesis of innovation and production
Manufacturing infrastructure	Arm's length supplier relations	Firm networks and supplier systems as sources of innovation
Human infrastructure	Low-skill and low-cost labour • Taylorist workforce • Taylorist education and training	• Knowledge workers • Continuous improvement of human resources • Continuous education and training
Physical infrastructure	Domestically oriented physical infrastructure	• Globally oriented physical and communication infrastructure • Electronic data exchange
Governance system	• Adversarial relationships • Command and control regulatory framework	• Mutual dependent relationships • Network organizations • Flexible regulatory framework

Source: Figure adapted from Rutten et al[109]

Policies need to be designed to address the requirements for the learning region and the principles of continuous learning and development. The following figure, adapted from Rutten and Boekema,[108] provides a summary of the shift in focus for various infrastructure development initiatives.

Regions are increasingly required to build and maintain new regional infrastructures which can support knowledge-based production systems. The triple helix framework is a useful paradigm for better understanding the role universities, public sector and industry play in supporting innovation within a region.[110]

- Universities have started to play a more important role in the incubation of technology-based firms and in knowledge exchange activities such as consulting, contract research and executive education through which innovation in a region is supported. This has given rise to the "entrepreneurial university", which performs an active role within a regional economy to make productive use of academic knowledge.
- As the private sector firms raise their activities to become more knowledge intensive, these firms start to move closer to an academic model, through which they engage in higher levels of training and in sharing of knowledge which very often strengthen their relationships with the university sector.
- In addition to its traditional role of regulator, within a triple helix framework a government acts as a public entrepreneur and venture capitalist and provides assistance in the form of supply-side as well as demand-side interventions to stimulate innovative activity.

Key to strengthening the knowledge exchange activities in regions is therefore the strengthening of triple helix collaborations, as is clearly illustrated in the 22@ Barcelona and Newcastle Science City case studies.

4.3. A governance framework for driving green economic development

Figure 4.3 provides a summary of the key governance principles to be implemented

for driving the development of a green economy. The following sections shortly explain the rationale and provide insight into each of these areas:

4.3.1. Creative governance can stimulate innovation and creativity in a region

Key to development success is the ability of a region to engage in self-exploration activities and to be innovative. The principles of creative governance may enhance the capacity of the region to stimulate such activities.

The role of governments in fostering an environment for creativity and the support of innovative activities could be achieved through the implementation of creative governance principles. Governments could improve their potential to foster creativity in social and economic dynamics and to creatively transform their own capacities. A multi-level approach to the various dimensions of urban governance is suggested, through which certain qualities of activities could be identified to encourage creativity and innovation.

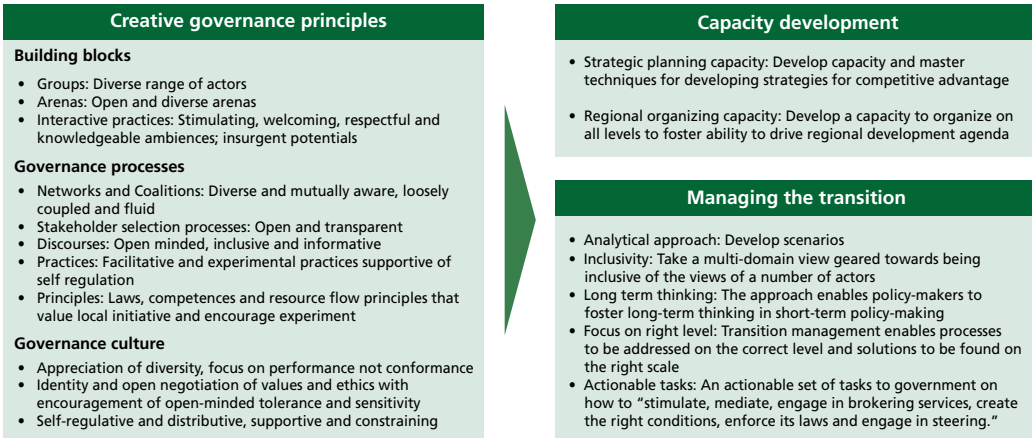
The basic principles of creative governance are outlined in Figure 4.3 where a number of categories of the multi-layer approach are outlined. The following provides context to these principles:[113]

- **Building blocks:** The choice of stakeholders and arenas where discourse takes place should be open and diverse. Stimulating and welcoming interactive processes should underpin the mechanisms through which negotiations, planning, strategizing or discussions take place.

- **Governance processes:** The principle of diversity and mutual awareness of stakeholder groups and networks is important for fostering a creative milieu. Practices and regulatory processes should be supportive of experimentation and self-regulation.

- **Governance culture:** The governance culture should speak to the open mindedness and openness to diversity and experimentation that underpins the governance processes mentioned above.

Figure 4.3: **Principles for governance for creativity**



Source: Principles adapted from Healy (2004),[111] Loorbach (2010)[112]

Recommended reading
Healy, P., (2004). *Creativity and urban governance,* Policy Studies, 25(2). pp. 87-104.

4.3.2. Development of a regional organizing capacity and strategic planning capacity

Capacity development needs to take place to be able to develop actionable strategies and achieve agreement and coordination.

- **City-level competitive advantage:** First and foremost, it is important to develop a strategic planning capacity if the region wants to be able to exploit existing competitive advantages and to develop new ones. It is therefore important to have established strategic planning capabilities and to master strategic planning techniques and methodologies.

- **Regional competitive advantage:** To be able to exploit the theoretical benefits of polycentric urban development the active development of a regional organizing capacity is required. To achieve synergies between centres, a high level of interaction will be needed between actors who should be able and willing to adjust their internal profile and external behaviour. This means that the region needs to develop the ability to coordinate regional co-operation, debate, negotiation and decision-making.[114]

Key challenges in developing a regional organizing capacity were extracted from evidence from four polycentric urban regions in North-West Europe. These cases showed that building a regional organizing capacity is affected by a number of spatial-functional, political-institutional and cultural factors. Major constraints in these cases were institutional fragmentation and a lack of association with the region.

4.3.3. Managing the transition and stakeholders

Greening economies are prone to resistance from many different actors; so effective change management of transitions is required. Transition management has been developed as an interdisciplinary field and is believed to be an effective approach to deal with the governance of societal problems that are complex in nature.[115,116] This approach has found traction especially in policy documents in the Netherlands, Belgium and the United Kingdom, and has been used to address areas such as energy, building, health care, mobility and water management.[117]

The fourth Dutch National Environmental Policy Plan provides guidance regarding what is required for the management of a transition:[118]

- "Make use of tools such as scenarios to deal with uncertainties and to communicate potential outcomes"[119];

- "The approach takes a multi-domain view and is geared towards including the views of a number of actors"[120];

- "The approach enables policy-makers to foster long-term thinking in short-term policy-making" [121]

- "Transition management enables processes to be addressed at the correct level and solutions to be found on the right scale" [122]; and

- "An actionable set of tasks to government on how to "stimulate, mediate, engage in brokering services, create the right conditions, enforce its laws and engage in steering"[123].

Central to transition management is the belief that change is dependent on the mechanism of co-evolution of society and technology. A useful analytical framework for analysing how these transitions occur is the Multi-Level Perspective (MLP). Through this framework, three levels of transition are identified:[124]

- **Niche innovations:** Niches refer to innovations as well as socio-economic and political opportunities for deploying the innovations. This means practically that for a transition to occur the niche innovations need to go through a process where learning-by-doing and price-performance improvements need to take place so that it becomes economically and politically feasible.

- **Regime:** A regime change is required for a transition to occur which refers to factors under the control of actors in the system. This practically implies that changes in rules, technologies and social networks as well as behaviour will need to take place.

- **Landscape:** The landscape level refers to factors that are beyond the control of actors in the system where transition needs to occur. This may include macro-economic factors, climate change, socioeconomic trends, macro-political developments as well as deep cultural patterns. The factors on this level are the factors that put pressure on the system to change. Existing practices in regimes may be destabilized and also provide opportunities for niches to become accepted.

The following table from Kern[125] provides insight into what this framework practically would mean for a transition in energy systems.

Table 4.3: **Summary of the multi-level perspective applied to energy systems**

Niche	**learning processes** e.g. learning processes have stabilized in a dominant design	**price-performance improvements** e.g. price-performance improvements have been made and are believed to continue to improve	**support from powerful groups**	**establishing market niches** e.g. innovation is used in market niches
Regime	**Changes in rules** e.g. belief systems, problem agenda's, guiding principles, search heuristics; relationships, behavioral norms; regulations, standards, laws	**Changes in technologies** e.g. in the case of electricity: resources, grid, generation plants	**Changes in social networks** e.g. new market entrants gain in importance compared to incumbents	
Landscape	**macro-economic trends** e.g. globalization, oil crisis	**socio-economic trends** e.g. recessions, unemployment developments	**macro-political developments** e.g. the 'philosophy' behind policy making	**deep cultural patterns** e.g. trend towards more 'individualization'

Source: Copied from Kern[126]

Thousands of young employees work in shifts covering 24 hours at this call centre in Uberlândia, Brazil, answering customers scattered across the globe and strengthening the city's position as a logistics hub © UN-Habitat/Alessandro Scotti

Implementing Competitiveness

5

This section provides key action points for the implementation of a green economic development strategy. Government could adopt certain best practices through which the desired results of increased regional competitiveness, innovativeness and transition to a green economy could be achieved.

5.1. Organize and mobilize the stakeholders

The first step of the process is to identify the most important institutions that are directly or indirectly involved in the competitiveness project. This is the organisational element of the stakeholder management process of the project and care should be taken to ensure the group includes public, non-profit and private sector representatives.

During this step, an information campaign should be launched and stakeholders should be informed of the project. Wide stakeholder inputs should be sought to ensure that a variety of views are considered. This phase focuses on achieving cooperation and coordinating the partners that will be involved in the project. Key questions that need to be asked are:

- Can you ascertain that stakeholder groups agree that there is a need for the suggested proposal and that a competitiveness strategy for a green economy should be developed?
- Are the various stakeholder groups willing and able to collaborate constructively?
- Is there agreement on how intellectual property issues will be dealt with in the case of the development of new ideas through collaborations between the private sector and the public sector?

When identifying stakeholders, the following potential stakeholder groups should be considered:

- Public authorities involved in regional and economic development.
- Specialists and associations with expertise in competitiveness strategy development, economic development, industry knowledge, sustainability and financing.
- Representatives from local and international non-governmental organizations whose work addresses local needs and challenges amongst marginalized groups.

- Community organizations and unions who might play a role in mobilizing support for the shared vision amongst the public and workers.

The key competences that are required during the first step include:

- Networks and networked individuals should be included to ensure stakeholders are engaged with and involved;
- Creative governance principles should be adopted in setting up the stakeholder groups to be inclusive and open to diversity; and
- A regional organizing capacity is required at this stage as cooperation and buy-in should be achieved for the initiatives.

5.2. Analysis

This phase will entail a systematic analysis of sectors and areas where competitive advantages from a green economy perspective may be achieved. Through the systems approach, the systemic weaknesses in the regional innovation system should be identified and analysed as follows:

- A project leader should be identified to direct the analysis and serve as a liaison or coordinator.
- The analytical framework for the analysis needs to be developed, after which researchers or consultants will develop a detailed analysis and suggested recommendations for the competitiveness strategy.
- The resulting report needs to be disseminated to stakeholders and facilitators.
- A workshop needs to be conducted to discuss findings and get stakeholder inputs.
- There should be a presentation, discussion and review of the matrix of strengths and weaknesses in the fields of analysis of the local and regional economy.

The key competences that are required during the second step include:

- Systems and network approach competencies.
- Strategic planning capacity is required.
- Practical and in-depth familiarity with the region, institutions and innovation system.
- Analytical competences and mastering of analysis techniques.

5.3. Develop the strategy and implementation plan

During the third step of the process there needs to be stakeholder agreement on the following:

- Priorities need to be defined;
- The key interventions that will be implemented must be designed;
- Project and initiative champions need to be identified;
- Implementation plan development needs to take place; and
- Funding required and green finance needs to be organized to set up projects and clusters.

Stakeholder involvement in this step is of high importance as it is during this step that interventions are identified that would address economic issues and build on opportunities. Furthermore, initiatives where smarter, less frequent interventions can be implemented should be considered because most governments are cash strapped. Implementable strategic initiatives need to be developed that should also include:

- Timelines;
- Resource requirements; and
- The identification of responsible people.

The key competences that are required during this step of the project include:

- Systems and networks thinking approaches to design initiatives.
- Implementation knowledge to ensure that points are actionable.
- Transition management skills and capacity to manage stakeholders.

5.4. Implementation

The implementation step of a competitiveness strategy lies at the core of achieving successful green economic development. The requirements for successful implementation are:

- Agree on clearly articulated plan with stakeholders. This plan should include clear tasks for the implementation phase. As discussed in the previous section, this will include clear action points as well as budget requirements.
- Ensure that a monitoring and evaluation mechanism is agreed on and is put in place. This is important for ensuring progress is tracked and success stories disseminated.
- Training and coaching of staff during the process as capacities in participatory planning and implementation is required for successful implementation.

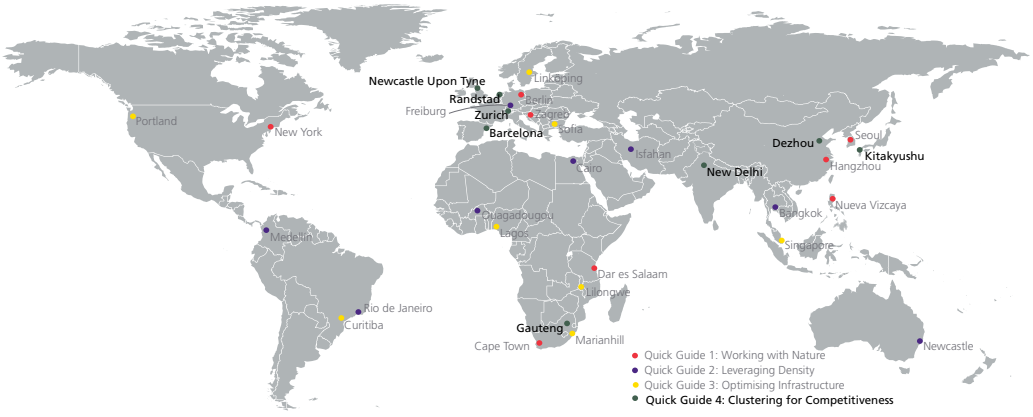
5.5. Monitor and evaluate

Monitoring is an important management tool supporting implementation. Properly done, it tells all groups involved in the local economy whether the initiatives are on track. There are two kinds of monitoring: the monitoring of activities and impact assessment. The major difference between them is in their focus and scope:

- Monitoring of activities determines service delivery performance. This is typically measured over the short- to medium-term.
- Impact assessment analyses the effect of interventions on the system. This is usually measured over the medium- to long-term.

When designing a monitoring and evaluation system the following need to be considered:

- Define or develop indicators to assess performance or impact.
- Integrate feedback mechanisms into stakeholder groups and wider community.
- Identify critical success factors.
- Share and highlight achievements and accomplishments.
- Discuss activities which achieved critical success factors.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Gauteng
Cape Town
Marianhill
Newcastle
Quick Guide 1: Working with Nature
Quick Guide 2: Leveraging Density
Quick Guide 3: Optimising Infrastructure
Quick Guide 4: Clustering for Competitiveness

Case Studies

6

6.1. Collaborating for innovation at 22@Barcelona, Spain

In just over a decade, the old Poblenou district of Barcelona has been transformed into an iconic model of sustainable urban regeneration, innovation and interactive learning for the twenty-first century knowledge economy.[i] This now ultra modern city and innovative district was, for more than a 100 years, the heart of Barcelona's industrial economy. The gradual dilapidation of this old industrial district between 1960 and 1992, the year of the Barcelona Olympics, motivated authorities to further investigate transforming the remaining area of Poblenou, meaning "new village" into a sustainable urban economic node. The need to uplift this city area and enhance its international reputation as an economic destination was clear[127] and would build upon the post-Olympic city competitiveness strategy. The 22@ Barcelona management company was formalized in 2000 to oversee development of the new area. It responsibilities included "project management; planning promotion, design, construction and management of infrastructures, urban facilities, public spaces; and national and international promotion of industrial and productive [sectors], as well as driving business creation [and] activities linked to ICT."[128]

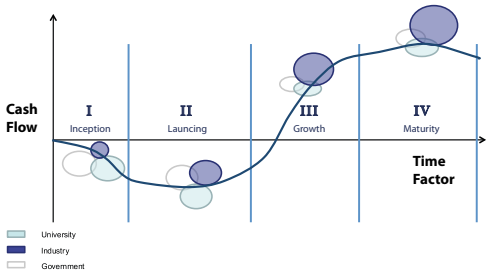
The motivation for the project was more than a conventional urban regeneration project, and the city council began by asking: What measures can be taken to improve and increase the interactions between the international community and the local firms and institutions in Barcelona?[129] The long-term strategic thinking involved productive partnerships between ten universities, the government and the city council, leading to the sustainable urban design of a modern and productive economic space for life-long learning, working and living.[130] The objectives of the initiative were clear – to provide a city-centre location for innovation, economic clustering and to become an international business destination. The 22@ initiative was born. Part of the strategy was to make the space attractive to international, national and local businesses through the provision and design of state-of-the-art

i Most information that is not sourced directly is taken from the comprehensive website explaining the 22@ Barcelona project in detail. To view this site please visit: www.22barcelona.com

infrastructure, facilities for and access to knowledge institutions, research centres and technology transfer offices, all in one accessible location.

The success of the project was primarily due to a collaborative approach between the essential stakeholders. Initially the government and universities partnerships played a larger role, with industry and the private sector becoming more involved over time. This is typical of a government-university-industry or "triple-helix" programme, which in itself becomes a system of collaboration, knowledge-sharing, learning and innovation contributing to private sector growth.

Figure 6.1: **Growth cycle of Industry as part of university-government-industry collaboration**



Source: Adapted from Etzkowitz, Parellada & Pique (2007) [131]

Figure 6.1 depicts the different phases and scope of involvement in the collaborative network between university, government and industry with regard to the inception, launch, growth and maturity phase of a knowledge-economy project such as the 22@Barcelona innovation district. Initially the role of industry is minor, but it grows steadily through increased benefits of knowledge exchange, becoming the main player within the growth and maturation phase of such a project. The role of universities and access to knowledge is vital for the high-tech industries of the twenty-first century knowledge economy as present in 22@Barcelona. Leydesdorf[132,133] explains the role of universities as producers of novelty, which is beneficial for industry who translate this into wealth, while governments play a normative or regulatory role. All of these factors were considered in the design of the 22@Barcelona innovation district and included both institutional and spatial agglomeration considerations. The ten universities with more than 25 000 students and researchers each interacted and engaged with the private sector businesses, professionals and industry, which was deliberate by design. The close proximity of knowledge institutions, work and living spaces created a culture of entrepreneurship, innovation and catalyzed innovation through a continuous cross-pollination of ideas and flows of knowledge, aided by the high-tech and sustainable infrastructure in place. The 22@Barcelona concept also included a professional network to facilitate and ensure social innovation. The essential ingredient of venture capital also made 22@ Barcelona a true "Technopole" in the words of Manuel Castells.[134] Castells emphasises the factors of production, which include access to financing and venture capital. He also mentions the importance of creating spaces for skilled people to engage with each other and for providing infrastructure for flows of knowledge, such as information and communication technology (ICT), which would result in a modern innovation milieu. The 22@Barcelona concept captured each of the specifications and characteristics considered to be important by Castells.

22@Barcelona focuses on five knowledge-intensive economic clusters or sectors, strategically positioned to share knowledge and ideas leading to innovation. This knowledge and experience sharing environment is stimulated via the strategic design and provision of formal and informal networking spaces to fast track a culture of

innovation. The various sectors include ICT, media, biomedical, energy and design. The scale of the 22@Barcelona project spans more than one hundred city blocks, with a total planned revitalization area of almost 200 hectares; it also includes 114,000 m^2 of green space; 145,000 m^2 of new space for facilities and offices; an estimated 130,000 new jobs were created; and the total cost of the project to date is USD 235 million (EUR 180 million). See below for a summary of the improvements made for this district between 2000 and 2010, highlighting the most important successes of the project:

- The urban regeneration of 65 per cent of original Poblenou area, (115 city blocks).
- 10 universities with more than 25,000 students each.
- 12 Research and Development and technology transfer centres.
- 1,502 companies established between 2000 and 2010.
- 44,600 workers in these 1,502 companies, of which 32,300 carry out 22@Barcelona activities.
- One in two companies in 22@Barcelona have more than 50 per cent university graduates on staff.
- 22@Barcelona is a benchmark for both the International Association of Science and Technology Parks (IASP) and The Competitiveness Institute (TCI).

The project was designed to facilitate and enhance innovation in the city of Barcelona through social, technical and economic interactions and engagement between strategic economic clusters, business professionals and academics. Among the project's main successes was the long term vision in which the city participated and its ability to collaborate on achieving a collective vision. This vision was linked to sustainability and innovation as the primary themes and objectives, but there were also sector-specific focus areas. Capitalizing on this and through knowledge spillovers, 22@Barcelona has become one of the most favourable business locations in the world in a short space of ten years.

6.2 Fostering innovation at Newcastle Science City, United Kingdom (UK)

Worried by the growing disparity in economic growth between the south and the north of England, the then British Chancellor, Gordon Brown, created the first wave of UK Science Cities in 2005 to accelerate economic renewal in Manchester, Newcastle and York. The initiative was to be driven by the relevant Regional Development Agencies (or RDAs, an executive agency of the government with substantial budgets) as part of their wider investment programmes in technology. Underpinning this investment was a belief that the northern UK cities had suffered because government investment in science and technology was almost exclusively concentrated in the south of England. In the particular case of Newcastle Science City this instruction from central government fitted well into the Regional Development Agency's existing investment programme that had created industrially orientated research centres in green technologies close to the city of Newcastle. Historically, Newcastle is also typical of many northern cities in having relatively low levels of educational attainment in sciences and below average rates for formation of new companies.

This intervention by Gordon Brown was unexpected by all of the Regional Development Agencies who were challenged

to come up with investment programmes very rapidly. Drawing on regional development concepts such as the Triple Helix approach, the North-East Regional Development Agency (in whose area Newcastle lies) rapidly began to engage with the two local research universities, Newcastle University and, to a lesser extent, Durham University (who promptly disengaged as a result of local sub-regional rivalries). The Regional Development Agency also worked closely with the civic authorities of Newcastle (Newcastle City Council) to ensure that there was close alignment of city and regional strategies. At this stage, a small number of prominent local industrial leaders were also invited to become involved to advise the emerging initiative on potential areas for business growth.

This process led to the development of a prospectus for Newcastle Science City that was aimed at persuading the central government to increase the agency budget so that the identified investment programme involved additional funding (rather than redirecting existing investment programmes). This additional investment was predicated on achieving a substantial number of new jobs primarily through the generation of new companies. Unfortunately, this prospectus was unsuccessful leaving the by now established Newcastle Science City partnership under-funded from its inception.

The Newcastle Science City partnership had a very clear philosophy of action from its outset – it aimed essentially to use the world-class research capability of Newcastle University as a catalysing force to increase business investment in new emerging technologies, attract inward investment and generate economic growth through innovation. In parallel, the importance of engaging the public and, in particular, inspiring children to higher attainment in science was identified. This was linked to the university by using leading research scientists as public speakers and leaders of school engagement events. In return for the academics' open attitude, investment programmes were put in place to provide new research facilities where industrial and academic researchers could come together to work on new opportunities. In essence, these programmes were designed deliberatively to bring to life the triple-helix model at the individual facility level through the creation of these translational spaces[ii]. Another mechanism has been the creation of the "Professors of Practice" role within Newcastle University whereby a small number of professorial positions were created that functioned in a triple-helix mode rather than in conventional academic roles. As the name suggests, the Professors of Practice are not standard academics but rather boundary crossing individuals (largely from business backgrounds) whose role is to enhance collaboration between the academic base and industry. This approach has proved highly beneficial but it has also been extremely challenging for the university to accommodate and support such a novel role.

Given global competition, it was always recognized that all of the activities of Newcastle Science City should focus on particular areas of research strength, which should be both areas of world-class expertise and also of emerging commercial opportunity. Initially, four topics were chosen (ageing, regenerative medicine, energy and molecular engineering) although this was changed to three (ageing, sustainability and regenerative medicine). Each of the science theme areas developed investment programmes that were designed to supplement existing resources and to attract collaboration with relevant leading companies.

In parallel with these science investment programmes, the initiative has also undertaken a large urban land development

ii Spaces that span the boundaries of academia and industry

adjacent to the main Newcastle University campus. This 81,000m^2 (20 acre) land development has taken place on a brownfield site purchased on a joint basis by the three primary Science City partners (the university, the City Council and the Regional Development Agency). The development is conceived to be a location where the triple-helix model can be grown on a larger scale and thus will supplement the smaller scale implementation described above. The development has now finished phase 1 (with the creation of a new University Business School) and will soon proceed to phase 2, in which new university research facilities in sustainable technologies will be created alongside collaborating companies.

In addition to this 81,000m^2 (20 acre) development, a significant redevelopment of the University's Campus for Ageing and Vitality has been done. This is also situated on a brownfield site in the urban core of the city but is located approximately 1.5 km north of the city centre. Again, the development is based on the same concept; namely the creation of translational facilities in which academic researchers can collaborate with industry. Interestingly, the ageing topic developments are particularly multi-disciplinary in nature involving close collaboration between medical doctors, bio-scientists, electronics and computer experts and people from a number of other disciplines. A strong focus on engagement with groups representing older citizens has also been a key feature and an enabler of success in developing new commercial opportunities and attracting industrial participation.

The professional team recruited to run the Newcastle Science City initiative also undertook a highly innovative initiative designed to create new high technology-based companies. This approach was based on a highly structured programme of mentoring of young entrepreneurs who are tutored not to find applications for new technology but rather to do the opposite – to seek new technology for indentified market needs. This programme, the Newcastle Innovation Machine, has been very successful and has led to the formation of numerous new companies. It is, however, an expensive model and it will take some years before the long-term success can be evaluated.

Looking back over the five years of the initiative, much has been achieved. For example, the establishment of the Campus for Ageing and Vitality has led both to spectacular research wins (including a recent series of awards totalling over USD 47 million [GBP 30 million] from the central UK authorities that have effectively designated Newcastle as the UK's centre of excellence in ageing research) but also inward investment from major multinational companies. It is also noticeable that many local technology based companies have grown substantially over this period. Another clear win has been the flowering of relationships between the civic and university authorities as a result of the close collaborative work at many levels. The substantial investments in new translational research facilities have also paid dividends in attracting the involvement of industry.

One of the most complex aspects of the initiative has been the difficulties introduced by European Union (EU) regulations governing state aid to businesses, which, by and large, prevent direct government assistance to individual companies. This inhibits the creation of triple-helix type structures within the EU because it restricts the project structures that can be adopted when government support is provided. In a sense this strikes a blow at the heart of the Science City concept, which is based on state investment to catalyse industrial investment. Interestingly, this problem is also evident in the difficulties experienced by the coalition government in the UK through their

Regional Growth Fund initiative. It is also clear that the recent recession in the UK has made conditions more difficult for schemes such as the Science Cities – both in the short term through making companies less likely to invest, but also through the more pernicious long-term eroding of confidence and aspiration in the local population. Despite these difficulties, the Newcastle Science City Partnership remains strong and committed to long term collaboration and the fundamental aims of the initiative.

6.3. Developmental Green Economy Strategy for Gauteng, South Africa[iii]

In 2009, South Africa's Gauteng province, the country's smallest, yet most densely populated region,[iv] made the first of series of policy and strategic commitments towards a greener economy, and adopted the Developmental Green Economy Strategy for Gauteng (DGESG). The province's Department of Economic Development requested the strategy in response to research showing that other parts of the world were responding to the global economic crisis by investing in green jobs and industries as potential drivers of the economic recovery. This research, done by the Gauteng City-Region Observatory (GCRO), found that "green" technologies, low carbon economics and sustainable growth were to be the context of a post-crisis economy.[135] The strategy, prepared by the Gauteng City-Region Observatory on behalf of the province, was the first step by Gauteng to conceptualize these sustainable economic options. Over the past two years the strategy been the basis for increasingly more sophisticated debates around the green economy, the development of ever clearer policy statements, and the early implementation of promising greening work.

For an economy whose foundations have been built on commodity extraction and resource-intensive manufacturing and exports, the strategy provided a transformative economic approach based on initiatives in a range of non-traditional sectors and clusters. Importantly, the strategy argued that a green economy is not an additional set of industry clusters deserving targeted support, while leaving dirty options still being pursued elsewhere[136]. Instead, as a "green jobs" strategy prioritizing sustainable development, it argued for over-arching investments in non-traditional sectors of food, energy and water security, zero waste and sustainable mobility, all in-turn underpinned by programmes for "sustainable human settlements" and "resource efficiency".[137]

The strategy-work included detailed studies and scenario modelling on the application of green economy initiatives to local contexts. On the basis of this it was able to proffer concrete targets of how economic growth can be boosted through reducing environmental costs. For instance, using comparative analyses of the costs and job creation potential of 15 per cent energy efficiency versus 20 per cent energy efficiency target by 2025, the strategy shows the feasibility and potential impact of concentrated solar power and other alternative energy initiatives on labour income and economic return on investment.[138] According to the strategy's 2025 baseline estimate, the potential energy cost savings are USD 2 billion (ZAR 16 billion) per annum while up to USD 79 million (ZAR 624 million) in revenue could be added

iii This case study draws on first-hand experience of the advancement of the Developmental Green Economy for Gauteng. For more information, see www.gcro.ac.za/project/strategy-development-green-economy

iv The province of Gauteng, with an urban population of just over 11 million in 2011, is the smallest, yet most densely populated, region in South Africa. Covering 18 179km2 it has an average population density of just over 600 persons per square kilometre. The wider functional economy of the Gauteng City-Region includes the prominent cities of Johannesburg and Pretoria, and other outlying but still significant urban centres, to make the largest contribution of Gross Value Added (GVA) (33%) nationally.

Table 6.1: **Comparative economic and employment potential based on a 16 per cent renewable target from predominantly Concentrated Solar Power (CSP)**[140]

	15% Target 2025	20% Target 2025
Business-As-Usual Gauteng Energy Consumption 2025	999.5 PJ	999.5 PJ
Energy saved through efficiency	149.9 PJ saved in 2025	199.9 PJ saved in 2025
Energy cost saved	R 12 billion / year (USD 1.4 billion)	R 16 billion / year (USD 1.9 billion)
Jobs creation potential	**50 jobs/PJ14**	**50 jobs/PJ15**
Jobs created by 2025	7,500 minimum	10,400 minimum
Monthly salary per technician	R 5000 (USD 595)	R 5000 (USD 595)
Total yearly salary revenue in economy	R 450 million (USD 54 million)	R 624 million (USD 74 million)
Total asset expenditure on energy efficiency equipment in economy	Approx R7.5 billion per year (USD 0.9 billion)	Approx R10 billion/year (USD 1.2 billion)
Economic return on energy efficent initiatives	Typically 2x on investment over 4-6 years	Typically 2x on investment over 4-6 years
Estimated cost to Province to establish programme	R 10 million / year USD 1.2 million	R 13 million / year USD 1.5 million

to the economy annually.[139] Table 6:1 shows that these are relatively cheap, economically feasible and employment-generating benefits considering it would only cost Gauteng USD 1.65 million (ZAR 13 million) a year to establish such a programme.

A similar set of robust calculations were done for, inter alia, local food production, energy efficiency, and waste and transport, providing the first real attempt to understand the concrete costs and benefits of pursuing a green economy agenda in the full sense of the term.

The primary significance of the Developmental Green Economy Strategy for Gauteng was that it proposed to the Gauteng Provincial Government (GPG) and its partners – whether these be players from industry, civil society organizations or other arms of government – a way to select, and create a fusion of, an interconnected set of green clusters that might drive investment, innovation and job creation.[141] The particular focus on industries and technologies in non-traditional clusters that do more with less resources, and those that protect basic human requirements such as food and water, which are elevated as economic sectors in themselves, was a progressive step for a government strategy. This is particularly so in a region where the economy is historically based on minerals extraction, and the upstream and downstream manufacturing and financing related to mining.[142] It therefore held out the promise of a deeper structural transformation of the regional economy. As such, the strategy captured the attention of provincial government departments and local municipalities financially reliant on the endlessly expanding growth in sales of resource-consuming services, such as electricity and water.

While the strategy was well received in government, it did not translate into immediate implementation as much as might have been expected. Instead, the Gauteng Provincial Government asked for more clarity in the form of more policy work and, subsequently, a more detailed programme design to implement the strategy's recommendations.

Table 6.2: **Revised food security viability calculations**[iv,146]

	Segment 1	Segment 2	Segment 3	Segment 4	Total
Number of beneficiaries	29,8810	43,140	43,140	64,710	44,9800
Area/beneficiary in m^2	100	300	850	1,000 (1 ha)	-
Reduced expenses/house hold[v]	USD 19 (ZAR 150)	USD 19 (ZAR 150)	USD 19 (ZAR 150)	ZAR 0.00	-
Income from surplus	USD 0 (ZAR 0)	USD 38 (ZAR 300)	USD 108 (ZAR 850)	USD 127 (ZAR 1,000)	-
Total reduced expenses/month	USD 5,681,200 (ZAR 44,821,500)	USD 820,200 (ZAR 6,471,000)	USD 820,000 (ZAR 6,471,000)	USD 0 (ZAR 0)	USD 7,321,100 (ZAR 57,763,500)
Total income/ month	USD 0 (ZAR 0)	USD 1,640,200 (ZAR 12,942,000)	USD 6,561,000 (ZAR 51,768,000)	USD 24,603,900 (ZAR 194,130,000)	USD 32,812,300 (ZAR 258,840,000)
Total area in ha	2,988.1	1,294.2	3,666.9	64,710	72,659.2
Months of full productivity	4	5	6	7	
Months of 60% productivity	4	4	4	3	
Months of 30% productivity	4	3	2	2	
Annual benefit/house hold	USD 145 (ZAR 1,140.00)	USD 684 (ZAR 5,400)	USD 1,540 (ZAR 12,150)	USD 4,563 (ZAR 36,000)	
Total annual benefit in million USD (million ZAR)	43.18 (340.64)	29.54 (232.96)	66.46 (524.15)	295.39 (2,329.56)	434.52 (3,427.31)

First, the idea of a "green jobs" strategy was taken up in the Gauteng Employment Growth and Development Strategy (GEGDS), finalized mid-2010. This envisaged an economy shifting to an endogenous growth trajectory based primarily on "innovation, green growth and inclusivity". As the overarching economic strategy for the province, the GEGDS states that Gauteng will not provide decent work and economic opportunities for all unless it creates "a green, environmentally friendly economy, which capitalises on the enormous economic value to be gained by investing in green processes and products, and which uses existing resources in a more efficient and sustainable manner, thus reducing the carbon footprint of Gauteng. Gauteng needs an economy based on green technologies, green jobs, green energy and green production processes that reduce the ever higher input costs stemming from unsustainable resource use".[143]

Second, the policy foundations laid by the Developmental Green Economy Strategy for Gauteng and Gauteng Employment Growth and Development Strategy were then built on through the development, and formal adoption in mid-2011, of a Green Strategic Programme (GSP) for Gauteng. This provides programmatic detail to fill out the Developmental Green Economy Strategy for Gauteng and Gauteng Employment Growth and Development Strategy. It is designed to inform the activities of departments and municipalities in Gauteng, so that all parts of government are working on the same green issues and towards the same green objectives.[144] The GSP takes forward the DGESG message that there is a need for deep structural transformation of the economy, and that this requires investment in non-traditional sectors, by proposing concrete interventions in nine sectoral areas. These are: air quality, climate change, energy, economic development, food security, land use, transport, water and sanitation and waste.[145] The Green Strategic Programme also integrated earlier calculations around green economy initiatives to provide more sophisticated scenario modelling of local greening potential and to augment the

v Calculated on an estimated USD 0.64 (ZAR 5) per household saving per day

vi These calculations are based on a revision of assumptions emanating from previous food security research. See original documentation for detailed explanations.

growing intelligence around the implications of integrated green jobs initiatives within the province. (See Table 6.2)

While this policy, strategy and programme development work has taken some time to unfold, it has been paralleled by the implementation of some pioneering greening initiatives, leveraged through resources from agencies such as the Industrial Development Corporation (IDC) and the Automotive Industry Development Centre (AIDC). Under the auspices of the Automotive Industry Development Centre, for instance, a number of green projects have coalesced around Gauteng's automotive cluster. For example, the centre has launched a liquid petroleum gas (LPG) mini-bus taxi conversion pilot programme, which has converted 150 taxis to operate dually on LPG gas and petrol. A second pilot project, run jointly with the City of Tshwane, sees the extraction of landfill gas for local industrial use. A third looks to the declassification of foundry sand, currently regulated as a toxic waste, so that it can be re-processed as an input into the construction industry. These and a range of other projects are driving changes in historically resource-intensive and wasteful industries.[147] Through attracting investment from local municipalities, as well as large financiers such as the Industrial Development Corporation, they are feeding into wider industrial supply chains as a progressive conversion towards green.

Another positive result of the provincial policy and strategy work is that it has stimulated a green economy movement within local government, with a range of municipalities working towards including the green economy in strategy and policy procedures. Municipal interventions across the province include, for example: proposals for green economy by-laws in the City of Tshwane's Integrated Development Plan;[vii,148] the development of green infrastructure in the City of Johannesburg's Growth and Development Strategy; and a "Green IQ" vision by West Rand District Municipality to be the greenest municipality in South Africa by 2016. This series of commitments integrating the idea of the green economy into the local government policy space suggests that municipalities are beginning to question how they can do business differently. Although some of this progress has occurred outside of the Developmental Green Economy Strategy for Gauteng policy space, and often lacks the concrete calculations included therein, the translation of the green economy ideal into local integrated development planning has the potential to drive real shifts in the ways municipalities reconfigure infrastructure and service delivery for sustainability.

Notwithstanding the importance of the progress highlighted here, it is not yet clear whether Gauteng's emerging policy consensus around the green economy can ultimately cohere, and remain cohered, around a set of measurable and tangible commitments. For instance, will the underlying premise of both the Developmental Green Economy Strategy for Gauteng, and its successor, the Green Strategic Programme – that without investment in non-traditional sectors of food security and waste a true green economy cannot be achieved – be adequately absorbed in municipal planning processes? Between various provincial programmes, municipal investments and stimuli from funding agencies, the need for a fundamental transformation of the regional economy off its resource intensive base may dissipate in the face of

vii The IDP (Integrated Development Plan) is a tool used by the South African Government to provide a framework for economic and social development within municipalities and part of an integrated system of planning and service delivery (DPLG, 2000).

implementation obstacles. The danger is there will only be a few narrowly defined green economy projects to support new businesses in easily identifiable sectors, such as alternative energy. The promise contained in the Developmental Green Economy Strategy for Gauteng, successor strategic frameworks such as the Green Strategic Programme, and inspiring initial projects by the Automotive Industry Development Centre and others, is profound. But it remains to be seen whether the end result will be the desired fundamental structural transformation, across all sectors, towards a sustainable economy.

6.4. Delhi post Commonwealth Games: world–city or urban fiasco?[viii]

The nineteenth Commonwealth Games (CWG–2010) hosted by the city of Delhi in India were hailed as successful, despite initial media reports covering the raft of security, venue and health problems associated with the sports infrastructure. The ten-day event was well-attended, with more than 6,000 athletes and officials representing 71 Commonwealth nations. India gave its best performance ever, by securing second position in the medal tally. However, findings of government-led inquiries, including the Comptroller and Auditor-General's Report, and the subsequent arrest of high-level sports officials on corruption charges, point to the fact that it was not a straightforward victory for the nation, or for the city.

This case study attempts to ascertain whether the opportunity to host the third largest multi-sporting event in the world was strategically used to develop Delhi's infrastructure and services and increase the city's competitiveness. Did a more vibrant, attractive and investment-friendly metropolis result from the investments in sporting venues and stadia, the upgrading and extension of transportation networks and city infrastructure, the construction of the new Games Village, and the renovation of historical buildings and architectural heritage sites? A broader question is whether huge events such as the CWG are appropriate vehicles of urban renewal in developing countries.

Delhi won the bid to host the Games, defeating a competing bid by the Canadian city of Hamilton, in November 2003 on the basis of a financial guarantee by the Government of India (GoI) and the Government of the National Capital Territory of Delhi (GNCTD). The damning CAG Report says that the seven-year period from November 2003 to October 2010 was not used effectively to plan the state of the art city infrastructure for the Games. Delayed financial approvals from various government agencies led to a bunching of projects towards the end, which, combined with deficient and highly irregular contract management, resulted in increased costs.[149] The original government budget for both sports and non-sports Games infrastructure was estimated at USD 236 million but this had escalated to USD 3.6 billion by October 2010. This made the Indian Games the most expensive Commonwealth Games ever; those in Manchester 2002 cost approximately USD 420 million, and those in Melbourne in 2006 cost approximately USD 1.1 billion!

The Games organizers argue that government funds were well spent on transforming Delhi into a "world-class city" with the acquisition of a fleet of 6,000 new environmentally-friendly buses, nine rapid transit corridors, 60 new flyovers, and several thousand

viii The author of this case study would like to thank Aromar Revi, Jessica Seddon, Kavita Wankhade and Geetika Anand of the Indian Institute for Human Settlements, India, for sharing their resources on the Delhi Commonwealth Games case study; and Debjani Ghosh of the National Institute of Urban Affairs for her valuable input.

The Delhi Metro was expanded to accommodate more people and boost the use of public transport during the 2010 games © Flikr/Le Rétroviseur

kilometres of new roads.[150] The escalated costs, however, exclude investments made by agencies such as the Delhi Metro Rail Corporation and the Airports Authority of India towards infrastructure upgrades in preparation for the Games.

A large part of the Games' expenses were for increasing Delhi's connectivity: globally, through airport upgrade; regionally, through extended metro lines between Delhi and peripheral towns; and locally, within the city from the site of the Games Village and new sporting venues to the city centre. The construction of Terminal 3, a two-tier building with over 130 check-in counters, 55 aerobridges, 30 aircraft bays and the capacity to cater to more than 34 million passengers a year, was a high-value, strategic investment tied in with the Games. The expanded and upgraded Indira Gandhi International Airport services not just Delhi, but the entire National Capital Region and increases the competitiveness of the city as well as the region. In addition, Delhi acquired 193 kilometres of metro lines extending to the satellite cities of Gurgaon and Noida, and connecting the airport to the city centre. Commentators are quick to point out that these improvements would have ensued regardless of 2010, but the Games served to deliver them over a much shorter time period. [151,152]

The vision for CGW-2010 was that it would transform East Delhi, along River Yamuna, with improved transport connectivity to the city centre and increased infrastructure investment; similar to the development of South Delhi in the run up to the 1982 ASIAD Games, which were also hosted by Delhi.[153] To contain spending by the Indian Government and Government of the National Capital Territory of Delhi within the confines of the administrative region of Delhi, several planning and ecological conventions were disregarded. An example of this was the initiative to

The Delhi Expressway Toll Gate © Wikipedia/ gurgaonshoppingmalls

beautify the roads, which was not part of Delhi's existing City Development Plan under the GoI's flagship urban development and renewal programme. Street-scaping and beautification work were awarded at exorbitant costs and executed in an arbitrary manner, with no common design guidelines. The Government of the National Capital Territory of Delhi did not get clearance from the Delhi Urban Arts Commission for this largely consultant-driven intervention, nor did it coordinate with the relevant police departments to prepare for the impact of the project on Delhi's considerable traffic.[154] Secondly, locating the Games Village on the bank of the River Yamuna violated all ecological principles encapsulated in Delhi's urban development policies. Games organizers chose this last, undeveloped space in the city for the Village, despite the river being environmentally fragile, and that permanent construction on it would create the potential for a city-scale disaster.[155]

Construction of the Games Village also attracted the most serious criticisms levelled against the hugely expensive event. These were about the gross violation of the human rights of the displaced poor who lived on the site of the Village and in other informal settlements, and the indignity suffered by thousands of disempowered construction workers who were paid below minimum wages.[156,157] Unfortunately, while instances of greed and corruption, governance and management failures, and the lack of accountability received considerable national and global media attention; the human cost of the Games was largely unaccounted for.[158]

Despite the millions spent and the thousands of people rendered homeless, the project to transform a historic city into a modern metropolis is still incomplete. Despite efforts to rush execution through a single (and expensive) contractor, less than half of the bus shelters were constructed in time. The Games failed to address severe and chronic gaps in the provision of water, electricity, housing or sanitation services to the city residents. An expensive and irregularly

awarded contract for a water treatment plant, constructed for the Games Village and surrounding areas, is currently shut down. The construction of a new, gas-based, 1,500 MW power plant, intended to cover the energy-usage spike during the Games was delayed and not completed in time.[159] Strengthening of the power supply situation in Delhi was also not achieved by the distribution utility, primarily due to poor contract management.

The most visibly incomplete city development project initiated through the Games was the renovation and restoration of the central business district of Connaught Place. Built when the capital of British India was moved to New Delhi in 1942, Connaught Place occupies a place of great pride and cultural affiliation for Delhi's citizens, the majority of whom descend from migrants to the city during its centuries' old existence. Connaught Place is a symbol of Delhi's ability to adapt and absorb each new culture that has descended on it and has branded it as part of the city's heritage. Plagued by undue delays, mismanagement by the New Delhi Municipal Corporation and unchecked increase in scope, the historic and elegant structures of the business district will be covered in scaffolding and occupied by construction workers for at least three years after the hosting of the Games.

In conclusion, the overall gains from the newly-created infrastructure aimed at increasing Delhi's investment potential have been thwarted by the sizeable financial losses incurred by the state. This is in addition to the huge embarrassments faced due to unprofessional handling of the event. The extension of Delhi Metro and upgrade of the airport are of great strategic value, because India aspires to hosting mega sporting events in the future. However, if the disrepair and under use of the world-class stadia built for the 1982 ASIAD Games are any indicator, the sports infrastructure built or renovated for Commonwealth Games is unlikely to be fully used beyond the coveted sporting events.

Barcelona and Manchester are cities that were able to generate positive images on the basis of successful hosting of mega events. However, attempts at transferring such successes to a developing country are riddled with complex challenges, as the case of the Delhi Commonwealth Games demonstrates. The drive to elevate Delhi's competitiveness through ignominious levels of state spending resulted in considerable human misery and ecological risk.

6.5. The Zurich Cleantech Innovation Park: Dübendorf a contested space

The planned decommissioning of Dübendorf airbase in Zurich, Switzerland, by 2014[160] has resulted in debate, contestation and conceptualization about its future use. The idea to transform and develop this 165 ha space into a novel urban hub for sustainability and clean technology (cleantech) innovation features prominently in ideas on its future.[ix] The necessary ingredients and capacities for realizing this vision are present. These characterize Zurich as a city and include: a growing willingness in the financial sector to invest in green business and clean technology;[161] a high proportion of knowledge producers; universities, institutions and knowledge-industries; highly organized and effective public and private institutions and partnerships with a focus on "cleantech" and sustainability; some of the world's most prominent environmental organizations, for example the World Wildlife Fund (WWF), the International Union for Conservation

ix An interview was conducted with Diego Salmeron – the lead consultant on the project from LEP Consultants on 18th November 2011. LEP is one of the main partners of FFGS for this initiative. The interview was necessary as there was little formal information available on the project.

Location and layout of the Zurich Cleantech Innovation Park
© Foundation for Global Sustainability (FFGS) 2009 [162]

of Nature (IUCN) and the Foundation for Global Sustainability (FFGS) are present and influential in this initiative.

This case study highlights how the rationale for a cutting-edge and viable concept for sustainable urban innovation and cleantech development is being stalled by divergent stakeholder contestation and complex political and administrative processes. The success of this high-level project has the potential to not only become a beacon for sustainable development and cleantech innovation but also to kick-start a new economic frontier in sustainability for Switzerland and enable it to compete in the global green economy.

The Masdar[x] sustainable city experience and success in Abu Dhabi prompted leaders in Zurich to consider replicating this on home soil. The Foundation for Global Sustainability (FFGS), a primary stakeholder and leader of the initiative, said: "The Dübendorf project will be able to profit directly from the economic and technical know-how gained (in Masdar)."[163] Zurich is considered to be a prime location for the financing, innovation and development of cleantech, sustainability enterprises and services for a global market. This is in particular because it harbours one of the world's most advanced financial systems, with an increasing interest in providing venture capital and incubation for cleantech and sustainability services.[164] The Swiss Federal Institute of Technology (ETH) Zurich supports the initiative. It is one of the top technology focused research universities in Europe and produces high quality graduates and skilled workers. The knowledge, research and development industry of Zurich is also in a prime position to engage in the cleantech industry and global markets. This is supported by this statement suggesting that: "The greater Zurich area boasts outstanding pioneering institutions, where the best brains are at work in basic and applied science, creating a solid and excellent foundation for cleantech."[165]

The Foundation for Global Sustainability[xi] initiated the Swiss Sustainability Initiative (SSI) and the Swiss Cleantech Association who partnered in driving the concept of developing cleantech innovation hubs and clusters in Zurich and other potential regions in Switzerland. After the Swiss Federal Government announced that the Dübendorf airbase would be decommissioned by

x The Swiss are prominently involved in the design features of Masdar city and have a section of the development dedicated to Swiss cleantech production. See http://www.masdarcity.ae/en for further details.

xi Visit www.ffgs.org; and www.swisscleantech.ch for more information.

2014,[xii] the site became a prime location for the development of the Swiss Sustainability Hub, Zurich. Another group, the Stiftung Forschung Schweiz (SFS), was also interested in the site to develop a Swiss Innovation Park. Recently, these opposing forces found common ground and joined forces to officially rename the initiative the "Swiss Cleantech Innovation-Park."[166] Additional stakeholders, who were either already in a partnership or formed a partnership with the Foundation for Global Sustainability joined the effort to transform this space towards this renewed goal. Among them were politicians, entrepreneurs, the Swiss Federal Institute of Technology University, the World Wildlife Fund (WWF) and other non-governmental organizations; local government agencies; consulting firms and others already mentioned. Although the project enjoys widespread support, its actual implementation is not certain. This is for several reasons: it is hindered by Switzerland's highly regulated and complex administrative processes and political procedures; not all of the stakeholders are in favour of the project; and there needs to be a democratic process that allows for contestation.[167]

The project managers realized that there would be stakeholder conflict and they developed a process of stakeholder classification and engagement. Eventually, however, the complex political process of decision-making about the future use of the space took precedence, with many alternatives being suggested, including building a Formula One racetrack. Complicating matters further was the administrative process, which began with drawing up zoning capacities and dividing the space between three separate communes. The Swiss democratic system requires a unanimous decision for the zoning to be changed.[168] The canton of Zurich holds the executive power and also

xii Since this announcement in 2009, the Federal Government and Swiss Air Force have reviewed this decision again.

Fig 6.2: **Stakeholders and influences on Swiss cleantech Hub concept**

Source: Author's own; map from LEP consultants

Figure 6.3: **Linkages of the project on an institutional and geographic level**

Source: FFGS 2009 [169]

speaks on behalf of the owner of the site – in this case, the Swiss Federal Government and the Swiss Army. The realization of the concept proposed by the Foundation for Global Sustainability as a cleantech hub will require careful stakeholder management and lobbying of the various communes and governmental agencies. Figure 6.3 depicts the complex stakeholder involvement, and administrative and political processes that have stalled the project.

In the context that the country is trying to diversify its economy and become one of the global leaders in cleantech, the potential for the project and its implications for Switzerland are substantial. Growing interest in the global green economy initiative has given cleantech a substantial boost. With the global financial recession, Zurich's financial hub is seeking new financial and investment landscapes, and greater interest in cleantech opportunities have emerged. The Dübendorf case study, therefore, represents a critical number of components and factors that may support the cleantech industry as well as sustainable industry and services.

The project is unique because of the intention to construct one of the first innovation hubs in the world to focus on sustainability and use the cleantech industry as the primary mandate. The institutional design of the site itself will be attractive to a wide range of stakeholders from an international level to a local level. This includes international universities and large cleantech industries, some of which have already made a decision to base themselves in Zurich,[xiii] in anticipation of a fast developing location for sustainable industries. The site is also designed to integrate the local contexts of business with a link to the city centre, as well as the natural surroundings in a

xiii Suntech, one of the world's largest solar producers has recently located its EU headquarters to Zurich for this reason (Insight 2010).

sustainable way. The international airport is also close by, making it a nationally and internationally accessible location with direct transport routes. The hub itself is designed as a sustainable model and integrates work, living and play areas, and will include existing surrounding communities in the design features. The hub is intended to attract a flexible mix of knowledge intensive tenants with a focus on research and development, sustainability and cleantech. The presence of universities and research centres would enhance knowledge transfer and innovation in this productive city space. A planned low energy infrastructure and an end-point personalized transport system would make it an attractive location for cleantech businesses. Additionally, Zurich's renowned reputation as a stable, safe and efficient location centrally situated in Europe also creates a positive influence.[170]

A lesson learned from this case is relevant in the context of a changing global economic landscape, whereby an advanced city such as Zurich is attempting to catalyze and consolidate a new green economic sector as cleantech that culminates in an urban spatial development. Another important lesson is that even though Zurich and Switzerland have all the required ingredients, expertise and favourable business and innovation climates, the project remains unconsolidated due to complex stakeholder opinions and political processes. This should be noted by other nations attempting similar projects. Careful consideration of the required ingredients, the critical mass of components and a willingness to execute the project also need to be placed in a context of anticipated administrative and political procedures and potential stakeholder conflict.

6.6 Clustering solar energy industries in Dezhou, China

Dezhou, in the north-western Shandong province, is the largest solar thermal research and development centre in China, with over 120 solar energy enterprises and annual renewable energy sales revenues of USD 19 billion (CNY 120 billion). The solar thermal industry in Dezhou accounts for 16 per cent of China's market.[171] The city's construction of a world-leading hub of solar technology and manufacturing, known as the "Solar Valley", demonstrates how the renewable energy industry can catalyse economic development, and how industry and government can collaborate to optimize economic, social and environmental outcomes. Based on California's Silicon Valley, the aim of the development is to centralize solar technology research and development, manufacturing, education, capacity building and demonstration. Industry and government have invested over USD 740 million[172] to develop the Solar Valley.

China's rapidly growing demand for energy presents a significant challenge to its future development. Increasing demand along with low electricity tariffs and poor efficiencies in the power sector has contributed to severe electricity shortages in recent years, and spurred an interest in renewable energy development and demand-side energy management.[173]

Solar energy is a large and rapidly growing industry in China. In 2009, there was a total of 310 MW of solar photovoltaic (PV) capacity installed throughout the country, over double the amount in place the previous year. In the same year, 42 million m^2 of solar

hot water heater collectors were installed; an increase in capacity of 31 per cent to a total of 135 m^2. China is now the world's largest PV producer, and can produce over 40 million m^2 of solar water heating panels per year.[174] China accounts for 70 to 80 per cent of the global solar water heating market,[175] and its market for solar water heaters was estimated to be worth USD 5 billion (CNY 32,000 million) in 2007.

Recent policy decisions in China outline ambitious plans to dramatically increase solar targets to 10 GW of installed solar capacity by 2015 (including 9 GW of solar photovoltaic installations and 1 GW from solar thermal electric power generation), and 50 GW total installed capacity by 2020. Given that the existing installed solar capacity is around 700 MW, this represents a capacity expansion of over 1,000 per cent in just four years.[176]

Dezhou's solar thermal industry and associated businesses employ almost a third of the local workforce (approximately 800,000 people), and over 90 per cent of households use a solar water heater.[177] However, even in Dezhou, the bulk of electricity still comes from coal-fired power stations and it remains to be seen whether its investments in solar technologies will be sufficient to move the city towards a more sustainable energy mix as its economy grows.[178]

The Solar Valley is a mixed-use development, incorporating apartments and parks, industry, educational facilities (including a solar university), tourist attractions, and a sports and entertainment complex within the 330 hectare site. The Valley incorporates a wide range of solar technologies, such as water heating, desalination and air conditioning, that brings together manufacturing, research and development, education and tourism around solar energy technologies in a showcase of cutting-edge solar innovation and economic revitalization.[179] As noted by Greg Bruce, Executive Manager of Integrated Sustainability Services at Townsville City Council, Australia: "The scale and boldness of the development of the Solar Valley is simply remarkable. Having visited the Dezhou Solar Valley in 2008 and 2010, I am simply staggered at the vision and action that is occurring here."[180]

Tours of the solar valley by solar buses © Ming. H. (2010)

Dezhou Solar Valley © Ming. H. (2010)

Solar energy has become an integral part of Dezhou's infrastructure and economy. Solar water heaters are installed in 95 per cent of new urban communities in Dezhou, and 50 per cent of surrounding towns,[182] The city uses solar energy for applications ranging from street lighting to powering buildings and tourist buses. In 2010, over USD 10 million was spent installing nearly 100,000 solar lights along Dezhou's roads.[183] There are approximately 40 energy efficient buildings in Dezhou, including hotels and museums, showcasing solar and energy efficiency technologies such as solar heated toilet seats, solar heated pools and even a solar-powered Tibetan prayer wheel. Energy management systems (EnMS)[xiv] have been introduced in eight key energy-consuming companies (including iron and steel plants, coal-based power plants, paper-making factories, chemical factories, mechanical plants and coal mines) as part of an initial pilot, with plans to expand this to other energy-consuming industries, as well as the transport, construction and public sectors.[184] As a result of the initial pilot EnMS programme in Dezhou, 63,000 tons of coal and the equivalent of 160,000 tons of CO_2 emissions have been saved.[185]

The story of the Solar Valley is heavily intertwined with that of the world's leading manufacturer of solar thermal tanks, Himin. The company has been highly successful in developing and manufacturing cost effective solar thermal products and has been instrumental in transitioning Dezhou's economy from agriculture to research, manufacturing and education. Building on this success, the Chinese Government is investing funds and providing policy support to develop the Solar Valley as a major manufacturer of solar technologies, and to further stimulate the economy and catalyze more sustainable development paths.

xiv An EnMS adopts a similar framework to the International Standards Organization's groups of standards on quality management (ISO 9001) and environmental management (ISO 14001), in which an iterative process of continual improvement is undertaken to reduce the energy intensity of the organization. The EnMS requires the organization to develop an energy efficiency policy, to identify all energy-consuming activities within the organization, to highlight which of these have the greatest impact on the organization's energy consumption, and to develop policies and procedures to reduce the energy consumption of these activities. Over time, the organization iteratively measures their progress and reviews these policies and procedures, and addresses an increasing number of their activities.

Himin's Solar Valley headquarters is currently the largest solar powered office building in the world.[187] Himin is vertically integrating components of solar technology production, from research and development, to manufacturing, demonstration and promotion, and is building capacity in Dezhou for future innovation and technology development. Himin has invested over USD 161 million to construct two demonstration projects in the Solar Valley, the "International Environmentally-friendly Energy Conservation Demonstration Zone" and the "Chinese Solar Energy Demonstration Town'. Himin has also established a university campus and training centres for professional engineers, academic engineers and business managers in the solar thermal industry.[188]

Himin's founder, Huang Ming, is a strong advocate for the role of business in promoting sustainable, affordable solutions, enhanced by government regulation when necessary,[189] and has been instrumental in providing the momentum for the solar industry in Dezhou and China, and in developing the vision for the Solar Valley. His broader vision is for many similar developments throughout China and the rest of the world, enabling the transition to a solar powered sustainable future.[190]

The success of Himin and the development of the Solar Valley is a reflection of the relatively unique level of cooperation between government and industry in China. The government has recently provided a range of policies and incentives that have stimulated the development of the renewable energy industry. Some of these are the Renewable Energy Law (2006), National Action Plan on Climate Change (2007),[191] the Twelfth Five-year Plan, incorporating the Twelfth Five-year Plan on Greenhouse Emission Control[xv] (2011),[192] and pilot carbon trading schemes for the cities of Beijing, Tianjin, Shanghai, Chongqing and Shenzhen, and the provinces of Hubei and Guangdong (announced in 2012).[193] China's significant investment in science and technology over the last 20 years has created the capacity and knowledge base that has enabled it to become a global leader in renewable energy innovation and manufacture. It now dominates the global market, harnessing its citizens' skills in low-cost, efficient manufacture to produce highly competitive products.

Although the Solar Valley is still under construction and there appears to have been no formal evaluation of the project, there are a number of key lessons that can be learned from the case study. This development, along with others throughout China, is the result of the government's recognition of energy as a strategic sector for economic development. The host of policies and incentives aimed at increasing energy efficiency and conservation, coupled with support for the renewable energy sector, is indicative of the scale and breadth of political support needed to foster the growth of sustainable technologies. Furthermore, the growth of this industry and strong financial position of Chinese solar technology companies at a time when many countries are struggling to recover from financial crises shows how renewable energy technologies can support local economic development and a green economy. Huang Ming advocates strongly for the role of industry in catalysing a sustainable revolution, and his drive, vision and strategic investments have been fundamental to the development of China's world-leading solar thermal industry. He frequently attests that his company received minimal government support in its early days, and that this has been a key factor of Himin's success.[194] With its focus on developing cost-effective solar products that meet market needs, Himin

xv The Twelfth Five-year Plan on Greenhouse Emission Control aims to reduce CO_2 emissions per unit of GDP by 17 per cent by 2015 from 2010 levels.

was able to grow without government assistance. Huang Ming sees the commercial viability of solar technologies as being key to the business's success, and warns against too much government support for solar industries.[195]

While the development of the Dezhou Solar Valley appears to be rapid by western standards, it must be remembered that it followed two decades of capacity building by government and industry. Both invested heavily in research and development in energy systems and have since capitalized on China's competitive advantage in cheap and efficient manufacturing. Due to China's unique political and economic situation, these circumstances may not be fully replicable elsewhere, but this case indicates the scale at which change can take place given the right mix of vision, determination and resources.

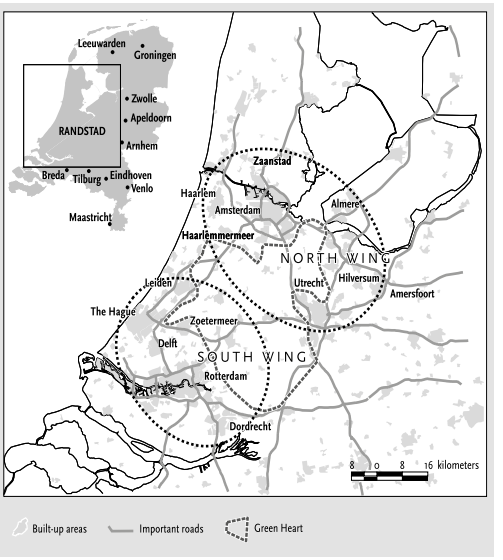
6.7. Randstad: A polycentric urban region

The Randstad is an urban constellation located in the western parts of the Netherlands. The name is derived from the Dutch word "Rand", which means "rim" and makes reference to the location of the Randstad along the edge of an open green area known as the "Green Heart". Much of the Netherlands' economic activity is in the Randstad region, accounting for 45 per cent of national employment and accommodating 44 per cent of the population in less than 20 per cent of land area. As depicted in Figure 6.4, the Randstad region is formed by the four largest cities, namely Amsterdam, Rotterdam, The Hague and Utrecht. The Randstad is composed of a North Wing (Amsterdam, Utrecht and surrounding cities) and a South Wing (The Hague, Rotterdam and surrounding cities). With a host of smaller and medium-sized cities in the region surrounding the four large centres and the lack of a dominant centre for political and economic activity, the Randstad is a classic example of a polycentric urban region.[196,197]

In the last few hundred years, the development of the region has been characterized by highly fragmented political and administrative organization.[198] More recently however, the Randstad has benefited from a more coordinated approach towards urban and regional planning, and the Green Heart has been a central focus area for planning policies since the 1950s.[199,200]

The key rationale for polycentric urban development is that in regional development, one city could not provide a complete range of economic functions, urban facilities or residential and business environments. This could be better achieved through strategic design and the coordination of development of specialized facilities within a region,

Figure 6.4: **Map of the Randstad region.**



Source: Copied from Meijers E (2007). Synergy in Polycentric Urban Regions Complementarity, organising capacity and critical mass.PhD thesis. Delft University

thereby creating synergies between centres.

Synergy in polycentric urban regions is generated through:[201]

- Complementarity: The interplay of regional demand for more specialized services through the differentiation of economic and functional roles of cities for facilities.

- Co-operation: The development of a regional organizing capacity through which co-operation in the development of polycentric development can take place (discussed in more detail in the governance framework section).

It is argued that through the development of complementary functions in the cities in a region, citizens will be able to have access to a wider range of functions. This will be achieved as the demand market for such services is the region, which is larger than the city, and therefore will give rise to a situation where more specialized, diverse and higher quality services and functions could be developed.

The Randstad region's four biggest cities have different specialization areas which demonstrate complementarity:[202]

- Amsterdam's specializes in commercial services, including financial intermediation, information and communications technology, publishing and printing, culture and sports.

- Rotterdam has economic specialization in areas of manufacturing and transport, mostly due to its port. It is also home to heavy industries such as the petrochemical and chemical industries, and the manufacturing of fabricated metal products and transport equipment. The city also has a vibrant waterborne transport network and auxiliary transport industries, as well as construction and public utilities sectors.

- The Hague, which is the seat of government, is particularly dominant in public administration. It is also a centre for agricultural activity, mostly due to the presence of agricultural interest groups.

- Utrecht is relatively strong in wholesale trade and education.

Empirical evidence shows that there is a trend towards diminishing complementarity in economic roles between the four main cities in the Randstad region. The divide of the Randstad into a North- and South-Wing also shows that there is substantially higher complementarity in the North Wing. It could, however, be noted that there is substantial division of labour (an essential ingredient for complementarity) between the three largest cities, which each specialize in commercial services (Amsterdam), manufacturing and transport (Rotterdam) or public administration (The Hague).[203]

As far as administrative infrastructure is concerned, there are three tiers of government in the Netherlands, namely national, provincial and municipal. Dealing with spatial trends and forces in a cohesive way is complex because the Randstad region stretches over four provinces. This has highlighted the need to develop a capacity for cooperation and multilevel governance across public and private players.[204]

Many cooperative networks have been developed in the Randstad region to address the lack of administrative capacity between municipal and provincial levels, and provincial and national level. Around the four largest cities in the Randstad, city-regions were formed where cooperation

platforms have been created to address issues such as transport, traffic, regional spatial development, housing, employment, economic affairs and youth welfare.[205]

An example of networks where formal cooperation has been established between the four provinces, regional authorities and major cities is the "Bureau RegioRandstad" (Randstad Agency). The key objectives of this agency are to develop the Randstad as a high quality urban and rural environment and to improve the international competitiveness of the region.[206]

An informal cooperation platform has emerged in conjunction with the formal cooperation network of the Randstad Agency, which is called the Delta Metropolis Association. Initially founded by a number of municipalities and chambers of commerce, the Delta Metropolis Association is an open network that now includes members such as housing corporations, organizations of the agriculture and horticulture branches, an employer's organization, the transport sector, environmental organizations and water boards. This cooperation platform's main function is to provide members with a platform to discuss and lobby for the interests of the Randstad region.[207]

The cooperation networks discussed mainly developed from a bottom-up process where actors within the region initiated these platforms; that is, it was not implemented by a higher level of government. The networks in the region provide Randstad with a solid regional organizing capacity. Recognition of the "region" as a suitable scale for competitiveness, and evidence of the beneficial synergies that arise from a coordinated approach, have led to the re-examination of intra-regional interdependencies, which in turn has resulted in higher levels of cooperation.[208,209,210.]

See the following paper for an empirical analysis and evidence of synergy in the Randstad:
Meijers, E. (2005). Polycentric Urban Regions and the Quest for Synergy: Is a network of cities more than the sum of the parts? in *Urban Studies*, 42 (4), pp. 765-781.

The current trend in academic literature is that the network metaphor is increasingly being used to describe inter-urban relationships. Analysis of the synergy concept and transferring it to spatial phenomena such as the polycentric urban region shows that the interactions and nature of relationships between cities determine whether synergies can be created on a regional level.[211]

This case study shows that through the creation of synergies in a region, a polycentric urban region, could indeed be more than the sum of its parts through complementarity and cooperation. In summary the case study showed that:[212]

- The first mechanism through which synergy can be achieved (namely cooperation) is becoming increasingly prevalent in the Randstad region. Through both formal and informal networks a regional organizing capacity has been established;

- The second mechanism through which synergy could be created (namely complementarity) reveals that the key cities each perform distinct roles within the region, specializing in commercial services, manufacturing and transport, public administration, or trade and education.

Considering the trend of diminishing economic complementarity between the four main cities in Randstad, the question arises whether the mechanisms of reduced complementarity and increased coordination

contribute to achieving synergies in this region. Further research is required to provide more clarity on this area.[213]

Finally, it can be concluded that where inter-urban relationships traditionally have been defined in terms of hierarchy, the current trend in the Randstad is that horizontal, network-like relationships are increasingly seen. Through complementarity and cooperation, a new model of spatial organization emerges referred to as a network urban structure. It could be concluded that a network urban structure in urban regions could be beneficial to create synergies.[214]

6.8 Building a recycling industry at the Kitakyushu Eco Town Project [215,216,217]

The Kitakyushu Eco-Town Project is a 2,000 ha industrial park built on a landfill site facing the Hibiki Sea on the northern outskirts of Kitakyushu City, Japan. Started in 1997, its aim is to achieve zero emissions and zero waste by using all waste as materials in other industries, thus closing resource loops within the park.

Kitakyushu Eco-Town came about in response to the city's history as a leading industrial hub throughout Japan's pre-war industrialization, followed by economic growth in the 1960s. Since its first steel plant opened in 1901, Kitakyushu was home to many heavy industries, such as chemicals, steel, glass, cement, bricks, and power generation. With the growth of such industries, pollution became a serious problem. Skies were filled with "seven colours of smoke" due to red iron oxide particles and dust from coal. The nearby sea was dubbed the "sea of death" after a study revealed that not even bacteria could survive in its toxic waters.

In the wake of a movement to clean up the environment driven by women's groups, the city and local companies started taking action to reduce pollution in the 1960s. Actions included the signing of voluntary pollution prevention agreements between the city and companies. These stipulated targets more stringent than regulatory standards; the dredging of sludge from the "sea of death"; the creation of a pollution surveillance centre to check air quality; and the passing of a Pollution Prevention Ordinance in 1971. By

Birds' eye view of the Kitakyushu Eco-Town © Kitakyushu City 2011

the 1980s the situation had greatly improved, and Kitakyushu's air and water achieved the required national environment standards. The city's success in improving its environment was highly regarded both domestically and internationally, and it recognized with awards such as the Global 500 Award from UNEP in 1990, and the United Nations Local Government Honours at the 1992 Earth Summit in Rio de Janeiro, Brazil.

In the early 1990s, Kitakyushu's mayor started thinking about the next challenge for the city: how to combine environmental policy with industry. This coincided with discussions on how to make best use of its Hibiki landfill site. Study groups met within the city administration, incorporating not

Figure 6.5: **Kitakyushu City overcoming heavy pollution**

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Figure 6.6: **Kitakyushu City's Environmental Industry Promotion Strategy**

Kitakyushu Environmental Industry Promotion Strategy

Comprehensive Development of Basic Research, Technological Development, Practical Research and Commercialization

Education and Basic Research

- Establishment of an environmental policy concept
- Basic Research, human resource training
- Base for industry – academia cooperation

Technology and Practical Research

- Aid for practical research
- Incubation of local enterprises

Commercialization

- Various recycling projects and Implementation of environmental business
- Aid for small / medium size enterprises and venture enterprises

Kitakyushu Science and Research Park

- Universities
  - University of Kitakyushu, Faculty of Environmental Engineering, Graduate School of Environmental Engineering
  - Kyushu Institute of Technology, Graduate School of Life Science and Systems Engineering
  - Waseda University Graduate School of Information, Production and Systems

  and others
- Research Institutes
  - Waseda University, Information, Production and Systems Research Centre
  - Fukuoka Research Institute for Recycling Systems

  and others

Practical Research Area

- Fukuoka University, Institute for Recycling & Environmental Control Systems
- Kitakyushu Institute of Technology, Eco-Town Practical Research Facility
- Nippon Steel Engineering Co. Ltd. Kitakyushu Environmental Technology Centre
- Practical test site of the Fukuoka Research Centre for Recycling Systems
- Practical research in various fields
  - Waste disposal site management
  - Proper disposal of hard-to-handle waste
  - Waste recycling technology
- Kitakyushu Eco-Town Centre

and others

Comprehensive Environmental Industrial Complex

- A complex of recycling factories
  PET, home appliances, office equipment, automobiles, florescent tubes, medical instruments, construction waste, complex core facility, nonferrous metals, PCB-polluted soil purification

Hibiki Recycling Area

- Local SME and venture enterprises (cooking oil, organic solvents, used paper etc)
- Automotive dismantlers and used parts dealers

Hibikinada East Area

- Reycling Plants
  Sludge, metals, waste wood, vending machines etc
- Wind power plants

Other Areas

- Recycling / Reuse plants
  - Styrene foam, office equipment, foaming inhibitor, melting furnace fly ash, plastic containers and packages, food waste

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only the environment department, but also the economic department. The 1990s saw the enactment of basic legal frameworks for recycling and resource management in Japan, including the Recycling Law (1991), Container and Packaging Recycling Law (1995), and the Electric Household Appliance Recycling Law (1998). Together, they obliged industries, governments and consumers to reduce material usage, thus creating a market for recycling technologies. Companies like Nippon Steel were also looking for new business areas as global competition pressured heavy industries to promote rationalization and efficiency. Environmentally-friendly industries were identified as a key area of opportunity, and stakeholders from industry, research institutions and government joined forces to create the Kitakyushu Environmental Industry Promotion Council.

When the Ministry of International Trade and Industry (MITI) and the Ministry of Welfare set out their Eco-Town Initiative aims of for zero emitting societies through the strengthening of recycling industries in 1997. Kitakyushu was ready to put its ideas into action. Initially, many companies took advantage of MITI's Eco-Town grant, which was provided for setting up systems (e.g. research to inform planning, engagement with citizens etc.) and constructing infrastructure for new companies.

There are two main zones within Kitakyushu's Eco-Town. The first is the Practical Research Area where industry / academia / local government institutions conduct research and development in waste treatment and recycling technologies. The second is the Comprehensive Environmental Industrial Complex, where newly developed technologies are brought to market. Inside the Comprehensive Environmental Industrial Complex is the Hibiki Recycling Area, where the city provides business sites for long-term leasing to enable small and medium-sized enterprises to venture into environment-related industries.

Kitakyushu Eco-Town is characterized by strong collaboration between government, industry and academia. Situated close to the Eco-Town is the Kitakyushu Science and Research Park, where universities and research institutions themed around the environment and information generate new research and build human resources. Universities in the Kitakyushu Science and Research Park received support from the Ministry of Education, Science, Sports and Culture's subsidy for pioneering academic institutions.

Kitakyushu's answer to waste management was to create a system whereby energy and materials are flexibly shared by individual enterprises in different industry sectors. Taking advantage of the fact that the Eco-Town is a gathering of different recycling and reuse factories, residue from one factory is, in turn, used as material at a different factory. Unusable industrial wastes discarded from enterprises within the Eco-Town (mainly residual substances from recycling and automobile shredder dust) are sent to the complex core facility, where they are processed by melting. In this treatment process, molten material is recycled as slag and metals and the power generated during the process is supplied to enterprises in the Eco-Town area. With this process, Kitakyushu is able to raise material productivity, recycling and reuse rates, and in turn lower final waste volumes.

Kitakyushu City's strategy of comprehensive development and support resulted in many innovations in the recycling industry. For example, Kitakyushu was the first city in Japan to start the reuse of florescent tubes,

and its recycling rate for automobiles is an impressive 99 per cent (exceeding the 95 per cent recycling rate targeted by the Japanese Government for achievement by 2015). According to a survey done in 2006, during its first six years, the construction and operation of Kitakyushu Eco-Town is estimated to have generated USD 1.34 billion (JPY 109.3 billion) in direct and indirect investments, and created 6,470 jobs.[218]

Kitakyushu's success can be attributed to a combination of the following factors:

1. *Accumulation of technologies and human resources*
   The use of existing industrial infrastructure and technological capabilities accumulated throughout Kitakyushu's history as a manufacturing centre acted in its favour. The technologies, human resources and culture developed while combating heavy pollution in the area also played an important role.

2. *Timely national policy and subsidies*
   New national policies helped to promote new industries like recycling, and timely subsidies encouraged civil enterprises to take on the risks of entering new fields.

3. *Communication*
   Kitakyushu was very careful to communicate information about the Eco-Town to the public throughout its development. In principle, all facilities were open to public, helping to create the understanding necessary to build support for new waste treatment plants.

4. *Clustering*
   The clustering of similar businesses allowed them to benefit from shared efforts to communicate and negotiate on behalf of their industry.

5. *Motivation*
   Having experienced firsthand the hardships associated with extreme pollution, there was a strong appreciation for the need to improve the environment, which helped to align interest groups toward these goals.

Having managed to achieve many of its initial Eco-Town Project Plan goals long before 2005, Kitakyushu City started drawing up its Phase 2 Plan in 2002.[xvi] Phase 2 includes new strategies not only to promote recycling, but also for various environmental projects such as energy and resource conservation that promote a more sustainable local society. For example, the city has built a "Next Generation Energy Park" within the Hibiki landfill site to promote the use of solar photovoltaic panels, wind power and coal gasification. Kitakyushu City has also been working on the Green Corridor Project, aimed at harmonizing nature within this industrial city through the involvement of non-profit organizations and citizens in the creation of green spaces in the city and educational programmes, amongst other initiatives. In 2011, the city was selected for inclusion in Japan's "Future City" initiative, recognizing the Green Corridor Project and others promoting the development of a Smart Community as examples of environmental excellence.

xvi Some projects introduced above – e.g. the complex core facility – are projects that will be completed in Phase 2.

The development of the city of Uberlândia, Brazil is strongly tied to its geographical position. Located at a crossing point for roads connecting Brazil's main coastal cities with the interior, Uberlandia is considered the local capital of logistics © UN-Habitat/Alessandro Scotti

Conclusion 7

This quick guide provided insight into the approach, mechanisms and governance framework to achieve green economic development. The guide mainly grapples with the perceived trade-off between economic development and environmental protection. This is a key issue addressed in the guide and it explores pathways of how both of these goals may be achieved in union.

Approach: The quick guide suggests the analytical framework and approach to be adopted for designing initiatives to develop and find new areas of competitive advantage:

- The systems and network view should be adopted as a guide to design strategies and support structures;
- Demand-side and supply-side considerations are important and should be considered in the design of mechanisms and support structures.

Mechanisms: A number of mechanisms through which competitive advantage may be achieved were discussed. In summary these include the following:

- Polycentric urban development principles should be adopted on a regional scale. Synergies between centres could be created through cooperation and complementarity;
- The mechanism of clusters is suggested because this will provide a framework for focused support for innovative activities and create a competitive advantage. These clusters need to be stimulated to exhibit self-exploration activities for green economic development;
- The strengthening of knowledge infrastructure and linkages between helixes to support growth in clusters for economic development is suggested as a key mechanism for supporting innovation in these clusters.

Governance framework: Governance of these measures is important because this addresses the framework from which government will stimulate and coordinate such activities. The following key principles are suggested for a governance framework to optimise benefits from the above mentioned mechanisms:

- **Capacity development:** Stimulate the development of a regional organizing capacity and strategic planning capability to ensure regional green economic development goals are reached;

- **Creative governance:** Governance mechanisms should be designed in a way that innovation and creativity in the region is stimulated to encourage self-exploration activities for finding new areas of competitive advantage;

- **Managing the transition and stakeholders:** The process of greening economies is likely to meet resistance from many different angles, therefore change management of transitions is required. Many stakeholders are involved in green economic development projects therefore careful management of such stakeholders are also important.

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