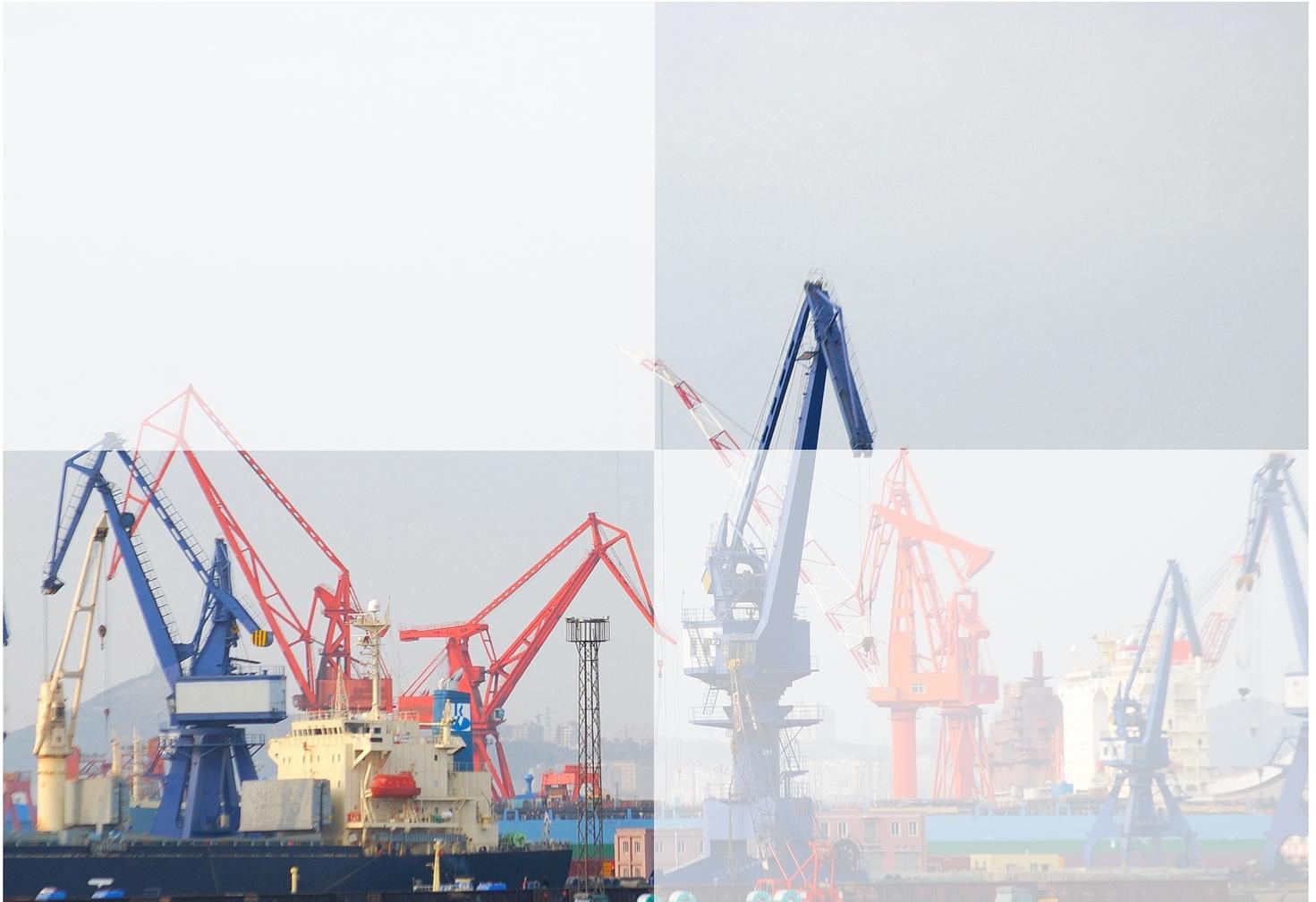


Industry Agenda

The Future of Urban Development Initiative: Dalian and Zhangjiakou Champion City Strategy

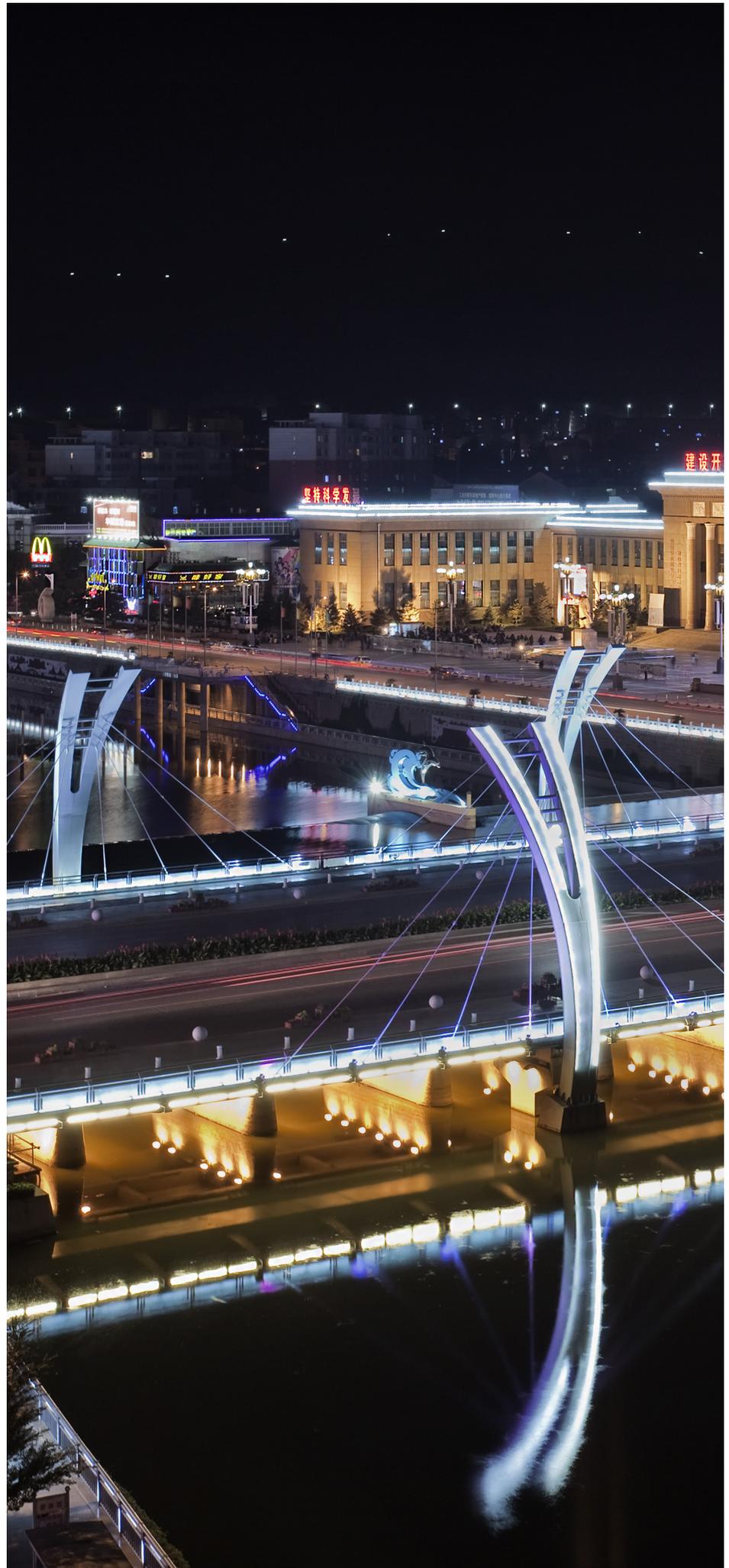
In collaboration with Accenture

July 2014



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Preface

The world's population is gravitating towards urban locations at an unprecedented rate, which is expected to result in the world's urban population surpassing 5 billion by 2030. This evolution is particularly striking in China, where more than 50% of the population live in cities today and more than 60% will do so in 2018, with further increase expected in future. Urban expansion to this degree presents urban challenges that need to be addressed holistically if cities are to remain liveable, productive and sustainable. In this context, the World Economic Forum has embarked on a series of urban-related initiatives over the past several years, including SlimCity (2010), Catalysing Retrofit Finance and Investing in Commercial Real Estate (2011), and since 2012, the Future of Urban Development Initiative.

The Future of Urban Development Initiative serves as a partner in transformation for cities around the world as they address urban challenges. It aims to make innovation accessible and mutually beneficial to city leaders and businesses alike. The Initiative is based on two premises: First, that pre-eminent, multistakeholder thinking should be available to cities of all types, sizes and geographies. Second, that new models for urban problem-solving are crucial to securing healthy and sustainable urban systems and land-use patterns at a time of changing city dynamics. Leveraging the convening power of the World Economic Forum, global experts, industry leaders, leaders of the selected Champion Cities and local stakeholders have worked together on ways to resolve specific urban challenges identified by the cities themselves. From its inception, the Initiative has focused exclusively on action in China, with a first successful collaboration with the Champion City of Tianjin in 2012.

This report presents the outcomes of the multistakeholder collaboration with the new Champion Cities Dalian and Zhangjiakou. We hope that the review of the challenges before these cities and the strategic recommendations proposed will serve as a foundation for greater collaboration and development. In this regard, we would like especially to recognize and thank Li Wancai, Mayor of Dalian Municipal People's Government, and Hou Liang, Mayor of Zhangjiakou Municipal People's Government, for their leadership and commitment to the Champion City process.

We also would like to thank all the members of the Future of Urban Development Initiative Steering Board, Advisory Board and China Working Group for their continued support of this Initiative – in particular, Accenture as Project Adviser and Arup as Project Champion. Finally, we wish to recognize and thank the core partners of our work in China, the China Center for Urban Development and the World Bank.



Olivier Schwab
Executive Director
World Economic Forum
Beijing Representative Office



Alex Wong
Senior Director
World Economic Forum
Head of Centre for Global Industries &
Head of Basic Industries

Foreword from Champion Cities and Partner Organizations



Qu Xiaofei
Vice Mayor
Dalian
Municipality

Dalian is greatly honoured to be one of the Champion Cities selected by the Future of Urban Development Initiative, which brings together international and domestic experts and industry leaders. The project team has visited Dalian a number of times and organized workshops to explore how to address the bottlenecks and other pertinent issues in Dalian's urban landscape together with local experts. Practical and effective, the Initiative has provided Dalian with a platform of international practices and success stories from which to learn.

As the gateway to northeast China, Dalian is home to the largest port in the region and promises greater potential. As the outcome of this Initiative, the strategic report offers constructive recommendations for planning of transportation, energy management and industrial restructuring. Dalian is pleased to partner with the World Economic Forum and the project team to make a great contribution to urban development.



Hou Liang
Mayor
Zhangjiakou
Municipality

Well-known for its history and culture, Zhangjiakou boasts a unique resource endowment and second-mover advantages. The city is now entering a golden age of development and its globalization process is accelerating, as demonstrated by two historic opportunities: an integration development plan for Beijing, Tianjin and Hebei, as well as its partnership with Beijing to bid for the 2022 Winter Olympic Games. The city urgently needs innovative solutions to address its development challenges. The Future of Urban Development Initiative has provided an unrivalled platform for innovation to meet these challenges. In collaboration with the World Economic Forum, leading foreign and domestic experts as well as industry leaders, the city will explore strategies and solutions, seize historic opportunities and address its urbanization challenges.

The three themes identified by the initiative are highly relevant to the context of Zhangjiakou, and challenges we hope to overcome. Throughout our collaboration process, experts from the public and private sectors as well as from various fields have shared their practices, insights on policy frameworks and various business models. Their insights and expertise have been further integrated through a variety of meetings and activities. The project report thus is a strong combination of a global vision, practicality and sustainability, and will serve to guide urban development in Zhangjiakou. The approaches introduced in the report are good examples for other cities around the world confronted with similar urbanization issues.

I believe that the vision mapped out in the report will become a reality in the near future and we look forward to deeper cooperation with the Future of Urban Development Initiative.



Li Tie
 Director General
 China Center for
 Urban
 Development

Following the example set by the city of Tianjin, Dalian and Zhangjiakou have been selected as new Champion Cities by the China Center for Urban Development and the World Economic Forum. The aim of the initiative is to explore the transformation of urban development in cities of different sizes in China, in line with the spirit of China’s central urbanization work conference and China’s new urbanization plan. Dalian should focus on enhancing the management of its inner city and explore how to address the availability of infrastructure, industrial restructuring and traffic congestion, particularly in its city centre. By contrast, Zhangjiakou should focus on the management of its outlying areas and define its role in the upcoming national strategy of integrating Beijing, Tianjin and Hebei. Taking advantage of the opportunity presented by its partnership with Beijing to bid for the 2022 Winter Olympic Games, Zhangjiakou should explore how to reorganize its resources in a sustainable manner so as to improve the development of infrastructure across the region and catalyse the transfer of the services sector from Beijing to Zhangjiakou. It is my belief that by learning from international experience and grasping favourable opportunities, the two cities will serve as role models for other Chinese Champion Cities in the years to come.



Gong Li
 Senior Managing
 Director &
 Chairman of
 Greater China
 Accenture

The Chinese urban population is set to exceed 900 million by 2030, according to current industrialization and urbanization trends. Cities are not only focal points for industries but also centers of resource consumption and environmental stress. According to the New Resource Economy study for Chinese cities, the prosperity of cities can be sustained only if they can achieve economic growth with lower energy consumption per unit and reduced environmental impact. Despite the challenges of “urban disease”, most mid-sized cities in China have the greatest potential to succeed a sustainable transformation. We hope to continue our work with the World Economic Forum and Chinese partners, to share insightful knowledge and research and to contribute to capacity building for the future development of Chinese cities.



Michael Kwok
 Director
 Arup China

Transportation remains a critical factor that is stunting the urban development of many cities in China. To resolve traffic problems simply by building more roads is like controlling an obesity problem by loosening the belt, which does not address the root cause. It would be more effective to reduce road pressure by introducing a smart transport system (STS), including analysis based on transport data, electronic road pricing, dynamic speed limits and a smarter, more efficient road as well as improved public transport services to reduce road pressure.

Executive Summary

The Future of Urban Development Initiative (FUD) serves as a partner in the transformation of cities worldwide as they address significant urban challenges. It aims to make innovation accessible to city leaders and businesses in a mutually beneficial setting.

Committed to this mission, the FUD Initiative expanded its activities in China, after having successfully collaborated with the Champion City of Tianjin.

The new Champion Cities are Dalian and Zhangjiakou. Both are unique but at the same time representative to enable the Initiative to explore innovative solutions for urban problem-solving and to scale the knowledge to other cities. Dalian, around 800 kilometres east of Beijing, is the portal of north-eastern China and the most developed city in the region. It is on the pathway to becoming a more sustainable urban centre.

Zhangjiakou, around 180 kilometres northwest of Beijing, will bid for the 2022 Winter Olympic Games. The city could then completely transform itself from an old industrial town to a liveable city with sizeable natural resources, integrated into the “Greater Beijing” area.

To help Dalian and Zhangjiakou address their main urbanization issues, the following three urbanization themes were selected by the FUD Initiative:

1. Transport planning and management
2. Urban energy management
3. Sustainable industry development

Based on these three themes, an Urbanization Issues Framework was developed to map the detailed issues Dalian and Zhangjiakou currently face. Six key issues were then identified by the initiative to provide strategic recommendations. These strategic recommendations stemmed from the Initiative's community of international and Chinese experts, from both the public and the private sector. They provided best practices and insights on policy frameworks as well as on various business models.

Now in its third year, the Initiative has reached a milestone of fruitful cooperation with three Chinese cities: Tianjin in the first year, Dalian and Zhangjiakou in the second year. More than 70 organizations participated in the expert community. As the world undergoes unprecedented urban development, both in scale and in speed, the insights of the Chinese Champion Cities will serve as role models for other cities in China and across the world.



Introduction

The Future of Urban Development Initiative

The Future of Urban Development Initiative (FUD) serves as a partner in transformation for cities worldwide as they address significant urban challenges. It aims to make innovation accessible to city leaders and businesses in a mutually beneficial setting.

The core activity of the Initiative is for the multistakeholder Steering and Advisory Boards to work with selected Champion Cities and local and regional stakeholders to tackle urban challenges identified by both cities and strategize specific goals.

Since its launch in 2012, the Initiative has focused on equipping Chinese city leaders and relevant industry leaders with multistakeholder thinking as they strive to convert the challenges of rapid urbanization into opportunities for smart

and sustainable growth. In 2012, Tianjin was elected as the inaugural Chinese Champion City for the Initiative. Twenty local officials and stakeholders collaborated with over 50 members of the global Steering and Advisory Boards through a seven-step process to create a six-point Tianjin Champion City strategy which addresses two of the city's major goals: combating traffic congestion and expanding the service sector.

Following the initial collaboration with Tianjin, the Initiative decided to significantly scale up its activities in China by expanding to two additional Champion Cities, Dalian and Zhangjiakou. A China Working Group was then launched to work more closely with Chinese stakeholders.

This report captures the Initiative's process and activities to provide strategic insights and recommendations for the new Champion Cities to address their key issues on urban development.

Organizational Structure of the Future of Urban Development Initiative in China



Methodology — The Champion City Model

The strategic recommendations developed for the Champion Cities are a result of collaboration between the World Economic Forum, the Champion City governments, the global Steering and Advisory Board members and the China Working Group. They were derived through the FUD Initiative's seven-step Champion City Model.

Upon launching the two new Champion Cities at the Annual Meeting of the New Champions in Dalian in September 2013, the global Steering Board decided to focus collaboration with the cities on three urbanization themes. The criteria for selecting the themes were based two aspects: First, how urgent their underlying issues are to the cities. Second, what the global Steering and Advisory Boards as well as the China Working Group could contribute, given their respective expertise and capability. The three urbanization themes for Dalian and Zhangjiakou are:

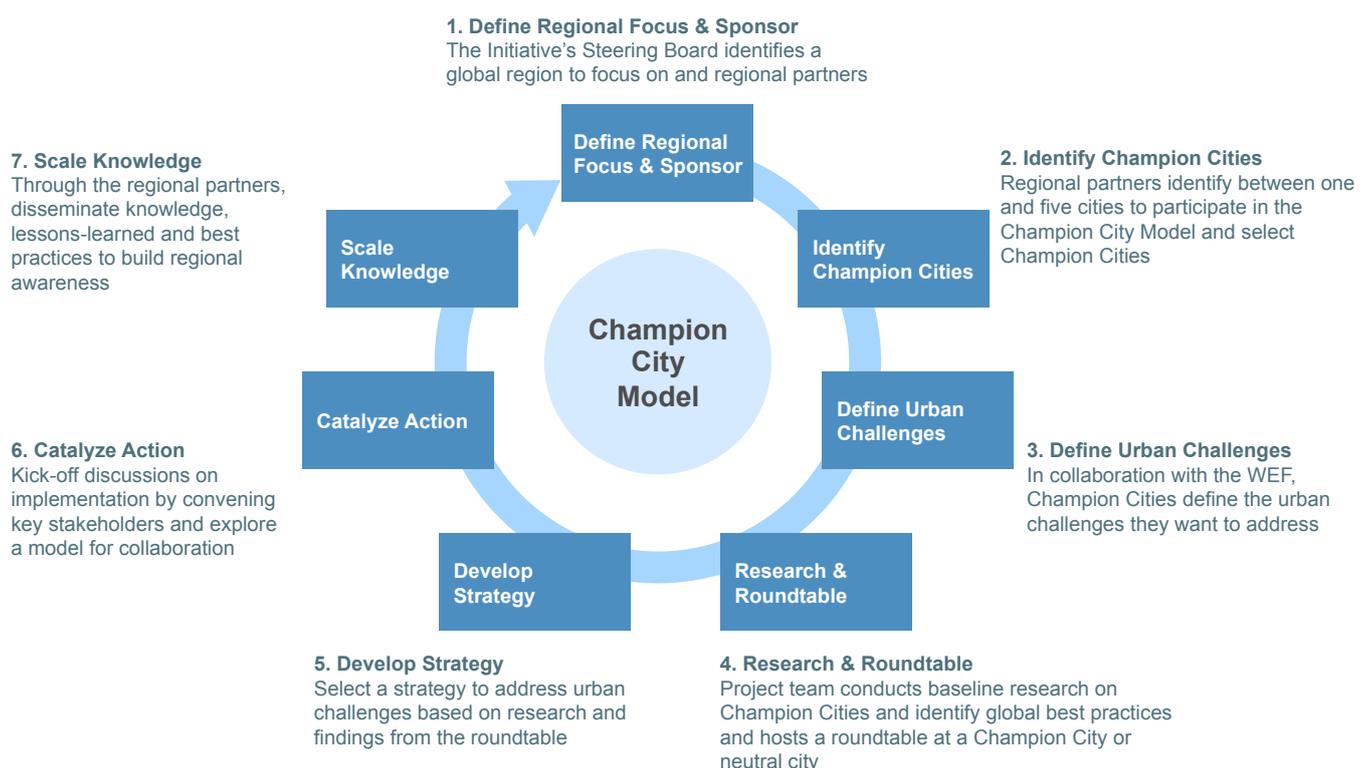
1. Transport planning and management
2. Urban energy management
3. Sustainable industry development

The selection process of the themes included an in-depth discussion with Champion City leaders as well as site visits to both cities to obtain a comprehensive understanding of the key urbanization issues each city is facing. This was followed by desktop research and interviews where global Steering and Advisory Board members and China Working Group experts were prompted to share best practices in addressing these issues. The best practices were then debated for their applicability to the cities at the Champion City Roundtable in December 2013, co-organized by the China Center for Urban Development and the World Economic Forum. The roundtable convened more than 25 Chinese and international experts from both the public and the private sector. Participants mapped the issues each city is facing on the focused urbanization themes and a set of recommendations to address them.

Together with the Champion Cities, the Initiative prioritized a small number of issues for each city and further developed strategic recommendations supported by successful case studies to provide guidance on how the recommendations could be adopted and implemented. The strategic recommendations were developed through a second round of interviews with selected global Steering and Advisory Board members, China Working Group members and the project's research team.

Accenture worked in collaboration with the World Economic Forum as Project Adviser, helping to build and execute the seven-step process of the Champion City Model. Arup China was Project Champion and Content Adviser to the World Economic Forum, providing subject matter expertise on the strategic recommendations.

Champion City Action Model of the Future of Urban Development Initiative



Trends and Priorities of Urban Development in China

The year 2013 was important for urban development in China. By the end of 2013, more than 50% of China's population (around 730 million people) lived in cities. The country has six megacities with more than 10 million people and 103 cities with more than 1 million people. It is estimated that China will continue its massive urban expansion at an estimated speed of 1% each year. (China State Council, 2014) The unprecedented urban development brings a wealth of opportunities but also leads to great economic, social and environmental challenges.

Towards slower growth

During the past 30 years, China has reformed its economic system and experienced continuous double-digit growth, becoming the world's second largest economy. Since 2012, the Chinese government began to refocus the next stage of its economic growth from ensuring speed to maximizing efficiency and productivity. The annual GDP growth target of the country was set at a relatively lower speed of 7.5% for the past two years, and the recent 2014 National People's Congress (NPC) further confirmed that moderate growth will be the country's main economic strategy for the coming years.

From an urban perspective, rapid economic growth resulted in many megacities with booming populations, unlimited expansion and lagged infrastructure support. Traffic jams are notorious and housing prices are skyrocketing.

Main challenges of rapid urbanization

From a societal perspective, rapid urbanization exerted a lot of pressure on infrastructure and public services. Hukou, the Chinese household registration system based on where citizens are born and their families are located, is divided into agricultural registration and non-agricultural registration. Rural migrants coming to Chinese cities and who have not obtained an urban residency are commonly mid-to-low income citizens with limited access to public services.

From an environmental perspective, cities in eastern China are suffering from poor air and water quality. Cities are reaching their limit of providing sustainable living environments for their citizens.

Moving forward

Urbanization, therefore, becomes one of the government's key focuses to shift away from the bold type of growth to a more sustainable and resource-efficient economy. Following the 12th NPC, the Chinese State Council announced the latest National New-type Urbanization Plan (2014-2020), a comprehensive urban development framework resulting from more than a year of cross-ministry collaboration and debate. The plan recognizes the challenges Chinese cities are currently facing, and focuses on sustainability as the main guiding factor for urban development.

On the city-planning level, the plan encourages cities to adopt a citizen-centric approach, embed green and low-carbon strategies, preserve historical and natural heritage in the planning process, and limit urban expansion. Cities should concentrate on providing a convenient, comfortable and efficient public transport system, as well as affordable housing, utilities and other public services to all citizens. Moreover, the plan recognizes that industries will remain a significant part of future urban development in terms of economic growth and job creation.

The Initiative's three themes for the term – transport planning and management; urban energy management; and sustainable industry development – are in line with the National New-type Urbanization Plan (2014-2020). In the future, the new Champion Cities of Dalian and Zhangjiakou can be used as role models to lead the change.



New Champion Cities: Dalian and Zhangjiakou — Facts and Challenges

The new Champion Cities of Dalian and Zhangjiakou are facing individual challenges. Yet, the two cities share good opportunities to transform and become more sustainable, liveable and competitive. The aim for these two cities is to become role models for other fast-growing cities in this area.

The selection of the two cities is the result of a comprehensive process involving the initiative's global Steering Board, the Champion City governments, and key project partners of the China Center for Urban Development, the National Development and Reform Commission and the World Bank China.

Dalian and Zhangjiakou stand out among other candidate cities because of the nature of the urban challenges they encounter, the expertise and ability for the Initiative to contribute and intervene, the city leaders' willingness to collaborate, and the representativeness of the cities to generate valuable insights and experiences for other cities to learn from. Dalian and Zhangjiakou are economically advanced cities with depleting resources and old industrial quarters; they are potential regional centres given their proximity to the capital.

Dalian and Zhangjiakou Location Map



Source: Google Maps

1.1 Dalian

Located at the southern tip of Liaodong peninsula, Dalian is the gateway of north-eastern China and one of the earliest economically advanced cities in the region. Being the corridor between north-eastern China, East Asia and the rest of the world, Dalian is China's fifth largest port and ranks 13th globally by container throughput. Cargo ships, many built locally, carry a wide range of goods, including automobiles, computer chips, industrial equipment and agricultural products.

Dalian has five industrial parks and economic development zones. Dalian's traditional pillar industries include petrochemicals (China's largest petrochemical refining industrial park will open in the next few years), equipment manufacturing, shipbuilding and logistics. In the past few years, Dalian launched its electronics and information technology sector, attracting leading multinationals such as Intel, Dell and Hewlett-Packard to invest in manufacturing or research and development (R&D). In addition, Dalian gradually built its reputation as a service outsourcing centre serving customers globally, in particular Japan and South Korea (The China Perspective).

| Dalian | |
|-------------------------|--|
| Area (total) | 12,574 km ² |
| Area (city centre) | 2,415 km ² |
| Population | 6.85 million |
| GDP (total, 2012) | CNY 700.3 billion (\$114.8 billion) |
| GDP (increase, 2011-12) | 10.3% (versus 7.5% nationally) |
| GDP (per capita, 2012) | CNY 102,000 (\$16,200; i.e. more than twice the national average of \$6,093) |

Source: Dalian Bureau of Statistics

As the host city of the World Economic Forum Annual Meeting of the New Champions every other year, Dalian has significantly raised its global awareness and attracted an increasing number of events and visitors, both domestic and international. The city's service sector is also booming and contributed more than 40% of GDP growth in 2012.

The preferential economic development of Dalian leads to a fast expansion of the city. Not only has the existing city centre expanded in every direction, Dalian's three satellite towns are also catching up quickly. Dalian has developed its urban development strategy as "all region urbanization", to adopt a holistic approach to balance the socio-economic development of urban, rural and industrial areas, and develop a cluster of city and town centres to improve livelihoods and the quality of life.

1.2 Zhangjiakou

With a 2.5-hour drive inland from Beijing, Zhangjiakou is a small historical city undergoing major transformations. Compared to Dalian, Zhangjiakou has three times more land but two-thirds the population and generates one-fifth of the annual GDP. Zhangjiakou is an industrial town with an emphasis on resource extraction and heavy industries, including coal, iron and steel, cement, and paper and pulp. These industries are facing significant challenges due to depleting mining reserves and growing concerns over environmental impact.

| Zhangjiakou | |
|------------------------|--|
| Area (total) | 36,680 km ² |
| Population | 4.60 million |
| GDP (total, 2012) | CNY 123 billion (\$20.6 billion) |
| GDP (per capita, 2012) | CNY 27,000 (\$4,500, i.e. below the national average of \$6,093) |

Source: Zhangjiakou Bureau of Statistics

Due to its proximity to Beijing and considering the air pollution crisis, Zhangjiakou's industrial legacy should take into account the emerging green sector and the city's abundant ecological resources.

In fact, these natural resources allow Zhangjiakou to develop some unique agricultural sectors as well as tourism sites, such as the wine-making and the brewing industry in Huailai County and the small ski resort of Chongli. Moreover, Zhangjiakou has abundant wind resources and the city's installed capacity of wind turbines surpassed 5,000 MW by the end of 2013 (China Equipment), ranking it first in wind energy among all Chinese cities. The city government also aims to attract emerging industries to leverage Zhangjiakou's location and resources advantages, including logistics centres, a Volvo motor factory and cloud computing data centres.

At the end of 2013, Beijing officially announced that it will partner with Zhangjiakou to bid for the 2022 Winter Olympics. Not only will this put Zhangjiakou on the global map, but it will also provide an opportunity for the city to advance its urban development with preferential policies, investments and more integrated interaction with the capital. Zhangjiakou could use this opportunity to practice and demonstrate sustainable urban transformation and act as a role model for other Chinese cities.

Analysis and Prioritization of Urbanization Issues

2.1 An Urbanization Issues Framework for Dalian and Zhangjiakou

Analysing urban issues

Under the three focused urbanization themes, Dalian and Zhangjiakou are facing challenges based on their current situation and development prospects. The Initiative has performed due diligence to identify, understand and analyse the specific urban development challenges the Champion Cities face. Through direct interactions with city leaders and representatives from corresponding government departments, complemented by on-site visits and roundtable discussions with leading Chinese and international experts, the initiative developed an Urbanization Issues Framework to capture the detailed issues Dalian and Zhangjiakou encounter. The Framework intends to map out issues under the themes of transport planning and management, energy management, and sustainable industry development for the Champion Cities. These issues are specific enough to guide the development of strategic recommendations applicable for Dalian and Zhangjiakou, but could also be scaled and shared with other cities.

- **Transport planning and management** – Dalian's main issues are typical for a large Chinese city: traffic jams in the city centre due to a growing number of cars and an ill-managed network of roads and public transit. Zhangjiakou is mainly suffering from intercity traffic, in particular on highways towards Beijing, with heavy competition between passenger vehicles and trucks. When looking at the cities in pair, Zhangjiakou could foresee its potential intracity congestion and adopt early measures to prevent the worst by leveraging successes and lessons learned in Dalian.

- **Urban energy management** – The cities share the same obstacle: their issues are mostly regional and national in scope and their solutions will therefore require cross-departmental and cross-regional collaboration.
- **Sustainable industry development** – Both cities want to develop their emerging sectors in which small and medium-sized businesses (SMEs) play a key role. Despite the difference in sectors, there are transferable practices and experiences that could be insightful for other cities to follow, namely in innovation and entrepreneurship.

Prioritizing key issues

Upon confirming the framework with the Champion Cities, the initiative sought advice and best practices from expert members of the global Steering and Advisory Boards and the China Working Group in an initial screening of potential recommendations for the cities. Recognizing the large number of issues identified in the framework and given the limited time and resources, it was agreed that three issues would be shortlisted for each city. Detailed recommendations for these issues have been developed with best practices on implementation, always taking the capability of the initiative to contribute into account.

For Dalian, the three key issues are:

- Traffic congestion (road saturation)
- Reliance on coal for energy supply
- Lost potential of an emerging technology sector

For Zhangjiakou, the three key issues are:

- Traffic congestion (intercity transport corridors to Beijing)
- Integration of wind energy, locally and cross-regionally
- Meeting sustainability goals for the Winter Olympics bid

Urbanization Issues Framework

| City | Transport Planning and Management | Urban Energy Management | Sustainable Industry Development |
|-------------|--|--|---|
| Dalian | <ol style="list-style-type: none"> 1. Limit urban expansion and reduce sprawl 2. Enhance public transit system 3. Decrease car dependency | <ol style="list-style-type: none"> 1. Scale up the use of natural gas 2. Explore the development of renewables, in particular off-shore wind 3. Foster solutions for the petrochemical sector 4. Improve energy efficiency | <ol style="list-style-type: none"> 1. Further develop existing industries, e.g. petrochemical and equipment manufacturing (ship building, machining) 2. Promote service and high value-added industries, e.g. R&D, software and outsourcing 3. Build an industrial value chain |
| Zhangjiakou | <ol style="list-style-type: none"> 1. Address intercity traffic congestion, mainly on expressways to Beijing 2. Address intracity traffic congestion, mainly between the city centre and two new urban clusters 3. Improve public transport development 4. Address conflict between transport and land development | <ol style="list-style-type: none"> 1. Increase power transmission capacities, in particular wind 2. Optimize the use of power within the city, both efficiency and new sources of consumption avoiding wasted capacity | <ol style="list-style-type: none"> 1. Scale up emerging industries, such as high value-added manufacturing, premium food and agriculture, ecotourism and renewables 2. Promote industry-induced local economic and social development 3. Attract human capital |



| | Key Issues | Strategic Recommendations |
|-------------|---|---|
| Dalian | Traffic congestion (road saturation) | <ul style="list-style-type: none"> – Develop traffic management and an intelligent transport system (ITS) to maximize intracity traffic efficiency – Encourage the use of public transport through preferential policies – Discourage car use at peak hours – Install an appropriate institutional mechanism |
| | Reliance on coal for energy supply | <ul style="list-style-type: none"> – Supply side: Scale up natural gas and increase the share of renewable energy – Demand side: Improve energy efficiency performance, in particular in the petrochemical sector |
| | Lost potential of an emerging technology sector | <ul style="list-style-type: none"> – Build a full-sector value chain through an efficient market structure – Encourage SME development through innovation |
| Zhangjiakou | Traffic congestion (intercity transport corridors to Beijing) | <ul style="list-style-type: none"> – Develop traffic management and ITS to improve highway traffic efficiency – Create innovative financing mechanisms for highway construction – Improve intermodal transport – Optimize goods movement and logistics – Enhance capability in transport analysis and monitoring |
| | Integration of wind energy, locally and cross-regionally | <ul style="list-style-type: none"> – Avoid undesirable development by designing strategic policies – Collaborate beyond city boundaries on the long-distance transmission of electricity – Explore opportunities to enhance the use of wind power |
| | Meeting sustainability goals for the Winter Olympics bid | <ul style="list-style-type: none"> – Create a branding identity for the city – Emphasize green sectors – Educate rural dwellers on sustainability through mobile technology |

2.2 Key Issues for Dalian

Traffic congestion (road saturation)

Due to the rapid expansion of the city in the past decade, the current road system is unable to cope with the demand of road users. Congestion along main arteries is commonplace during peak hours.

Despite continuous efforts to promote the use of public transport, a number of the city's residents heavily rely on private transport for their daily commute.

Since urban infrastructure cannot be expanded overnight, the city is trying to find ways to make the best use of the existing road network. With its relatively high living standard and more established urban management system among Chinese cities, Dalian is well-positioned to adopt advanced technology in solving its urban traffic challenges and could thus serve as a showcase for other Chinese cities.

Reliance on coal for energy supply

Dalian is relatively self-sufficient in its energy supply and benefits from diverse sources of energy, including coal, oil, natural gas, water and nuclear (expected to be operational by the end of 2014). However, 70% of Dalian's energy supply still comes from coal. With the growing focus on sustainability due to severe smog outburst across China and climate change concerns, the carbon-intensive energy mix may not present immediate problems for Dalian but has significant risks in the medium to long term. Early actions are essential to avoid lock-in effect.

On the supply side, Dalian has the opportunity to adopt alternative energy sources, in particular natural gas which the city already receives from overseas and is accessible through the Chinese-Russian gas transmission pipeline. On the demand side, there is a significant opportunity for energy efficiency improvements for both industrial and municipal consumption.

Lost potential of an emerging technology sector

Dalian's technology sector – electronics, software, and technology outsourcing – has experienced fast growth for the past few years, and the Dalian Hi-tech Industrial Zone is already a reputable location attracting multinational and local companies. However, the sector remains small in terms of economic contribution and job creation. Growing this more value-adding and environmentally less impactful industry is highly in line with Dalian's plan to expand the modern service sector and shift to a sustainable and low-carbon economy.

2.3 Key Issues for Zhangjiakou

Traffic congestion (intercity transport corridors to Beijing)

With the goal of becoming a regional logistics centre, Zhangjiakou needs to deal with the competition between the flow of goods and the flow of people, while having limited transport infrastructure resources available. Currently, Jing-Zhang Highway is the only corridor connecting to Beijing with predominantly passenger traffic. No trucks are allowed on this highway. Jing-Xin is a partly-opened highway with predominantly freight traffic. Under the 12th five-year plan, future highways do not provide direct routes to Beijing.

With limited existing highway capacity, national roads and provincial roads now share the burden of connecting Zhangjiakou to Beijing. However, many of these roads are not effective for intercity traffic. The lack of funding is regarded as a main reason for the slow upgrading of transport facilities in the city.

With the bid for the 2022 Winter Olympics, it is foreseen that further infrastructural investments will be in place for the development of Zhangjiakou.

Integration of wind energy, locally and cross-regionally

Zhangjiakou is a net exporter of electricity to Beijing and other surrounding cities. It already has more than 5,000 MW of installed wind capacity, which accounts for more than half of the city's energy supply. Yet, Zhangjiakou does not have the capability to transmit its clean energy generated elsewhere, nor is there sufficient demand for it locally. As a result, most of the wind turbines are not generating power at their most productive level.

The problem lies not only in the inability of electricity grids to take on more wind energy, but also in the way the wind energy industry is developed in China. It is not an uncommon issue for many other cities, and is often too complex for a city to undertake on its own. Policy reform, technological breakthroughs and business cases are all essential for solving this.

Meeting sustainability goals for the Winter Olympics bid

Being part of the Greater Beijing region, Zhangjiakou is facing increasing pressure to phase out polluting industries; however, it has not yet fully benefited from its proximity to Beijing, nor integrated itself into the economic development of the capital.

In parallel with the Champion City process, Zhangjiakou is partnering with Beijing to bid for the 2022 Winter Olympics. This provides an unparalleled opportunity for Zhangjiakou to advance the transformation process and fully integrate itself into the Greater Beijing economy.

Strategic Recommendations for the Champion Cities

3.1 Recommendations for Dalian

Traffic congestion (road saturation)

There has been no lack of traffic improvement projects and management schemes implemented in recent years. Given its economic strength and relatively advanced urban management structure, Dalian should look beyond constructional solutions and improve its traffic conditions with non-spatial means. Technologically, Dalian should seize the opportunity to be at the forefront to adopt intelligent transport systems (ITS) for traffic management. Given the relatively slow adoption of ITS in other Chinese cities, Dalian would stand out as a role model for other Chinese cities at a comparable scale and stage of development. Economically, the right incentives should be introduced to encourage the use of public transport while discouraging car use during peak hours. Institutionally, Dalian should experiment with the right decision-making mechanisms that enables cross-district, cross-departmental decisions.

Strategic Recommendations

Develop ITS for traffic management to maximize intracity traffic efficiency

- Since Dalian has inherited a complex road network system, comprehensive **analysis and modelling** is vital to avoid implementing road improvements at the expense of other parts of the city.
- **Electronic road pricing (ERP) at the city level** could be introduced to further encourage road users to stagger their work hours to moderate peak hour traffic.
- **ERP revenue should be “ring fenced”** for public transport improvement, acting as a transitional incentive for achieving a mode shift from private car to public transport use.

Encourage the use of public transport through preferential policies

- **A shift from modal competition to modal cooperation** should be encouraged to harvest synergies between different modes of public transport.
- Enhancing **comfort and convenience**, such as cleanliness, quietness, Wi-Fi-provision, loyalty programmes and an integrated payment system, in public transport is a simple but effective way to enhance patronage.

- **More flexible forms of public transport** such as “residential shuttle buses” and “mini-buses” would give commuters direct and frequent connection to metro stations.

Discourage car use at peak hours

- Instead of controlling car ownership, a more pragmatic approach would be to curb car use by **pricing externalities** correctly (e.g. a gasoline tax, parking fees and a congestion charge).
- **Car sharing** balances the occasional need of auto mobility by individuals and the control of frequent car use for collective benefit.
- **Variable parking fees** and real-time parking availability data could reduce traffic while drivers look for spaces.

Install an appropriate institutional mechanism

- A **transport authority** reporting directly to the mayor could result in more holistic approaches to public and private transport investments by better coordinating inputs and responsibilities among different departments.

Develop ITS for traffic management to maximize intracity traffic efficiency

Dalian exhibits a complex road structure. A project relieving traffic congestion at a particular bottleneck does not guarantee aggregate improvement of the traffic conditions, especially when looking at induced demand.

The primary step to address congestion problems in Dalian is to develop a comprehensive understanding of the existing conditions and holistic modelling of the future situation. Data on both public and private transport systems should be collected and analysed to better understand how the system works. This would help make the right decisions for future investments.

Also, riding on the current attempt to stagger working hours to moderate peak-hour traffic, **electronic road pricing (ERP)** can be introduced to further encourage commuters to avoid peak-hour travel. A more active means can be seen in places like **London, Singapore** and **Stockholm**, where drivers travelling by car into the central area are charged by ERP. In Dalian, revenue from ERP could be used on transport improvement to placate potential public resentment. Alternatively, the use of main thoroughfares during peak hours could be limited to vehicles registered in Dalian. This may be implemented to stagger the use of existing road infrastructure.

Case Study: Stockholm ERP

Stockholm's electronic road pricing scheme charges motorists for entering the central city on weekdays, between 06.30 and 18.30. Exemptions apply to buses, taxis, eco-fuel cars, emergency vehicles and drivers coming and going from the isolated island of Lidingö.

During the first two years, peak-period traffic volumes within the tolling zone fell by 25% (removing 1 million vehicles from the road a day), and daily toll revenues reached about \$300,000. The revenues from congestion tolls have been used to enhance transit service (Arnold et al, Suzuki et al)



One of the 18 payment gates for the Stockholm congestion charge area (Roadtraffic-technology)

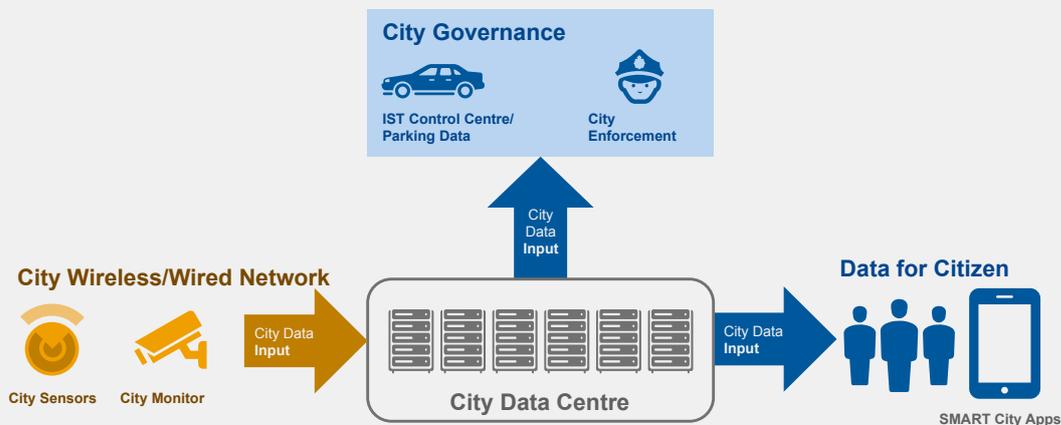
Technology companies such as Baidu Map have begun to provide real-time traffic information to drivers for better decision-making, and there is room to further enhance its power. First, interpretation of the traffic information in a more user friendly manner would encourage more people to consult traffic information before making a trip and to make better choices on their mode of transport. Second,

instead of merely reporting the real-time traffic conditions, dynamic traffic forecasts could be offered so that people can plan their trip ahead, similar to deciding on what to wear by reading weather forecasts. The example of **22@Barcelona** is a practical example of how urban mobility can be improved by smart technology.

Case Study: Barcelona Urban Lab

The Barcelona City Council encouraged projects via the Urban Lab initiative called 22@Barcelona. 22@Barcelona is a test bed used by SMEs to trial new technologies. Any innovative project that addresses unmet municipal needs and has not yet been launched can be submitted for testing in 22@Barcelona. The City Council is working closely with private companies on piloting and market testing these ideas. The aim is to encourage entrepreneurship on solving urban problems and save public expenditure at the same time.

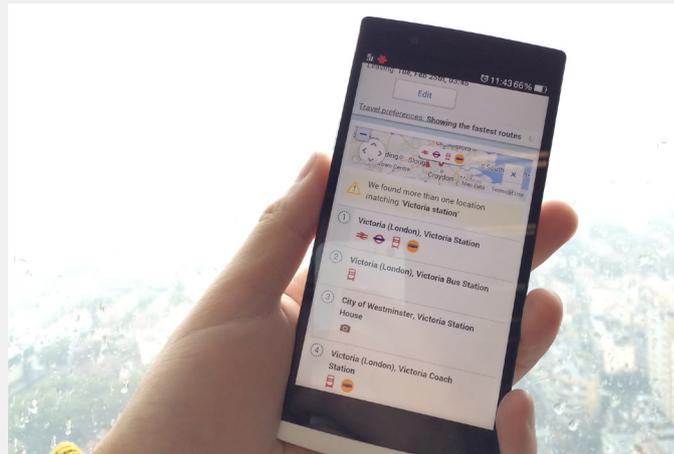
Parking management and traffic control cameras are two aspects that Barcelona has tried to improve urban mobility with smart technology. The sensors at parking spots and video with analytics provide real-time data on parking availability, which are transmitted through the city Wi-Fi infrastructure, linking devices belonging the end user and local authorities. Traffic control cameras are connected by fibre optics to the transport authority to monitor traffic in real time, providing the control centre means to increase or reduce the frequency of green lights according to the traffic conditions (Ajuntament de Barcelona; Cisco).



Smart+Connected City Architecture Framework, enabling city governance and giving citizens power over city enjoyment through city-wide smart data (Image: Cisco)

Case Study: London Electronic Journey Planner — Comprehensive Multi-Modal Travel Planner

This website was commissioned by the Greater London Authority and Transport for London to provide user conveniences and efficiency when deciding on a mode of transport and the route to be taken. The key to the success in the integrated journey planner was the willingness of operators to share information and to provide it to the general public. Further mobile versions of the journey planner was developed by private mobile application developers, providing the same experience on the move with the added bonus of GPS tracking, taxi booking and real time traffic monitoring, giving greater freedom for commuters to choose between modes of transport (Takhari).



Mobile version of Transport for London Electronic Journey Planner (Photo: Roland Wong, Free Source)

An integrated journey planner requires deliberate user input and is a passive approach. The proactive approach is the Integrated Proactive Intermodal Travel Assistant (IPITA). IPITA provides an interface that directly interacts with the user through GPS, movement gestures and data glass, such as Google glasses. By analysing the user movement habits, IPITA could suggest new routes. By analysing user data and habits, smart phones will notify the user with the latest flight information and traffic conditions for the journey to the airport according to the user's previous emails, travel patterns and online search habits. The example of the **London Electronic Journey Planner** demonstrates what powerful solutions can be developed if operators share data.

Encourage the use of public transport through preferential policies

It is currently estimated that public transport will account for half of the peak hour transport in Dalian after the opening of metro lines in 2014. With the legacy of encouraging public transport use at the expense of bicycle use, Dalian should attempt to formulate strategies to shift from modal competition (e.g. bicycle paths competing with bus lanes) to modal cooperation (e.g. bicycles as a feeder transport complementing buses for the main route).

Much can be done around metro stations to encourage intermodal transfer. To combat traffic jams, metro signalling should integrate communications-based train control into the metro construction to enlarge the transport capacity with less investment. In addition, an integrated mobility platform could combine all transport means with better efficiency. The metro company can operate the feeder service and bicycle rental system at the station area to attract more riders and provide them with greater convenience. The station can also provide customer services for other public transport modes so that it becomes a one-stop shop for public transport riders. **Deutsche Bahn** has been playing a leading role in integrated public transport services in major

German cities, linking from local train services to tramway and bus routes, all incorporated within its transport hub. Given Dalian's long coast line and the location of some important city functions adjacent to the waterfront, water transport is another way of providing further choice for public transport in Dalian.

In addition to enhancing public transport facilities, **user experience** is equally important to the ultimate mode choice. Public transport can offer Wi-Fi services to make journeys productive. Public transport loyalty programmes can be introduced to give greater incentive for taking public transport, especially for non-regular trips. An integrated network of metro, bus, bicycle parking/rental and even park-and-ride facilities should be formulated. It would address the "last mile" issue by providing opportunities for all residents to use public transport, including residents who live far from such facilities.

Different transport modes should not only be integrated in a physical sense, but also in terms of their payment system (e.g. by pre-paid travel cards), with fare reductions for transferring passengers. The **London Oyster Card system** and new transport interchanges demonstrate seamless integrations between transport modes.

In locations where the final destination is still beyond walking distance from a metro station, direct, frequent and comfortable transport connections to metro stations would be paramount in winning commuters over private car use. **Residential shuttle buses** are on the increase in megacities of China, such as in **Hong Kong SAR, Guangzhou** and **Shanghai**. In these cities, developers are including residential shuttle bus schemes in their concepts to better promote their residential developments. The idea of residential shuttle bus schemes is that residents, i.e. the prospective users, can also participate in deciding on the routes, travel frequencies, comfort level, etc. By doing so, the residential shuttle buses become more attractive to them. Dalian's municipal government can encourage it

implementation by reserving sufficient loading/unloading spaces at metro stations, and by mandating developers to provide such services in the first few years to build up residents' habit of using public transport.

The non-franchised yet regulated “green mini-buses” in **Hong Kong SAR** provide short-distance connections

between residential areas and metro stations. As for park-and-ride facilities, it was observed to be more successful at stations that are farther away from the city centre, so that the ride on the metro is relatively long and the resulting time-saving is more significant. Discounts on parking specifically for riders can also be offered to encourage park-and-ride behaviour.

Case Study: Hong Kong SAR – Public Light Bus

Public Light Buses (PLBs), known as mini-buses, complement the standard Hong Kong bus lines, serving areas that are not reached efficiently. With the carrying capacity of 16 seats, PLBs are typically faster and more efficient with higher frequency and offer non-stop service.

Being flexible in developing routes according to the market, mini-buses can respond quickly to market demands and provide a more direct, comfortable route for the “last mile”. It is a solution to overcome the “last mile” issue, and a solution to regulating illegal transport in megacities.



Green mini-bus and corresponding bus station in Hong Kong SAR (Photo: Mailer_Diablo, Creative Commons)



Although public transport integration is of top priority, a more compact form of development would need to be stressed to eliminate the “last mile” issue. If the distance between the origin or destination and metro station remains far, inconvenience in further connecting transport would greatly demise the effectiveness of this substantial investment. The example of **Copenhagen’s Integrative**

Public Transport Model demonstrates how modern public transportation can be integrated with other modes of transportation to address the last mile. It is important for Dalian to first review the development intensity along metro corridors to ensure that benefits from the metro are fully captured.

Case Study: Copenhagen’s Integrative Public Transport Model

Copenhagen has developed a strategy to invest in an efficient, reliable and highly integrative public transport network.

The integrative system aims to avoid or mitigate traffic congestion. It brings together three transport operators plus information links to agencies, companies and the government. The integrative ticketing system provides ease in ticketing via SMS, providing easy information about location, destination and tickets. It gives users greater flexibility and efficiency when boarding and transferring to different mode of transport.

A combination of bus stops and cycle parking facilities with metro stations ensures seamless integration of all modes of public transport in Copenhagen. A bus priority signalling system through the use of radio and GPS technology enables bus priority on the road, shortening travelling time.

The reduction in car use has already resulted in an 83% drop in CO₂ emissions. Additional social benefits such as the encouragement of cycling through the integrated cycling facilities have led to 63% of all journeys to work to be made by bicycle. This has further contributed to Copenhagen’s cycling initiative “Greenwave”, and has reduced CO₂ emissions by 90,000 tonnes annually.



Bicycles can be taken onto the metro, providing solutions for the “last mile”. (Photo: Johan Wessman, Creative Commons)



Skybridges provide better access for passengers, with multi-modal catering to the disabled and infants. (Photo: Caroline de Francqueville, Creative Commons)



Local railway and metro integration, forming a more convenient transportation hub. (Photo: Daniel Sparing, Creative Commons)

Discourage car use at peak hours

Most road users only need cars occasionally. However, once they own a car, its use becomes more frequent. With the increase in wealth of citizens, the number of private cars increases. Given this and the strategic importance of car manufacturing to the Chinese economy, strictly restricting car ownership would be difficult to implement and may even be unnecessary. Yet, moderate regulation of car ownership would be beneficial to balance people's needs, especially with respect to the capacity of the existing road infrastructure. The objective is to avoid traffic congestion. The key is to encourage people to use public transport instead of their car during peak hours on weekdays when maximum road capacities are exceeded.

A bundle of administrative arrangements should be implemented that manage car ownership (e.g. a car registration fee) and car use (e.g. gasoline tax, parking fees, parking spots at train or metro stations), and that allocate externalities caused by traffic congestion (e.g. charges on peak-hour travel).

Car-sharing and car-rental programmes are a possible means of assuring people that cars are available to them when needed. The market force can be introduced to deliver these services to the public. The **Zipcar programme** in **London** has been expanding rapidly since 2010. Alternative travel modes need to be facilitated to provide people with other options for commuting. **Hangzhou** has started a **public cycling system**, which serves the commuting demands for a large number of people.

Case Study: Hangzhou – Public Cycling System

As one of the world's largest public bike sharing programmes, Hangzhou has 67,000 public bikes and 3,000 service points, with the average daily renting volume of 230,000 in June 2013.

The public bike renting system is easy to use, with a smart card that can also be used for other modes of public transport, or with cash deposit for travellers without the smart card. The convenient use of the public bike renting system has built up residents' habit of cycling for daily travel needs and for transferring to other public transport services.

The success of the Hangzhou public cycling system lies in its integration with tourism in the city and the innovative bundling of advertisement rights to generate subsidies. The public cycling system not only provides a commuting mode for local residents, but also creates a popular recreational activity for tourists (UN Habitat; Xinhua News).



There are more than 3,000 cycling points around the city. (Photo: Thecraft, Creative Commons)



The cycling scheme is so successful that Hangzhou has become a prime international city for mountain biking. (Photo: Edward Wang, Creative Commons)

To reduce car use during peak hours, parking fees appear to be a better option for Dalian than a gasoline tax because vehicles can get gasoline outside the city boundaries. On the contrary, parking restrictions can be implemented specifically for the desired location. To efficiently operate and maintain parking facilities, they should be provided by the private sector with the fees varying according to the time of day or the level of congestion. This guarantees the appropriate allocation of scarce parking spaces. In addition, real-time information on parking availability at nearby locations would reduce the time for finding parking spots and therefore reduce traffic. **San Francisco** has been at the forefront in using mobile apps to inform drivers on **parking and travelling decisions**.

Install an appropriate institutional mechanism

In Dalian, an appropriate institutional mechanism would be conducive to the appropriate selection and implementation of traffic management systems. Reflecting overseas experiences, it is suggested that a city-level transport authority or transport commission, reporting directly to the mayor and allocated with funding, would help implement holistic and balanced transport solutions, which often require the collaboration of different governmental departments and jurisdictions. A separate statutory body that oversees and integrates transport improvement projects would be required. **Shenzhen**, for instance, has established a **transport committee** as an integrated authority for transport.

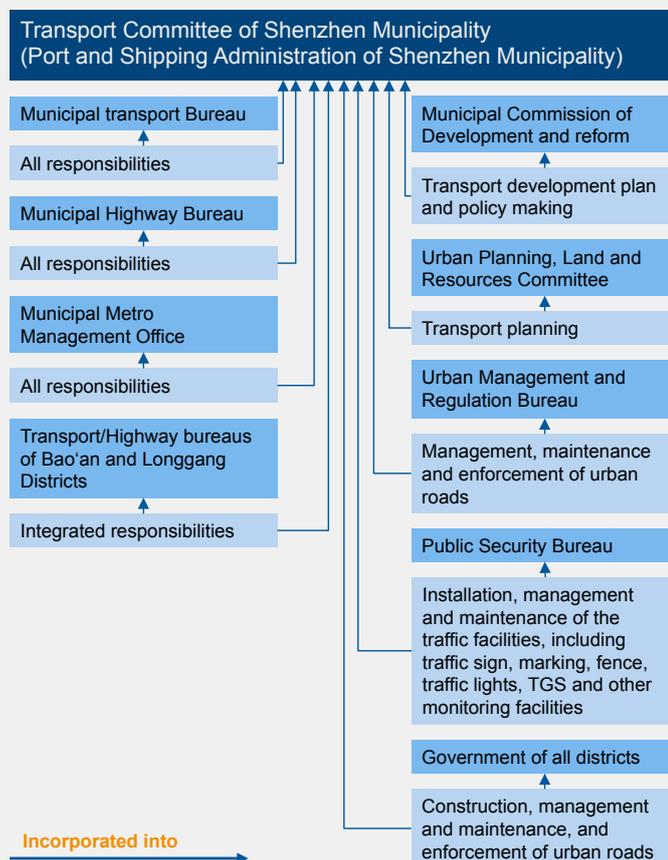
Case Study: Shenzhen – Integrated Transport Authority

As one of the first cities to carry out institutional reforms on transport management in China, Shenzhen has been integrating responsibilities of several departments to form a holistic transport management institute. In 2009, with reference to the experience of New York, Hong Kong SAR and Singapore, the Transport Committee of Shenzhen Municipality was established, marking the first “One City, One Transportation” mechanism in China.

The Transport Committee of Shenzhen Municipality incorporates former bureaux and offices on transport, road and metro at city and district levels, and transport-related responsibilities in planning and land

departments. The Transport Committee is responsible for managing transport mobility (public transport, metro, road, port, water transport, airport, logistics, aviation and rail) and coordinating the postal sector (Shenzhen Government Online).

The incorporation of various functions into one authority facilitates the establishment of an integrated transport management chain of “policy – planning – design – construction – operation – maintenance – service – emergency”. The incorporation of the transport and highway bureaux of Bao'an and Longgang districts breaks the institutional barrier for transport development within and outside of the boundary of the special zone (JIANG).



Since new, large-scale developments in the built environment of a city put pressure on its adjacent road network, a **traffic impact assessment (TIA)** is required to ascertain the extent of such impact and corresponding mitigation measures required. Yet, mechanisms to secure the implementation of measures are not always in place in Chinese cities. Once the development right is granted to individual land parcels, it is difficult to limit the scale of development and the amount of traffic it generates. Therefore, the first and most fundamental step is to conduct rigorous TIAs when master plans and control plans are being formulated. This will ensure that the proposed road network has been designed for the accumulated effect of all allowable developments. Regarding site-level development, developers and the transport authority can work together to form traffic arrangements that are mutually beneficial for private and public interests. The following mitigation strategies reduce traffic generated by new developments:

1. Reduction in car-parking requirements due to staggered demand (i.e. at different time periods within a day or a week) for parking spaces created within a complex (e.g. hotels, apartments, offices, shopping malls, etc.)
2. Reduction in car-parking requirements due to proximity to transit stations
3. Pedestrian-friendly connections to transit stations to encourage public transport use

For the remaining road-based mitigation measures, an enforcement mechanism should be established to link project approvals (either for construction or occupation) to the completion of all proposed traffic mitigation measures. The **development control system in Hong Kong SAR** provides an example for a proven enforcement mechanism.

To achieve the proposed intelligent transport system and transport management solutions, it is important for government officials to form partnerships with both practitioners and operators. Working together, good practices from other cities can be implemented and tailor-made to Dalian's needs. Such platforms would facilitate early adoption of advanced techniques and technology, and in turn make Dalian a demonstrative case for other Chinese cities.

Case Study: Hong Kong SAR – Mechanism for Implementing Traffic Mitigation Measures

In Hong Kong SAR, a TIA is required for developments within comprehensive development areas or in congested areas. If a proposed development is assessed to result in an unacceptable traffic impact, the developer (private, semi-private or public) is required to propose mitigation measures. In some occasions, the need for mitigation measures has been pre-identified and is prescribed in the land lease subject to detailed design by the developer. These measures can be in the form of government-agreed roadway improvement works, private works on public land, and traffic arrangements within the development boundary, or a combination of the three.

Implementation of measures is secured by the Buildings Ordinance in two stages:

1. *Approval of building plans under the condition that all requirements in the land lease and planning approval have been fulfilled*
2. *Issuance of an occupancy permit under the condition that the above requirements have been executed*



Reliance on coal for energy supply

Strategic Recommendations

Supply side: Scale up natural gas and increase the share of renewable energy

1. Dalian has good access to natural gas resources through the China-Russia pipeline. The current level of utilization is still limited and mainly caters for household use. **Market-based mechanisms** are essential to scale up natural gas use.
2. Renewable energy sources, e.g. onshore/offshore wind, make a small contribution to Dalian's energy mix. **Development of renewables** is a medium to long-term plan.

Demand side: Improve energy efficiency, in particular in the petrochemical sector

1. Energy-efficient improvement measures for industrial and municipal use are cost-effective for Dalian.
2. Holistic planning should be undertaken to improve the energy-efficiency performance of new industrial zones.

Supply side: Scale up natural gas and increase the share of renewable energy

There is consensus that Dalian should scale up natural gas consumption as the main replacement for coal in the energy mix. The city has already started the transition by building liquefied natural gas (LNG) stations and has rolled out gas-burning public vehicles. However, the overall use is fairly low and mainly focuses on converting household cooking gas from coal gas to LNG.

To accelerate the process, the adoption of natural gas in district heating and power generation might be helpful, as the **New York** example shows. In the case of Dalian, the key barriers to making the shift are mainly non-market-based pricing and limited infrastructure. Gas pricing is not determined by market rules, but is instead regulated at an artificially low price. This essentially makes LNG economically unviable and requires government subsidies. In turn, such a situation limits investment in the required infrastructure that has an attractive return on investment. Dalian should focus on providing an adequate policy framework and enabling appropriate market mechanisms that will encourage business to invest in the natural gas sector. Technology will also be able to drive down cost and develop a business case for natural gas.

Unlike natural gas, the challenges for developing renewable energy sources for Dalian are not scaling up since the technology still lags, grid transmission has limited capability and a suitable business model is still needed. These issues are mostly medium to long term, and renewable energy will not be able to contribute to a significant portion of Dalian's energy mix in the short run.

With the upcoming development of the Hongyan River Nuclear Power Plant, Dalian will have more diverse energy sources and a more secured energy supply. Also, given the large coal-fired power plant set-up, upgrading existing capacity with the latest technologies with less emissions and better efficiency could be an interim solution. Both could provide test beds for Dalian to try out emerging renewable technologies and support the development of a new energy industry such as offshore wind, tidal and energy storage. Dalian could then integrate renewable energy into the city's future energy development strategy.

Case Study: New York – Transition in Natural Gas Supply Drives Down Cost

Although the fracturing-led shale gas revolution in the US has significantly lowered the price of natural gas, not all US cities have benefited. New York City typically has the highest price of natural gas in the country. It costs even more than gas delivered across Asia, where prices are commonly more than triple the US average.

New York targeted to drive down the gas cost by allowing more pipelines to enter the city. After the opening of a Manhattan pipeline in November 2013, the gas price decreased by more than 17% in just 10 days. It is estimated that the new pipeline will be able to reduce the energy cost of businesses and households by \$350 million per year.

Natural gas will also help the city replace its less environmentally friendly and more carbon-intensive fuel-oil burners (the debate on the environmental impact of hydraulic fracturing is another matter). However, with more pipelines around and beneath the city, the safety concerns are also growing. Therefore, proper risk management of gas pipeline and storage safety will be the key to further scaling up natural gas in the city (Phillips).

Demand side: Improve energy efficiency, in particular in the petrochemical sector

Energy efficient improvement measures for industrial and municipal use will be the most cost-effective option for Dalian. A city-wide demand response and energy storage system could further balance the power grid with less capacity needs. As Dalian is gradually phasing out its old petrochemical and refining facilities near the core urban area and developing the Changxing Island Industrial Zone as the new petrochemical centre, holistic planning should be undertaken to improve the energy efficiency performance of the new industrial zone. In a **"New Energy Architecture"**, the World Economic Forum and Accenture identify archetypes and enabling pillars for an effective transition. Similar approaches could be used to design Dalian's transition to a less coal-dependent and more sustainable energy system.



Case Study: New Energy Architecture: Enabling an Effective Transition

Recognizing the global trend of moving towards a lower-carbon, better-connected and leaner new energy architecture, the World Economic Forum in collaboration with Accenture initiated research to help decision-makers drive an effective transition, based on a holistic approach that takes into account the impact of decisions across the energy value chain, and the need to balance competing imperatives: generating economic growth in an environmentally sustainable way while providing energy access and security for all.

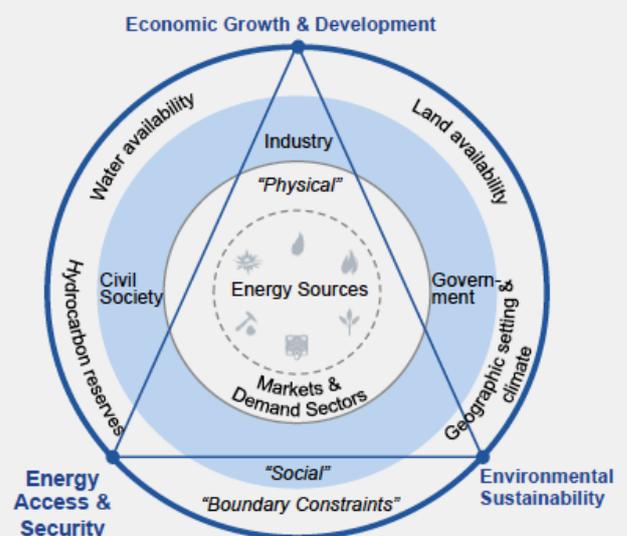
The research has created the Energy Architecture Performance Index to assess the balance and trade-offs of a country's energy system between energy security, economic growth and environmental sustainability.

Four archetypes have been identified:

- Rationalize and re-organize mature energy systems
- Capitalize on significant hydrocarbon resources
- Grow the energy supply to support economic expansion
- Access basic energy services at affordable prices

Also, four enabling pillars support change:

- Policy initiatives to put in place the rules, price signals and risk return incentives that attract investors and facilitate development
- Technology and infrastructure to address specific challenges in a country or stage of the value chain
- Market structures enabling producers to meet consumers' needs efficiently
- Human capacity to drive change and develop solutions



Energy Triangle put into perspective

Lost potential of an emerging technology sector

Strategic Recommendations

Build a full-sector value chain through an efficient market structure

1. Dalian can develop the existing electronics, information technology and service outsourcing sectors into a fully integrated industry value chain.
2. Dalian should invest in obtaining a unique competitive advantage as a leading technology industry centre.

Encourage the development of SMEs through innovation

1. Create an adequate policy and business environment to attract start-ups and SMEs in the technology sector.
2. Leverage Dalian's educational resources to provide and retain talent.

Build a full-sector value chain through an efficient market structure

Dalian already has a reputable technology sector that has attracted multinationals (e.g. Intel, IBM, Dell and HP) as well as the service outsourcing industry at the international (Accenture) and the local level (Neusoft). These companies are complemented by smaller players. The sector experienced fast development in the past decade but has not yet become a pillar industry for the city. The traditional competitiveness of Dalian to attract businesses is insufficient to support the expansion of the tech sector. Moreover, Dalian's outsourcing sector is focused on Japan and South Korea and was hit by the economic slowdown since 2009.

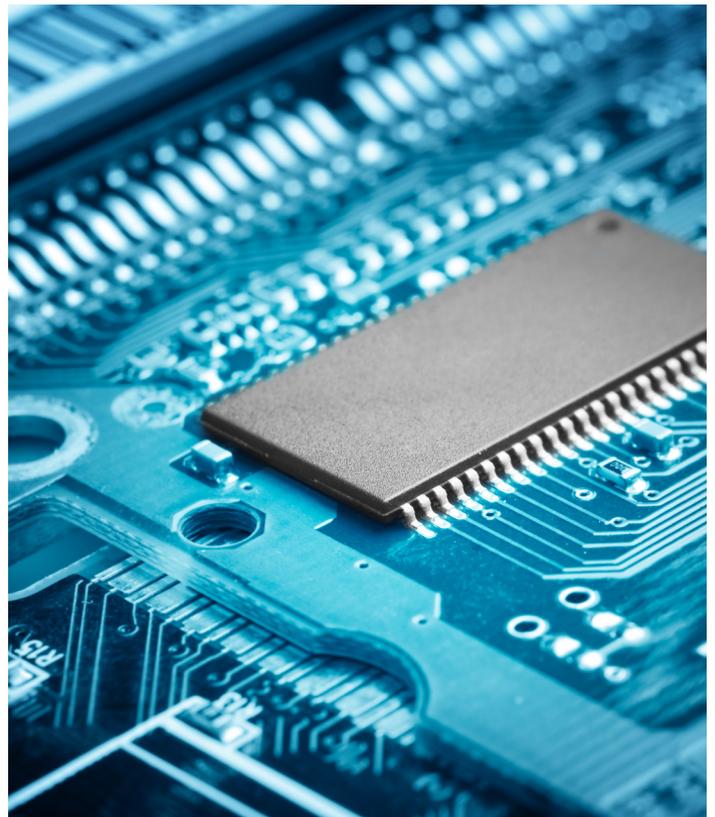
Dalian needs to build the value chain for the tech sector and develop an additional competitive advantage to catalyse growth. Upgrading the value chain means creating added business value in addition to the labour-intensive work. For example, R&D is adding high value and could generate sustainable and long-term growth.

Encourage the development of SMEs through innovation

Dalian should invest to help local companies seize this opportunity, e.g. set up a public centre for serving small and medium-sized enterprises. SMEs should be built around innovation through new products, services and business models. One concept to learn from might be "Industry 4.0", which is driven by the German federal government.

The technology sector is where innovation happens fastest. Yet, most technology SMEs in China, including those in Dalian, are not capitalizing on their advantages, but rather compete on repetitive and low-margin markets. This jeopardizes the profitability of the SMEs. It also limits the development of the entire market. Dalian already nurtures many SMEs in mobile app development, animation, comics and e-commerce. The next step is to improve the policy and business environment to encourage existing SMEs to invest further. These enterprises should generate value through innovation instead of duplication, and incubate new businesses in other emerging areas like mobile services, cloud computing and data analytics. This will complement the larger companies and improve the local value chain.

Innovation also stems from people and their mindset. Dalian is a leading city in college-level education and professional training. Improving curriculums and programmes will supply more talent to SMEs with a creative mindset to support the growth of the industry. Dalian could also draw on international examples of **SME-development**, such as those from the **European Union**.



Case Study: European Union – SME-Friendly Regions and Cities

The financial crisis and economic downturn had a negative impact on SMEs in the European Union (EU). The nature of the impact was diverse, with the most pressing effect on job losses, financial issues (decrease in investment or liquidity), falling demand (decrease in consumer demand or orders) and declining performance (decrease in production or R&D). Local authorities and city governments responded by introducing seven measures to help SMEs:

1. Improve access to new markets and foster international growth (within and beyond the EU)
2. Ensure easier access to financing for SMEs
3. Help address the regional skills mismatch
4. Promote entrepreneurship as a career path
5. Improve internet access
6. Provide e-government services for SMEs
7. Facilitate innovative activity and marketing of its results

Examples:

- Murcia Region, Spain: Worked with entrepreneurs on different business models (i.e. social economy businesses, cooperatives and social entrepreneurship)
- Moravian-Silesian Region, Czech Republic: Encouraged the use of repayable financial instruments such as micro-credits and revolving funds, or greater involvement of risk capital, to ensure the sustainability of the economic measures adopted
- Glasgow City, United Kingdom: Offered entrepreneurship training and advice through the Business Gateway network, the Prince's Scottish Youth Business Trust, and Digital Enterprise Glasgow in partnership with universities and colleges in the area and Scotland

(European Union)



3.2 Recommendation for Zhangjiakou

Traffic congestion (intercity transport corridors to Beijing)

The existing road infrastructure is not effectively serving the current mobility needs between Beijing and Zhangjiakou. The bottleneck is expected to become a hindrance to the future economic development of Zhangjiakou. Experts focused on the following aspects when providing recommendations for the city: traffic management and an intelligent transport system; a financing mechanism for highway construction, intermodal transport, goods movement and logistics; and capacity enhancement in transport analyses and monitoring.

Develop traffic management and ITS

While road building appears to be the most direct solution for insufficient road capacity, smart use of traffic management through an intelligent transport system should first be considered to make the most effective use of existing highway resources, complementing in the short term the lengthy process of highway planning and construction in the long term. The **United Kingdom Active Traffic Management Approach** is a good example to learn from.

GPS tracking devices in vehicles, CCTV and built-in road sensors can work together to provide a holistic traffic management system, detecting congestion and incidents ahead to alter mandatory speed and avert standstill congestion. With greater east-bound traffic during morning peak and west-bound traffic during the evening peak, traffic directions can be altered by turning one lane on the opposite side of the peak direction, providing greater capacity to peak traffic. Alternatively, for corridors with predominantly passenger traffic, one lane can be turned into a high-occupancy vehicle (HOV) lane that serves only vehicles with more than two occupants to enhance their speed. With complementary facilities at the trip origin such as pick-up point or car-sharing apps, HOV lanes would encourage car-sharing behaviour, in turn increasing the passenger-carrying capacity of the highway. **Toronto** has been running **HOV** lanes for more than 20 years.

Dynamic road pricing based on congestion levels is an alternative basis for the surcharge, which has been implemented in **Singapore** through **electronic road pricing** since 1975. The system increases average road speed while decreasing traffic (Danish Architecture Centre).

Cities with different cultural backgrounds and different stages of development require different approaches to implementing ITS. The government of Zhangjiakou should first declare the objective of pursuing ITS solutions. It can then gather ideas from different potential service providers in the form of a tendering process or a symposium. This process will inform the local government about the latest technologies and help them judge which solutions are most suitable for the needs of Zhangjiakou.

Strategic Recommendations

Develop traffic management and an intelligent transport system (ITS)

- **ITS solutions** should first be considered to increase roadway capacity through efficiency gain on the existing infrastructure.
- **Dynamic travel speed limits** could be imposed on bottlenecks such as checkpoints and toll plazas to increase road capacity by averting standstill traffic congestion.
- **Variable lane labelling** offers flexibility to implement ITS solutions such as a high-occupancy vehicle lane and reversible lane (tidal flow) during peak periods.
- Different **cultures** demand different ITS approaches. Government could first make use of a symposium/tendering process to clarify which approach is most suitable for its needs.

Create an innovative financing mechanism for highway construction

- Taking advantage of its position as tourist destination, Zhangjiakou can **bundle highway-related businesses and tourism-related businesses** to raise interest in roadway investment by the private sector.
- To avert a political opposition to a fee increase, a **dual toll level arrangement** could be arranged by creating a toll road coupling an existing highway to provide a fast route for users subject to a higher toll charge.

Improve intermodal transport

- A **high-speed railway (HSR)** should be built between Beijing and Zhangjiakou, based on a transit-oriented development that takes mixed uses and intermodal connections at its main stops into account.
- The **“last mile”** between a railway station and a traveller’s final destination should be bridged by seamlessly integrated green transport modes, e.g. a local bus system and non-motorist transport (cycling and pedestrian).
- High-quality local and intercity public transport, plus **discouragement of the use of private vehicles**, such as an entry fee for non-locally registered vehicles and for park-and-ride facilities, could reduce the demand for an intercity highway.

Optimize goods movement and logistics

- **City-wide comprehensive logistic planning** may provide a platform to consolidate all goods entering and exiting the city.
- Further regional consolidation centres would increase the load factor for intercity logistics connecting Zhangjiakou to other cities in the region (such as Beijing), decreasing the percentage of road space occupied.
- Further **collaboration between the government and businesses** from different sectors could optimize the regional logistic plan, **assisting the government to tap into private investment** in freight infrastructure.

Enhance capability in transport analyses and monitoring

- Developing **local capabilities in data analyses** is essential for effective implementation of ITS solutions and informed decisions on transport investments in the long run.
- **Furthering transport monitoring and analyses** could help understand the true causes of congestion and deploy specific solutions for specific areas.

Case Study: United Kingdom – Active Traffic Management Approach

To combat an extremely variable traffic flow on the M42, which handles over 120,000 vehicles per day, an active traffic management (ATM) system was piloted in November 2005 as a test bed to provide a fully flexible, controlled motorway. Variable message signs (VMS) are available on each lane, providing specific management in the speed, uses, opening and closing of each lane to combat peak-hour congestion and traffic incidents.

During peak hours, the travelling speed may be reduced mandatorily through VMS, increasing the carrying capacity of the road. Further options of new lanes are available through the temporary opening of hard shoulders to traffic. ATM will alert drivers of congestion and incidents ahead, giving motorists time to avert the affected section of the motorway.

The overall system was developed at the cost of five times less than the conventional widening of M42 (The Automobile Association), with emissions by vehicles falling by 10% due to a faster travelling speed and 4% less fuel consumption due to a smoother journey. Although ATM may not be suitable for all highways, it nonetheless offers a more cost-effective method to tackle congestion for more developed road systems.

(Roadtraffic-technology)



MIDAS traffic control centre (Photo: Highway Agency, Open Government License)



Traffic condition with Active Traffic Management (Photo: Highway Agency, Open Government License)

Create an innovative financing mechanism for highway construction

Building a new highway is not always economically viable and should always be considered in the context of all strategic recommendations. However, with a number of new highways being planned between Zhangjiakou and Beijing, innovative financing mechanisms can potentially help expedite their implementation through public-private partnerships (PPP). Lessons can be learned from the Chinese example in **Changsha** and **Sichuan** and from the British example in **Birmingham**. Attracting private capital is an important policy aim. Until 2008, only 5-6% of toll road development expenditures were privately financed (Asian Development Bank). Hence, private investments in this field are still a small proportion in China.

To encourage PPPs in infrastructural development, a **build-operate-transfer (BOT)** arrangement can be made by bundling highway construction and operation with other potential profit-generating businesses, such as petrol stations, restaurants, service stations, advertisement rights and even land development. Given Zhangjiakou's positioning as a tourist destination for skiing and other outdoor sports, this strategy should be considered as it enhances the attractiveness of the package for potential investors.

Regardless of the financing mechanism, highway construction does not necessarily imply the construction of a brand-new highway. Additional toll roads can be added in parallel with existing free corridors to provide drivers several options on road use. The dual speed, dual toll levels highway arrangement reduces political obstacles of a fee increase while employing economic mechanisms to provide a fast route for road users bearing greater time cost.

Case Study: China (Changsha and Sichuan) – Models for Private Participation in Roadway Construction and Maintenance

Land leasing and BOT have been used for financing highway construction in China. As the land along the highways is owned by municipal governments, land value gains associated with the highways can be leveraged to finance the construction. Tendering is used for appointing the BOT partner from the private sector.

Changsha Land Leasing for Ring Road Highway

In 2001, when an outer ring road was to be built encircling the region around Changsha, the total cost of the six-lane highway was projected at \$730 million. The Ring Road Corporation (a public-private joint venture company) was responsible for financing the highway. Development rights on both sides of the circumferential highway were transferred to the Ring Road Corporation, totalled at 33 km². The sale of leasing rights with infrastructure services accounted for half of the total cost, while bank loans backed accounted for the other half of the cost (Peterson).

Sichuan BOT Leyi (Leshan-Yibin) Expressway

The Sichuan Expressway Construction and Development Corporation (SECDC) is a state-owned enterprise. Highways will be built following competitive bidding managed by the SECDC. Tolling and management rights will be transferred to SECDC-owned expressway companies for operations and maintenance under concession agreements of usually 30 years. The Leyi expressway is the first highway BOT project in the Sichuan province. Shandong Expressway Group was offered the BOT project through an open bidding process in 2005. The winning criteria were low construction, tolling period and total cost. The corporatization and tendering approach offers good features including competitive bidding, comprehensive documentation, a transparent evaluation and award process, and a simple, clear selection process (Asian Development Bank).

Case Study: Birmingham (United Kingdom) – M6 Toll Road

The M6 toll road was one of the first privately funded public infrastructures in the United Kingdom, as an early form of public-private partnership. Located at the busiest stretch of the M6, it was originally conceived as a Birmingham North Relief Road, an alternative route built to bypass the busy stretch for vehicles that do not need to enter Birmingham. However, due to financial costs, the government decided to use a dual toll level motorway arrangement, tendering Birmingham North Relief Road for

private investors for bidding. Since its opening, the M6 toll road has successfully diverted 43,000 vehicles per day (Lumb).

As part of the PPP initiative, Midland Expressway Ltd was awarded the contract for a 53-year concession to build and operate the road. The government has granted flexibility on charge rates apart from intervals for change in rates. At the end of the concession period, the government will resume its rights to the infrastructure (Midland Expressway Limited).



M6 toll road (Photo: Richard Cattell, Creative Commons)



M6 toll road (Photo: Richard Cattell, Creative Commons)

Improve intermodal transport

Since Zhangjiakou provides services to Beijing and complements the function of the capital, an effective public transport route between the two cities is considered necessary for its long-term development. As both freight and passengers currently contribute to the traffic congestion between Beijing and Zhangjiakou, an intercity high-speed rail (HSR) line between the two cities has been proposed to share the burden of highways and reduce the travel time to 45 minutes. Zhangjiakou could consider becoming a consolidation hub for goods and people of Inner Mongolia and then dispatch to Beijing with intercity railway lines. This could greatly reduce the heavy freight flow to Beijing and make the transport greener and more economic. For railway-based transport solutions, the “last-mile” issue and community-building around stations must be addressed to secure the ultimate success of the project.

The lack of efficient connections from the railway station to the trip origin or the final destination within both cities often discourage people from using HSR. Therefore, the reorganization of the existing bus system should be

considered simultaneously when the station location of the intercity HSR is being planned. Also, cycling and pedestrian corridors radiating from the station should be enhanced to enlarge the catchment area of the station.

Coupling incentives for using public transport with discouragement of using private vehicles is another key strategy. The transport terminus should be conveniently connected to the local public transport network so that the “last mile” connection would not discourage travellers from using the intercity train or bus. Integrating the main train stations at both ends into the urban landscape, like in the case of Osaka, can encourage people using the HSR.

With the prospect of winning the bid to host the 2022 Winter Olympics and the associated development of tourist destinations, Zhangjiakou could also consider developing a monorail that connects the regional transport hub, the urban core and main tourism destinations. A charge could be put on the externalities that private vehicles from Beijing would create on Zhangjiakou. A charge on non-Zhangjiakou registered cars that enter the urban core of the city is an example of a way to make public transport an attractive option.

Case Study: Osaka Station City – Transit-oriented Community with a Big Ambition

Osaka Station City was a development opportunity, created by the economic influence of a transport hub. With access for 2,500,000 people a day, the Osaka government has set up a priority development area around Osaka Station to capture the surrounding value, triggering regeneration and encouraging the economic growth of Osaka (Invest Osaka).

The development of Osaka Station City was mainly a public-private partnership with the government setting up an Urban Renaissance Agency (2006) to holistically

manage the planning of Osaka Station City. Further governmental development corporations were set up to ensure the development aims were achieved (Knowledge Capital Management Corporation).

Osaka Station City had the ambition to create a transit-oriented community, utilizing the economic and development influence of the station to trigger a wider city economic development impact and transforming Osaka into an innovation centre. After completion of Grand Front Osaka at the heart of the Knowledge Capital Zone, further urban regeneration processes have been initiated, leveraging Osaka Station City.



Optimize goods movement and logistics

The traffic jams around Zhangjiakou are not driven mainly by the traffic flow between Zhangjiakou and Beijing, but rather between the whole Inner Mongolia region and Beijing. While there may not be a direct single solution to the freight problem facing Zhangjiakou, city-wide and even region-wide comprehensive logistic planning may provide a platform for consolidating all goods entering and exiting the city. With urban freight accounting for 22% of all urban traffic and further occupying an estimated 40-45% of all urban road space, the management of goods movement could potentially free up additional road capacity through greater efficiency (Ministry of Environmental Protection of the People's Republic of China).

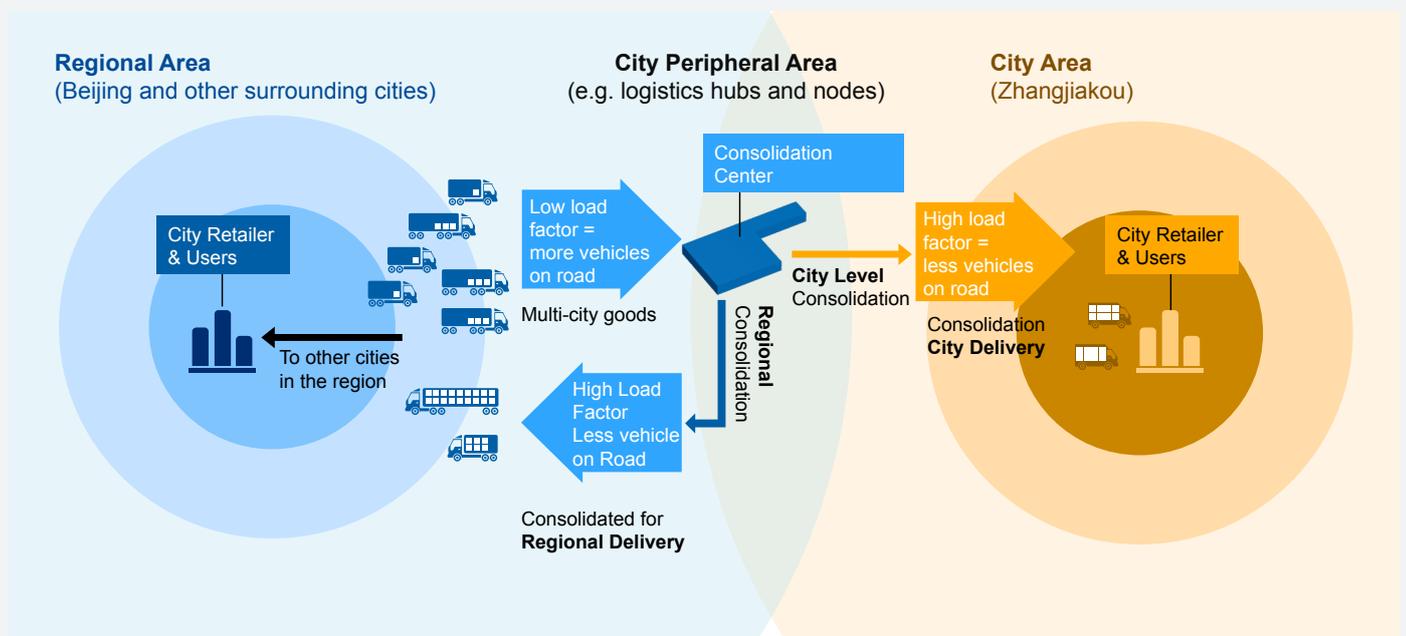
Increasing the load factor through the establishment of consolidation centres would reduce trucks coming in and out of the city, thus reducing road saturation. A close collaboration between government, multi-sector businesses and logistic service providers would be key in implementing a city-wide logistic policy that could assist the government to tap into private investment in freight infrastructure upgrade. The case study of **Ningbo City** is an interesting example to learn from.

Case Study: Ningbo City – Logistic Master Plan

Industrial and port logistical systems in Ningbo are well developed. Rising sales in the city and region, however, are putting pressure on the logistical infrastructure, causing rising demands on frequency and service levels. This is compounded by insufficient load capacity to handle the growing volume, disrupting management of traffic flow. Led by DHL and a consortium of private companies and governmental bodies, a City Logistical Master Plan was

piloted to improve operations. The following enhancements have been proposed:

1. Setting up smart consolidation centres at the periphery to enhance efficiency
2. Smart scheduling at off-peak hours
3. Maximizing the efficient use of available logistic providers through transparency of end-to-end open data
4. Optimizing smart logistic vehicles



Based on data from Megacities and DHL's City Logistics Programme Report (DHL), further modified by the author



Enhance capability in transport analyses and monitoring

The effectiveness of transport investment decisions and traffic management schemes depend on the quality of transport data being fed into the analytical process. It is therefore recommended that Zhangjiakou develops local capability in transport data analysis and traffic management systems so that more tailor-made and lasting solutions can be generated for the local context. In addition, the maintenance of the system and the right interpretation of the data collected would be indispensable to the ultimate success of the employment of these transport technologies. Furthermore, the actual cause of highway congestion should be carefully investigated to prescribe the right solution(s).

For example, the presence of inspection points for Beijing-bound traffic could be a potential cause for the slow traffic along the corridor. Understanding the origin and destination of trucks at major traffic corridors, such as Jing-Xin Highway, helps to make better decisions on infrastructure investment.

Best practice traffic management requires a holistic approach instead of a focused approach along a single corridor. Main roadways such as Jin-Xing and Jing-Zang serve as both regional corridors and connections between urban clusters. It is paramount to coordinate the regional highway network with local surface roads, discouraging passing traffic from entering the city centre while encouraging travellers between urban clusters to avoid regional traffic during peak periods.

Integration of wind energy, locally and cross-regionally

Strategic Recommendations

Avoid undesirable development by designing strategic policies

1. Consider **other indicators** (e.g. grid stability) to assess the healthiness of the wind energy sector, instead of only the capacity of wind energy installed.
2. **Coordinate** strategic planning for expanding wind energy with supply (installed capacity) and power demand, grid capability and available resources for expansion.
3. Design policies for expanding wind energy installation and grid enhancement accordingly in a coherent way.

Collaborate beyond city boundaries on the long-distance transmission of electricity

1. Seek **cooperation** in both planning and implementation **across city boundaries**, in particular with Beijing and the grid company.

Explore opportunities to enhance the use of wind power

1. Test and adopt advanced technology regarding power distribution, storage, stability, etc.
2. Use excessive wind energy as a catalyst to develop local industries.

Avoid undesirable development by designing strategic policies

The electricity grids have limited capacity to take energy from wind power. This is a common problem for all cities relying on wind energy in China. Zhangjiakou faces the same problem with an already installed capacity of wind energy exceeding 5,000 MW. Zhangjiakou needs to start assessing the healthiness of its wind farms and any further unstudied expansion with respect to the stability of the local grid. Zhangjiakou is unlikely to offer a solution to this by itself. Coordinated strategic planning for further expansion of wind energy installations should match grid capability and take the available resources needed for a stable expansion into account. Policies for managing the expansion of wind energy installation should be coherently aligned with the policies on enhancing the grid, at the distribution and transmission level.

Collaborate beyond city boundaries on the long-distance transmission of electricity

Given its wind energy capacity, Zhangjiakou is well positioned to become a role model for the development of renewable energy in China. In addition to a coherent policy alignment of capacity expansion and grid development (see above), the bulk of the solutions will inevitably come from the integration of the region's power system with the wider grid landscape. To facilitate the achievement of this goal, a new means of collaboration and cooperation between the capital and grid company is required.

Explore opportunities to enhance the use of wind power
Zhangjiakou should test the latest technologies focusing on distributed generation, energy storage, micro-grids, etc., to improve the stability of the distribution grid. Given the large wind power set-up, installing an energy storage system to store excessive energy and balance the grid is advisable. Zhangjiakou could increase the flexible domestic demand for the volatile provision of wind power. This could include, for instance, a refrigeration storage house used in agriculture (food processing). Increasing overall energy demand and hence creating a wider portfolio of power generation that could absorb volatile wind power could be a long-term approach that should be closely monitored from a sustainability perspective. It should go hand-in-hand with developing high-energy-consuming sectors (e.g. cloud computing and data centres) or – more broadly – local economies in Zhangjiakou's vast rural areas, such as high value added and tourism.

Case Study: Innovation of Wind Energy to Help Agriculture Become More Sustainable

One of the greatest challenges of wind energy is the limited options for large-scale storage. As a result, the power generated by wind turbines during the night when electricity demand is low are often wasted.

One possible opportunity for solving this issue is to use the excessive electricity generated by wind turbines to produce fertilizers for agricultural use, as researchers tried in Minnesota in the US. The electricity generated is used to produce hydrogen, which could then be used to form nitrogen fertilizer. The process would also help reduce greenhouse gas emissions since this method of producing the fertilizer does not emit CO₂.

(University of Minnesota)



Meeting sustainability goals for the Winter Olympics bid

Create a branding identity for the city

Zhangjiakou launched its branding campaign of “Wonder Land Zhangjiakou” in 2013 to reflect the city’s rich cultural heritage and geographic diversity. The campaign proved to be successful in delivering a strong and unified image of Zhangjiakou and was well received in surrounding regions. Zhangjiakou’s partnership with Beijing to bid for the 2022 Winter Olympics provides a perfect opportunity to further strengthen Zhangjiakou’s relationship with the capital, with a particular focus on sustainability and liveability. The branding campaign should be integrated into the city’s policy-making and socio-economic development process.

Strategic Recommendations

Create a branding identity for the city

1. Zhangjiakou already launched its branding campaign “Wonder Land of Zhangjiakou”. It could further build on it to strengthen the city’s identity and to **position and integrate** this branding into the 2022 Winter Olympics.

Leverage green sectors

1. Zhangjiakou should identify green sectors that could benefit from the 2022 Winter Olympics opportunity, and develop strong preferential policies and mechanisms to prioritize their development.
2. Zhangjiakou should avoid trying to develop a full spectrum of sectors in the city, in particular those with negative environmental impacts.

Educate rural population on sustainability through mobile technology

1. Zhangjiakou should leverage technological solutions to support the capacity-building for the emerging green sectors, in particular in the rural area.

Leverage green sectors

Zhangjiakou’s agricultural and industrial development should be in line with its identity. Transitioning from a traditionally industrial city to a sustainable city, Zhangjiakou has many predecessors to draw experiences from. For example, the “Steel City” of Sheffield in the United Kingdom is traditionally famous for its cutlery, heavy steel and polluting coal industry, but successfully re-branded itself into a vibrant modern city as Snooker World Cup host, with a hiker’s heaven in the Peak District and leading universities. Zhangjiakou has equally abundant natural and cultural resources, from outdoor music festivals in Zhangbei, ski World Cup series in Chongli, and numerous wine breweries in Huailai, sufficient for the city to depend solely on green sectors. The key to Zhangjiakou’s successful transition will be the city’s consistency in prioritizing sustainable development, and balancing trade-offs between traditional industries and the emerging eco-friendly sectors.

Case Study: Thrilling Cities

Thrilling Cities is a pioneering place-oriented branding initiative and creative agency. It focuses on bringing together cross-disciplinary activities to create an identity for a candidate city and help implement diverse and drastic actions to strengthen the branding image, as in the case of Shanghai.



Shanghai has been internationally promoted by Thrilling Cities

Educate rural population on sustainability through mobile technology

Many of Zhangjiakou’s emerging sectors, e.g. agricultural products, eco-tourism and associated services, will be operated by farmers and other rural dwellers. They commonly have limited awareness of and capacity in the concept of sustainability. Zhangjiakou should leverage these citizens and empower them with a green and sustainable mindset. Technological solutions can help to effectively and quickly disseminate know-how for green transformation. Over time, it can help support capacity-building on sustainability aspects related to agriculture, eco-tourism and associated activities. The extent of the potential of technology and sustainable patterns of operation can be learned from the Case Study on **Connected Agriculture**.

Case Study: Connected Agriculture – The Role of Mobile in Driving Efficiency and Sustainability in the Food and Agriculture Value Chain

Vodafone, Oxfam and Accenture jointly analysed how mobile communication can meet the challenge of feeding an estimated 9.2 billion people by 2050. The study identified and explored 12 opportunities that could deliver broad socio-economic and environmental benefits and increase agricultural income. The opportunities include adopting simple mobile communication technologies to improve access to financial services, provision of agricultural information, improving data availability for supply chain efficiency and enhancing access to the markets. The implementation and delivery of these opportunities requires collective support of key stakeholders across the agricultural supply chain, i.e. the government, NGOs and private enterprises, as well as the mobile network operator to catalyse change.

Next Steps

The Future of Urban Development Initiative serves as a partner in the transformation of cities worldwide as they address significant urban challenges. It aims to make innovation accessible to city leaders and businesses in a mutually beneficial setting.

The focus in 2013 and early 2014 was working with the respective local authorities of the two Champion Cities, Dalian and Zhangjiakou. Part of this work was identifying challenges and opportunities for the further urban development of Dalian and Zhangjiakou. Now, in summer 2014, the two cities are equipped with innovative yet achievable strategic recommendations, which have been clustered into the three urbanization themes:

1. Transport planning and management
2. Urban energy management
3. Sustainable industry development

The Future of Urban Development Initiative encourages Dalian and Zhangjiakou to initiate the implementation of the strategic recommendations with the support of the initiative's Steering Board and Advisory Board. The Champion City Model is the framework for Dalian and Zhangjiakou to leverage both the momentum and the community, which have been created by the Initiative. The Champion City Model also serves as a leading practice for cities around the world.

A variety of stakeholders, institutions and governmental bodies have contributed to this report. To implement the strategic recommendations contained herein, the Champion Cities need to employ best practice project management.

The Future of Urban Development Initiative serves as a platform for industry leaders, urban experts and urban stakeholders to transfer knowledge and facilitate exchange among them. The relationships, experience and collaboration developed with the three Chinese Champion Cities, Tianjin, Dalian and Zhangjiakou, will remain helpful and relevant for this process.

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