

Hong Kong General Chamber of Commerce

A Model for the Circular Economy in Hong Kong and the Pearl River Delta

21st February 2010

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Executive Summary

China has been testimony to some of the most rapid growth trends in the economy ever seen in the world. The country has risen to become a leading economic force as a result of supply chains and business models that have capitalized on opportunities brought about by globalization, advances in infrastructure and information flows. But is this development sustainable? Concerns have been raised by the Central government on the limitations of resources to fuel China's continued development as well as the risks posed by climate change and global warming. Even locally, the signs of stresses on society and the environment are evident in polluted lands and waters and urban blight in many of China's provinces.

The circular economy is a way of minimizing excessive consumption and - where consumption does take place - a means of re-using and recycling spent materials which would otherwise be treated as waste. Around Asia, the circular economy has been practiced from national initiatives down to communal levels. But what is the formula for success that China needs to adopt to reap the benefits of such an approach? Past attempts to implement the circular economy by converting waste into a resource have not always proved to be as effective as might have been planned.

The Pearl River Delta (PRD), the manufacturing heartland of Southern China, may offer a possible model for a successful circular economy. There are recycling networks in the region as well as buoyant primary and secondary manufacturing sectors to absorb materials from neighboring Hong Kong, whose economy has been inextricably linked to that of the PRD region since the 1980s. Hong Kong already makes use of the PRD's resources of labor and space for re-use and recycling but the full potential of this has not been fully realized.

Concept

A circular economy arises when a closed loop is created that regenerates resources rather than having to exploit new ones.

- Example (1): Companies making use of the waste generated by one party and convert it into a useful resource for another party.
- Example (2): Companies working with producers to take used products from users in exchange for new ones and reusing these goods either back into the original product stream or disassembling the used products for recycling elsewhere.

For the purposes of this discussion, there is a distinction between re-use and recycling. The former occurs when product waste is converted into a resource back into the original product as a remanufactured or reconditioned product. Remanufactured goods refer to goods that enter the market as new but with re-used components such as glass, wiring etc. Reconditioned goods are those that retain the original body but with new internal components such as upgraded circuits, chips etc. If the product waste is used as a resource for secondary use i.e. lower-value recycled products like road surfaces, plastic fillers or wood chip, these are considered to be recycled products and commonly come from disintegrated assemblies of used products.

China passed the 1st Circular Economy Promotion Law in 2008 backed by national targets on energy consumption reduction per unit GDP by 20 percent by 2010. The nation's eco-industrial park concept took root in 2004 further paving the way for circular economy implementation. However, challenges identified include: the top-down planned economy approach; lack of guidelines for planning to highlight how this approach differs from standard environmental protection planning; inflexible solutions

preventing company to company exchange; lack of integration with market-based solutions; and need for cognaisance of market forces and suitable governance of the participating parties.

The Pearl River Delta

Roughly 10 per cent of China's gross domestic product and about 30 per cent of China's exports come from the Pearl River Delta (PRD). By 2020, 100 state laboratories for engineering innovation and research and development will be established and at least 10 China-based multinationals with annual sales of US\$20 billion will be developed. But, as a result of the region's economic development, levels of pollution have escalated over the past two decades largely caused by Hong Kong-owned factories. In the PRD, the current recycling industry is fragmented, low-tech and labor-intensive, and crucially lacking governance.

Hong Kong could be a good partner for the PRD to develop a model for the circular economy. The circular economy was first mentioned in the "Policy Framework for the Management of Municipal Solid Waste" in 2005. Factors considered include: allocation of land resources; encouraging further R&D in clean technologies for recycling industries; improving the collection network for waste sorting and segregation; organizing public education programs to encourage consumers to consider re-use and recycle options as well as reducing waste; and fostering green procurement policies to increase demand for recycled goods. Like the mainland, Hong Kong too faced its own circular economy challenges in: delays in making producer responsibility and waste charges mandatory; lack of demand for recycled products; economic factors affecting decisions on whether to invest in the recycling industry; responsiveness of consumer behavior to sort and separate waste not being as strong as hoped; and finding the right balance to attract tenants to eco-park whilst at the same time controlling the lease conditions to prevent abuse of tenancy.

Harnessing the resources of the PRD with Hong Kong could be the basis of a circular economy

- Entry – only goods that have re-usable or recyclable components are allowed into the region i.e. DfE products.
- Mid-stream – wastes are sorted so that reusable or recyclable materials are extracted.
- Value-added processing – the sorted waste is processed in facilities in the PRD and/or Hong Kong (maybe a few times back and forth across the boundary) to become useful.
- Eco-efficiency – at each stage efficiency gains are made in water and energy as well as avoidance of secondary pollution through stringent environmental controls.
- Manufacturing – the materials (which were originally waste) now become valuable resources to be fed into primary or secondary manufacturing workstreams to produce remanufactured/reconditioned goods or secondary materials respectively.
- Market re-entry – stimulating a demand for remanufactured/reconditioned goods and recycled materials either in Hong Kong or in other parts of the PRD.

For a circular economy to work, there is a need for efficient trans-boundary supply chains moving waste from Hong Kong into the PRD and shipping back remanufactured/reconditioned or recycled products. Recycling companies and processes must be organized and coordinated to match the types of wastes shipped out and the recycled goods shipped back in, and support from businesses in the form of compliance with PRS to ensure take back of used products is necessary. DfE that enables products to be recovered and re-used or recycled into primary and secondary processes respectively must be implemented by producers and the demand for remanufactured/reconditioned or recycled goods over virgin goods should be encouraged through the right incentives or penalties for consumers. Lastly, attractive locations conducive to the recycling business must be identified where investments and paybacks can be realized over reasonable time periods and profit margins will be sustainable.

Options for Hong Kong are (1) to pair with various cities in the PRD to match complementary wastes with resources or (2) a bilateral exchange with Shenzhen.



Option 1



Option 2

Particular items for the circular economy model proposed include:

- Electrical appliances that can be disassembled and reassembled for re-use according to DfE principles. If this is not possible then the composition materials should be able to be safely stripped for recycling with no damage to the environment.
- Food substances that can be converted to organic waste for use as compost in farmed areas in the PRD to encourage local food production.
- Packaging such as glass, plastics and paper that can be recycled. In some cases, it would be recommended to turn away products that have excessive packaging which does not fulfill any hygiene or safety function.
- Building materials that can be re-used such as wood and composites.
- Used textiles and clothing.

Further benefits to consider would be the creation of much-needed jobs for China's population many of whom are vulnerable to the effects of global downturns and economic crises. The shocks of the last financial meltdown have reinforced the fear of unemployment in the minds of many. Setting up a circular economy that has supply and demand models that match and are consistent will help remove some of this uncertainty. Furthermore, it is important that with the oversight of government, the situation of damaging recycling practices which emit secondary pollution will no longer reoccur and that the jobs that emerge are clean, safe and reputable.

Recommendations

The Chamber recommends the following measures for a circular economy in the PRD:

- Identify the complementary primary and secondary manufacturing industries in the PRD for Hong Kong to create the closed loop for a circular economy - sharing of knowledge, technologies and skills.
- Focus on mid-stream value-added processes using Hong Kong's EcoPark to attract the right companies and act as a platform for overseas technologies
- Pass PRS and waste charging legislation in Hong Kong and elsewhere to promote more re-use and recycling; additional legislation to favor import of recyclable goods into Hong Kong
- Favor producers that practice DfE - convergence of DfE e.g. standardization of designs and homogeneity of materials
- Encourage regional supply chain businesses
- Promote market - green labeling and mandatory green procurement in Hong Kong and elsewhere
- Set up leasing and rental arrangements for appliances and equipment in Hong Kong and elsewhere

- Set aside capital and land to host the facilities needed to carry out the processing, storage and shipment of materials around the region.
- Establish clear lines of governance especially in cross-boundary processes
- Work with the Greater Pearl River Delta Council to establish leadership lines in setting up the circular economy model.

1. Introduction

China has been testimony to some of the most rapid growth trends in the economy ever seen in the world. The country has risen to become a leading economic force as a result of supply chains and business models that have capitalized on opportunities brought about by globalization, advances in infrastructure and information flows. But is this development sustainable? Concerns have been raised by the Central government on the limitations of resources to fuel China's continued development as well as the risks posed by climate change and global warming. Even locally, the signs of stresses on society and the environment are evident in polluted lands and waters and urban blight in many of China's provinces.

The circular economy is a way of minimizing excessive consumption and - where consumption does take place - a means of re-using and recycling spent materials which would otherwise be treated as waste. Around Asia, the circular economy has been practiced from national initiatives down to communal levels. But what is the formula for success that China needs to adopt to reap the benefits of such an approach? Past attempts to implement the circular economy by converting waste into a resource have not always proved to be as effective as might have been planned.

The Pearl River Delta (PRD), the manufacturing heartland of Southern China, may offer a possible model for a successful circular economy. Recycling networks in the region are active and there are buoyant primary and secondary manufacturing sectors to absorb materials from neighboring Hong Kong, whose economy has been inextricably linked to that of the PRD region since the 1980s. Hong Kong already makes use of the PRD's resources of labor and space for re-use and recycling but the full potential of this has not been fully realized.

In this report, the factors behind a successful circular economy are examined and recommendations are provided on the way forward for China, the PRD and Hong Kong to advance as sustainable communities through adopting a circular economy model.

2. China's Development

2.1 Growth at a Price

The growth of China's economy over the last decade has forced the central government to look at the sustainability of its course; there is a need to undertake critical measures to manage its continuing development at the same time use resources more efficiently. Already China's consumption pattern is massive. To fuel its economy, the country consumes 80 percent, 50 percent and 25 percent of the world's copper, steel and aluminum respectively. At its current rate of development, the stresses are plain to see not only in the degradation of its environment but also in China's footprint on the rest of the world through its consumptive appetite for resources.

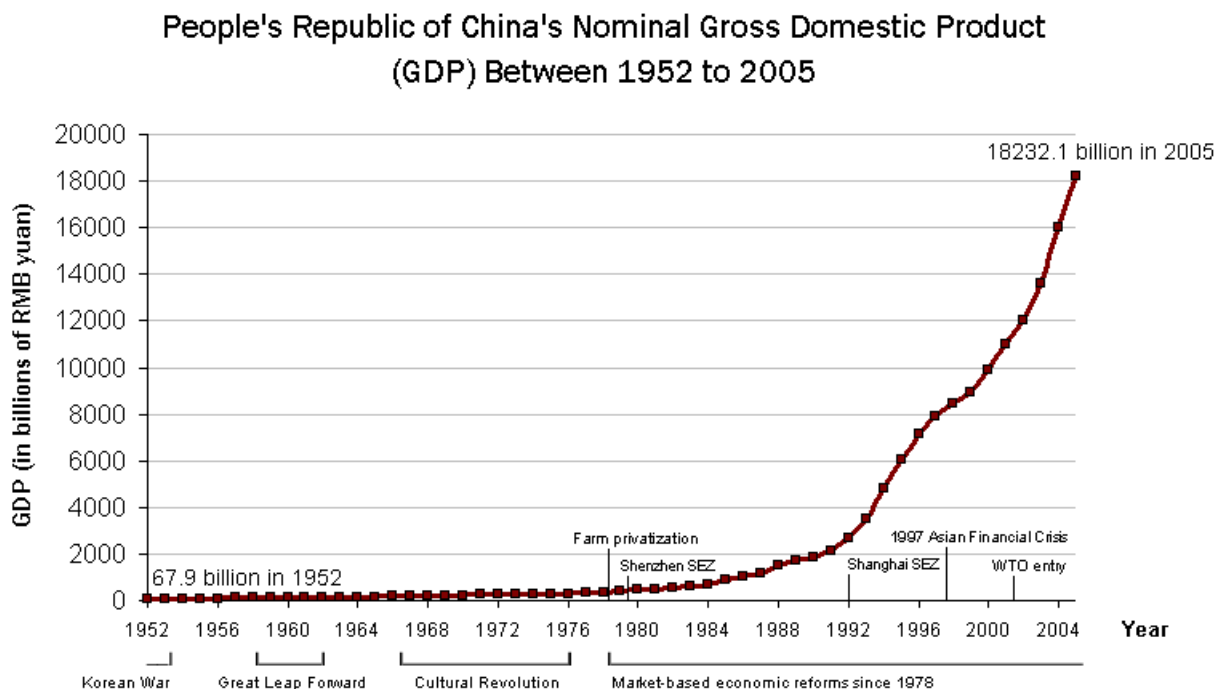


Figure 2.1 China's GDP Growth (Source: World Bank)

At a consumer level, urbanization in China has resulted in changes in lifestyle with the springing up of Western-like consumption trends leading to waste generation patterns experienced in developed nations decades ago. Such trends will have disastrous consequences if allowed to continue unabated.

The Pearl River Delta – a Success Story?



The Pearl River Delta (PRD) includes Hong Kong, Macao and the Special Economic Zones. There are nine mainland municipalities, namely Guangzhou, Shenzhen, Dongguan, Foshan, Jiangmen, Zhongshan, Zhuhai, and the urban areas of Huizhou and Zhaoqing¹. It was the open-door policy and economic reforms in the early 1980s that transformed the PRD into one of the fastest growing areas in the world particularly the areas next to Hong Kong and Macao which became the Special Economic Zones (SEZs) of Shenzhen and Zhuhai respectively. These zones had special tax regulations to attract foreign investments.

Many Hong Kong manufacturers moved into the Shenzhen SEZ nearby, as well as other parts of the PRD, to take advantage of cheaper land, labor and operating costs. Whilst labor intensive activities shifted to the PRD, higher value-added activities, such as management, finance, logistics, design, R&D, and quality assurance remained in Hong Kong.

Up to 2008, the PRD accounted for 10 per cent of China's gross domestic product and about 30 per cent of China's exports. Recognizing the importance of the PRD, the central government announced an ambitious 12 year plan to move the PRD up the value chain setting out how the region will re-focus on innovation, encompassing high-end manufacturing and high-technology industries such as automotive, steel, petrochemical and shipbuilding as well as modern services and finance. By 2020, 100 state

¹ <http://www.thegprd.com/>

laboratories for engineering innovation and research and development will be established and at least 10 China-based multinationals with annual sales of US\$20 billion will be developed².

Sadly, there was and still is a dark side to this development. Levels of pollution in the PRD have escalated over the past two decades with sewage and industrial waste treatment facilities failing to keep pace with the growth in population and industry in the region. A large portion of the pollution is caused by factories run by Hong Kong manufacturers in this area. Air quality issues due to the burning of low grade fuels to power the industries have become major causes for concern; much of this pollution affects not just the immediate area but also downwind into the stretches of Hong Kong.

China's concept of the circular economy³ has hence developed as a strategy to maximize efficient use of resources not just as a means of looking at ways of improvement in industrial waste management but also overall quality of life for its society. The circular economy in China is furthermore connected with the "zero-waste" economy or "green" accounting mechanisms⁴ endorsed by international organizations such as the World Bank.

2.2 Definition of the Circular Economy

The common definition of the circular economy is one where companies can make use of the waste generated by one party and convert it into a useful resource for another party. This description of waste can however embrace not just solid materials but also other resources such as energy and water. By applying this principle, a closed loop is created that regenerates resources rather than having to exploit new ones.

A common example would be that of a tenant on an industrial complex using the waste by-products of another tenant as an input into his process. A slightly more complex example would be recycling companies working with producers to take used products from users in exchange for new ones and reusing these goods either back into the original product stream or disassembling the used products for

² "Hong Kong & Pearl River Delta - A Winning Business Strategy" Invest HK

³ Zhang, J. "Approaching circular economy" (2004), China Daily

⁴ "Green accounting practice in China" (2008), United Nations Environment Programme and Tongji University

recycling elsewhere. This would be spurred by the producers themselves leading the initiative by implementing “take back” policies to encourage users to return the used products.

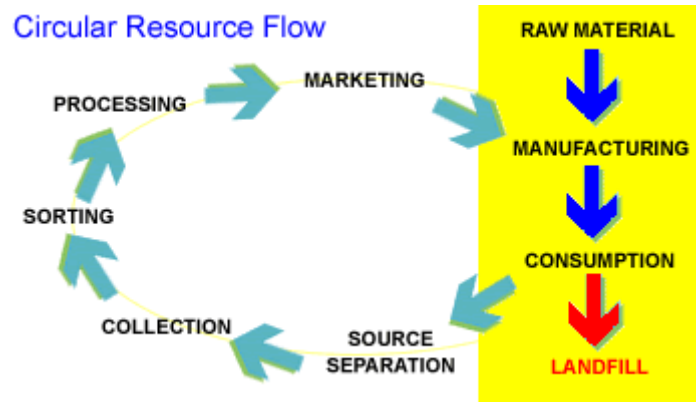


Figure 2.3 The Circular Economy

A circular economy reduces, reuses and recycles at different stages in the production-distribution-use recovery processes as well. In general, circular economies tend to exist internally within specific sectors but the key to a true circular economy is to link up separate sectors so that spent resources from primary markets are able to feed back into the same primary markets or into secondary markets i.e.:

Reuse and Recycling

Product → waste → resource back to original product
(remanufactured/reconditioned products)



Figure 2.4 Reconditioned mobile phones

OR:

Product → waste → resource to secondary use (lower-value recycled products)



Figure 2.5 Waste glass for road surfacing

For the purposes of definition, remanufactured goods refers to goods that enter the market as new but with re-used components such as glass, wiring etc. Reconditioned goods are those that retain the original body but with new internal components such as upgraded circuits, chips etc. Secondary use materials are materials from disintegrated assemblies that are recycled into low end applications like road surfaces, plastic fillers or wood chip.

2.3 Re-Use and Recycling in China

Early circular initiatives in China focused on the exchange of process waste in industrial complexes where the scope for waste exchange (including waste energy) is traditionally highest. More innovative means of re-use and recycling have been fostered as a result of entrepreneurs spotting opportunities to apply recycling technologies and methods to growing consumer markets.

The Nine Dragons company⁵ is a good example of an enterprise that has benefited from the circular economy and shown that the approach can be commercially viable. Nine Dragons Paper (Holdings) Limited is a private-owned paper manufacturing company in Mainland China, engaged in the manufacturing of containerboard products using recycled paper and is now one of the largest packaging containerboard manufacturers in the world. The company is listed on the Main Board of the Hong Kong Stock Exchange.

⁵ www.ndpaper.com/

Problems have arisen where less scrupulous recyclers have neglected environmental and health concerns in pursuit of commercial interests. Guiyu village in Shantou Province is an example where the recycling efforts have gone awry⁶. In the village, there are over 300 enterprises operating electronic appliance recycling and plastic dismantling operations, together with over 5,500 small private businesses. Many of these businesses are family-run workshops using backward technology and they suffer from poor business management, inefficient productivity and lack of support or direction from the larger enterprises. The result has been severe deterioration of the environment and elevated public health concerns emanating from toxic components in the appliances being discharged to the atmosphere and the waterways. Guiyu is not the only case in China where the recycling industry has created such problems under the guise of the circular economy but is perhaps one of the more infamous.



Figure 2.6 Scene from Guiyi Village, Guizhou

In the PRD, waste recycling is patchy. A recent survey conducted on over 100 recycling business enterprises in Huizhou in the PRD indicated that a third were running without proper licenses, and just over 15 percent were carrying out operations outside of their capabilities. Of 5,000 websites advertising

⁶ "Exporting Harm - The High-Tech Trashing of Asia" (2002) The Basel Action Network

recycling businesses in Guangdong, about half were illegal⁷. Much of the recycling technology employed is simple and crude, often in manual dismantling, or in the semi-manual semi-machine processing stage of appliances. Secondary pollution arising from the chemicals and other toxic materials held in appliances (especially computers) is a further problem. Many companies illegally carry out covert dismantling and burn waste remnants in uncontrolled furnaces releasing pollution causing serious damage to air, groundwater and soil resources and ultimately having harmful effects on humans.

The crux of this situation lies in the lack of governance controlling such enterprises. The industry is fragmented and run by small companies with limited or no management expertise. In addition, levels of modernization are low with many of these companies running labor-intensive practices often in disregard to labor and environmental standards.

On a positive note, in acknowledgement of this problem, Hong Kong is collaborating with the Guangdong authorities on plans to develop regional recycling industries and encouraging enterprises to adopt advanced technology for cleaner production, energy saving and emission reduction. This is being driven by consumers and customers who are pressing factory owners in the PRD to meet international standards in environmental protection as well as public health concerns. The Guangdong Government has earmarked a sizeable US\$16 billion by 2010 for environmental projects, as well as continuing to take measures to tackle pollution and enforce relevant environmental regulatory standards⁸. Ultimately, the aim is to transform the PRD region into a cluster of high-tech, low pollution and low-energy consumption cities.

⁷ Information provided by Hong Kong General Chamber of Commerce (2009)

⁸ "Guangdong cleans up Pearl River Delta" China Daily (October 13, 2004)

2.4 The Story So Far

The adoption of China's 1st Circular Economy Promotion Law⁹ in 2008 and subsequent enactment in 2009 gave sanction to the government to allocate funds and capital to enterprises for the stimulation of innovation in recycling technologies. China's Circular Economy Promotion Association was set up in January 2009 as a professional, non-profit making organization comprising a number of companies and research institutes engaged in the development of the circular economy.

As stated earlier, China's circular economy challenges do not just lie in waste materials but also in energy. China has stated its intention to reduce energy consumption per unit GDP by 20 percent by 2010, which is consistent with its recent climate change commitment to lower carbon-related energy intensity by 40 percent in 2020¹⁰. Energy is hence another indicator by which the country will measure its circular economy. Included in the circular economy law accordingly are tax exclusions for introducing and using energy-efficient technologies and equipment. The initial implementation phases of the circular economy were targeted at enterprises in high-consumption and high-discharge key industries as well as waste-recycling enterprises and eco-industrial parks. Provinces that took part in early measures included Guizhou, Jiangsu, Hainan, Jilin, Heilongjian, Shandong, Anhui and Fujian¹¹.

The Circular Economy Elsewhere

In the late 1950s, many industrialized nations began to recognize the severity of the impacts of pollution that were linked to high economic growth. This triggered the initial thinking about the circular economy to take polluting waste and recycle it back into the system¹².

⁹ "Circular Economy Law of the People's Republic of China adopted at the 4th Meeting of the Standing Committee of the 11th National People's Congress (August 29, 2008)

¹⁰ "Emissions target" China Economic Review (November 30, 2009)

¹¹ "Circular economy vital for balanced growth" People's Daily (October 04, 2004)

¹² Dietmar, R. "Compilation of case studies on circular economy from Japan, Germany and USA" (2003), China Council for International Cooperation on Environment and Development

Japan was one of the forerunners of the circular economy. A surge in economic activity led to dramatic increases in industrial waste levels necessitating legislation to make waste control mandatory for manufacturing companies. The Law for Promotion of Utilization of Recyclable Resources was an early example in 1980 of how a circular economy policy became mandated. Subsequent regulations covered containers and packaging, home appliances, construction materials, food and automobiles. These examples are important as they represent the inclusion of domestic materials indicating that the circular economy extends beyond industrial activities and reaches into commercial premises and households.

The key to this approach was the establishment of partnerships between business, consumers and government. Another critical factor was the linking up of upstream and downstream processes such as raw material production, parts and components manufacturing, processing and assembly, distribution, consumption, waste disposal and re-use/recycling. To further support businesses, the Japanese government set up the concept of 'zero-emission towns' by encouraging recycling industries in specific regions. This was the early 'Eco-Town' approach which took root in cities such as Kawasaki, Kitakyushu, Minamata and Naoshima. The Eco-Town or Eco-Industrial Park concept is a fundamental part of circular economies as these places are where primary and secondary markets intersect i.e. waste materials can feed back into the production of primary goods (remanufactured or reconditioned) or secondary goods (re-used as lower end materials such as road surfaces or plastic fillers).

Germany enacted its Waste Avoidance and Waste Management Act in 1986 to take into account waste avoidance through material recycling, energy recovery and waste disposal. Subsequently, the government later passed the Packaging Ordinance which was applied to all forms of packaging and made the take back of packaging waste mandatory for producers, thereby placing clear responsibility on those who manufacture and market products to relieve communities of the burden of disposal. This obligation on the part of business to take back waste became a driving force for avoiding waste in production processes in the first place and it constituted a strong mechanism in reinforcing the closed loop system of waste avoidance. In addition, the setting up of an independent nationally recognized organization, the Duales System Deutschland, responsible for the coordination of the recycling effort further demonstrated the commitment of business and government to work together to tackle this issue.

Other countries have applied similar versions of circular economies but the Japanese and German examples point to how circular economy models and eco-efficiency can be achieved through government working with business in collaborative partnership. But crucially, these cases show that a circular economy can only work if backed by robust and comprehensive legislation to enforce the take back of waste - or face the penalties of not doing so.

Fundamentally, the success of circular economies in Japan and Germany has relied on efficient supply chains to link up the different parties involved from producers to customers and identifying the intervention points for recycling companies. China's direction in this area and, particularly with its large labor force, could, too, potentially be based on a highly efficient supply chain dedicated to gathering post-use waste to feed back into the economic system. But as in all young industries, standards must be observed from the outset otherwise abuse will occur. The circular economy in China has been no exception.

3. The Challenges to China's Circular Economy

3.1 Lessons for Developing Economies

Shifting China's development into a circular economy is akin to adjusting the steering for a large ocean liner which has picked up momentum and is on an unstoppable course. It is extremely difficult for China, which has based its rapid economic development on exploitation of natural resources, to switch to a circular economy model in a short time despite the urgency of the situation and the remonstrations of the central authorities. Some of the problems identified, which serve as a lesson for other developing economies, include:

- The high expectations of the central government not matched by the knowledge and experience of local officials and citizens;
- A top-down planned economy approach;
- Lack of guidelines for planning to highlight how this approach differs from standard environmental protection planning;
- Inflexible solutions preventing company to company exchange; and
- Lack of integration with market-based solutions.

A recent World Bank report¹³ further highlighted the major causes of resource-use problems to be institutional and policy failures and recommended that the government improve the effectiveness of the circular economy by enhancing industry and community participation and clarifying the role of government. Put simply, this means that a solely government-driven circular economy without

¹³ "Developing a Circular Economy in China" (June 2009) The World Bank

cognassance of market forces and suitable governance of the participating parties has limited chance of success.

One attempt to address this issue has been the expansion of the eco-industrial parks (EIP) concept emulating the Japanese eco-town model. EIPs are a relatively new type of industrial organization for China designed along so-called 'industrial ecology' principles where businesses cooperate with each other and with the local community in an attempt to reduce waste and efficiently share resources (including materials, water, energy, infrastructure, and natural resources) with the intention of increasing economic gains and improving environmental quality¹⁴.

3.2 Eco-Industrial Parks

To promote the development of EIPs, the State Environmental Protection Administration of China constructed demonstration parks in 1999 and established a Standard for the Construction and Management of Eco-Industrial Parks in 2006. Currently, 24 national EIPs have been set up throughout the country. In terms of industry composition, most of the parks are primarily made up of manufacturing industries. Chemicals, coal, metals, electronics, composite materials, machinery, and bio-pharmaceutical industries are relatively common; a handful are related to agriculture, animal husbandry and tourism.

¹⁴ Fang, Y. "Eco-industrial parks in China", (2007) Chinese Academy of Sciences



Figure 3.1 EIPs in China (Source: State Environmental Protection Administration of China)

There are two types of EIPs: those that are converted from existing industrial parks and those that are newly built. The latter tend to be fewer in number due to the high capital costs of construction involved; conversion of an existing park into an eco-industrial park supported by enterprises and designated as a development zone, on the other hand, is more the norm. A development zone is a special location where a geographic area is selected to attract capital, technology or other external production elements with the aim of promoting economic development through new policies or reforms in this target area. In general, EIPs which are under government management have diversified types of industry and operate on a larger scale compared to parks under enterprise management which are relatively simple and concentrated.

Examples of the diversified industries within government-managed EIPs are:

- Nanhai - environmental protection, plastic, plate, and ceramic equipment manufacturing;

- Huangxing - electronics & information, new materials, bio-pharmacy, and environmental protection industries;
- Tianjin - electronics, communication, pharmaceuticals, machinery, food manufacturing, utilization of waste paper, coal ash and domestic waste, and electroplating industry;
- Suzhou - electronics & information, precision instruments, bio-pharmaceuticals and new materials.

Through this approach, these parks are able to take advantage of:

- Material integration - waste recycling and treatment centers, byproduct/waste exchanges
- Water integration - wastewater reduction , recovery of valuable material from wastewater, and central wastewater treatment
- Energy integration - central heating systems, energy cascading usage, energy saving technologies, and cleaner energy usage
- Information integration -web capability, management information systems, environmental management and technology services
- Harmony with the local environment - maintenance of local ecosystems, park landscape design, and green buildings

China's potential to create a circular economy is immense. Driven by the fact that its development is unsustainable in its current form, the central government has embraced the concept of the circular economy as one of the strategic measures for the nation's growth. Like Japan, China's internal manufacturing capacity – whether re-used into primary production or recycled into secondary production - is a key factor in providing the means with which to absorb the materials from spent products.

Hong Kong's Eco-Park

The setting up of an Eco-Park in Tuen Mun dedicated to the development of recycling technologies seemed to be an appropriate step for Hong Kong towards lending the right impetus to the industry to develop and exploit the different types of waste market opportunities¹⁵. The aim of EcoPark, similar to the China EIP models discussed earlier, was to promote the local recycling industry and jump-start a circular economy to provide a sustainable solution to the city's waste problems. By encouraging and promoting the recovery and re-use or recycling of waste resources and returning them into the consumption loop, the EcoPark's role was to help the local recycling industry and alleviate the heavy reliance on the export of recyclable materials recovered from Hong Kong into China. The notable difference between Hong Kong's Ecopark and China's EIPs is that the former is chiefly focused on recycling and does not have any primary or secondary manufacturing industries co-located there.

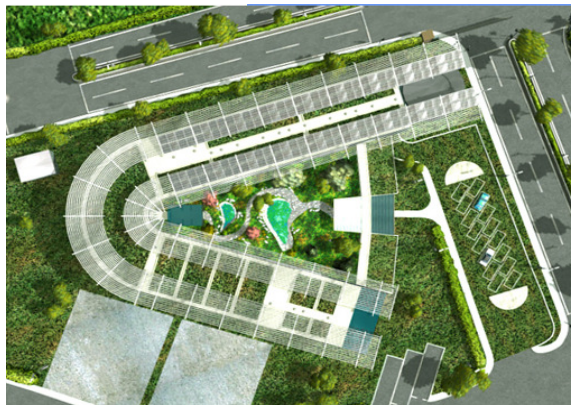


Figure 3.2 Hong Kong's Eco-Park

Occupying an area of 20 hectares, the EcoPark is being developed in two phases, the first commenced in 2006 to be followed by the second phase in 2009. Government funding was used to build the basic physical infrastructure of EcoPark so that the park could be divided into different sized lots for recovery of specific materials. Admission criteria for potential tenants, who had to go through a tendering process, gave priority to those with value-added technologies, and ability to target materials described under the government's proposed PRS i.e. electrical appliances, tyres, plastics, packaging and batteries.

However¹⁶, almost four years on, progress has not been forthcoming. Reasons cited by those in the industry and administrative circles include:

- Delays in making producer responsibility and waste charges mandatory;

¹⁵ <http://www.epd.gov.hk/epd/ecopark/>

¹⁶ "Benefits of recycling going to waste in untapped markets" Standard (October 6, 2005)

- Lack of demand for recycled products;
- Economic factors affecting decisions on whether to invest in the recycling industry;
- Responsiveness of consumer behavior to sort and separate waste not being as strong as hoped; and
- Finding the right balance to attract tenants to Eco-Park whilst at the same time controlling the lease conditions to prevent abuse of tenancy.

In Hong Kong's waste management policy framework, government legislation was proposed that included waste charging to favor the circular economy and in time, introducing new technologies such as incineration and composting to reduce Hong Kong's waste burden. In the meantime, low-end materials like paper, steel and plastics will continue as inputs into secondary markets in China.

But before an incinerator and other waste facilities are built, Hong Kong still faces the problems of growing waste quantities and diminishing landfill space. Hong Kong is further tasked with the challenge of dealing with high-end waste like used electrical appliances, white goods and electronic devices i.e. the so-called 'e-waste'. This is where the circular economy model needs to be revisited.



Figure 3.3 E-Waste, a major problem in Hong Kong

In a sense, Hong Kong's situation is unique. In spite of the clear messages promulgated in the waste policy framework, Hong Kong's market-led economy has stalled the recycling industry through the following economic attributes in the city's development policy:

- Land availability; and
- Fluctuations of the market.

The recycling industry has been affected by complicated land tenancy arrangements which have forced many companies in this industry to reject investment decisions on facilities that would be short-lived and lacking in a proper payback period to recoup the capital outlay.

3.3 Formula for a Successful Circular Economy

Taking Hong Kong's experience, the application of a circular economy was initially mentioned in the "Policy Framework for the Management of Municipal Solid Waste" in 2005¹⁷ charting out a strategy to address the problem of the city's waste. In the framework, the development of a circular economy suited to Hong Kong's needs was advocated to support a recycling industry through:

- Allocation of land resources;
- Encouraging further R&D in clean technologies for recycling industries;
- Improving the collection network for waste sorting and segregation;
- Organizing public education programs to encourage consumers to consider re-use and recycle options as well as reducing waste; and
- Fostering green procurement policies to increase demand for recycled goods.

Based on the experience from overseas though, circular economies only work if supported by strong enforceable legislation. The framework thus further proposed the introduction of waste charges, producer responsibility and a ban on certain wastes entering the landfill.

With these avowed intentions, Hong Kong's path towards adopting a circular economy was regarded by many to yield potential if successfully implemented.

Producer Responsibility Schemes

Take-back policies, often termed as "producer responsibility schemes" (PRS), it should be noted, must be implemented with due sensitivity to the products selected. Commercially sold products tend to differ in size, composition, shape etc. according to marketing or consumer preference. A sole recycler therefore has to deal with a range of materials (e.g. plastic-metal composites, equipment of different configurations) and has thus to invest in different types of recycling facilities to cover the whole range. This is clearly

¹⁷ "A Policy Framework for the Management of Municipal Solid Waste (2005-2014)", Environmental Protection Department, HKSAR Government

uneconomic for the recycler so some returned products may not enter the remanufacturing or reconditioning processes if the product is not from the original or a compatible manufacturer. These are instead disassembled to feed into secondary lower-end products or, if the materials are not homogenous enough, ignored altogether. PRS hence has to be introduced with product design in mind, where products are designed to be re-used or recycled back into the primary and secondary streams respectively. This concept is known as design for environment (DfE) and is followed by some companies with certain high-value products e.g. photocopiers. DfE and PRS will be discussed further in later sections.

Pricing is key to a successful circular economy. The pricing of recycled materials in the market though has been erratic whereby it is more economic to use virgin materials rather than secondary recycled materials. Ironically global supply chains that would have been the biggest ally of the circular economy principle work against recycling as it is more efficient to ship products halfway across the world than it is to set up a home-grown remanufacturing or recycling production centre.

This eschewing of external costs by producers (e.g. the costs to repair environmental damage caused by the production and transport of goods) means that Hong Kong has become a repository for other countries' product and packaging waste. Hong Kong's attempt at stimulating a circular economy clearly cannot work on its own as Hong Kong no longer has an internal manufacturing industry that can absorb these materials. This is where China's primary and secondary manufacturing processes in the neighboring Pearl River Delta can fulfill a burgeoning need.

4. A Model for a Circular Economy for China

4.1 A Joined-up Economy

A modern China cannot afford to remain isolated. Global supply chains are making an impact on the economy by introducing external product wastes which do not always fall within the re-usable or recyclable domain of the established manufacturing primary and secondary industries. The challenge is how to accommodate these 'resources' from the rest of the world by widening the boundaries of the existing circular economy. This is where Hong Kong's role could possibly fit into the jigsaw.

Expanding Hong Kong's role in the PRD may offer more scope for a successful circular economy where the region's recycling networks can be utilized and there are buoyant primary and secondary manufacturing sectors to absorb materials from Hong Kong. Hong Kong's economy has been inextricably linked to that of the PRD region since the 1980s so it is a logical progression to extend this interest towards a circular economy. Hong Kong already makes use of the PRD's resources of labor and space for re-use and recycling but the full potential of this has not been fully realized.



Figure 4.1 The Pearl River Delta Cities (Source: Invest HK)

Hong Kong has many factors in common with the PRD such as language, culture and trading partnerships. In addition, Hong Kong and the region are linked by well-run supply chains that ensure efficient delivery of goods and services as needed. There is the added advantage of diversity in the types of manufacturing activities taking place across the PRD which each require specific skills and technologies. These are being developed in certain cities to suit the needs of an industry or business located there and these cities have the potential to leverage off each others' activities given the right facilitation.

Hong Kong, as a member city of the region, thus has the opportunity to seek out cities which have complementary activities to itself. To foster this approach of inter-city sharing, the Greater Pearl River Delta Council¹⁸ was set up under the Hong Kong/Guangdong Cooperation Joint Conference to enable closer regional economic cooperation (see below).

The Greater Pearl River Delta Council

Established in March 2004, the GPRDBC is a non-governmental organization under the Hong Kong/Guangdong Co-operation Joint Conference engaged mainly in collating the views of the business, professional and various sectors and making recommendations to the Governments of both places. The ad hoc group consists of 25 members and is chaired by GPRDBC's chairman Dr Victor Fung. Mr. Tung Chee-chen and Ms. Marjorie Yang Mun-tak are the convenors of the Sub-group on Industries and Mr. Cheng Yiu-tong is the convenor of the Sub-group on Livelihood Matters.

The Council provides:

- Advice on the policies and implementation strategies needed to enhance the economic and other cooperation between Hong Kong and Guangdong which in turn will facilitate more value-added operations and sustainable development on both sides of the boundary;
- A forum for the private sectors in Hong Kong and Guangdong to exchange views with one another on how to further promote two-way trade and investments;

¹⁸ <http://www.info.gov.hk/info/gprd/>

- A platform for collecting opinions of Hong Kong business and professional sectors on issues relating to Hong Kong Guangdong cooperation and channel them to both governments;
- In collaboration with the Central Policy Unit, strategic research into the future economic development of the GPRD region; and
- A means of establishing closer ties with provincial and municipal institutions in Guangdong.

So far, the Council has published three annual reports and various study reports on how to cooperate with the GPRD in economic aspects. The most recent report was published in September 2009 and it was in response to the Outline of the Plan for the Reform and Development of the Pearl River Delta (2008-2020).

The Sustainable Development Sub-group of the Council was tasked with the role of achieving sustainable development in the PRD by working with Hong Kong's major chambers of commerce as well as the relevant Guangdong organizations. It is timely that this body seems to be a valuable facilitator for a circular economy in the PRD.

The linking therefore of cities with primary and secondary manufacturing industries in the PRD with recovered materials from Hong Kong is an effective way of closing the circular economy. Hong Kong by itself does not possess the capacity to absorb materials which otherwise end up as waste. By providing industries in the PRD with these materials, these manufacturers can incorporate them back into primary or secondary products for sale back into the PRD or into Hong Kong. The role of recyclers to collect and ship waste and ship back goods is crucial for this to work.

EIPs in the PRD

Guangzhou Economic and Technological Development Zone¹⁹

The Guangzhou Economic and Technological Development Zone has been identified as one of the key industrial parks under the circular economy policy. In cooperation with the city of Zhanjiang, the park has

¹⁹ <http://www.getdd.gov.cn/web/index.html>

a planned area of 100m² with over 100 industrial projects. There are around 30 recycling companies located here with three waste water treatment plants in the zone with total design capacity of 17.8 tonnes /day. There are some issues to be addressed namely misalignment of the material chains among the companies in the zone, the cost of new raw materials is lower than the recycled materials, lack of communication among the companies in the zone and the number and the scale of recycling companies in the zone are small.

Dongguan Eco-Park²⁰

With a planned area of 32 km², Dongguan Eco-Park is located in the north eastern of Dongguan city, near Huizhou city. As well as traditional industries (such as mechanical mold, packing & printing industries), the Eco-Park is focused on the industrial supply chains, the creativity industry and opportunity-oriented industries (such as the robotic industry). The park aims to promote service industries such as inspection, maintenance and technical consultation and build itself an incubating base for the industries.

Eastern Industrial Parks

The Eastern Industrial Parks are located at the junction between the four towns of Changping, Qishi, Qiaotou and Hengli, with a planned total area of 74.43 km², of which 37.42 km² are the park premises. Great emphasis has been attached to ecosystem and sustainable development in the general planning. Adjustment of the industrial structure will be launched to promote the development of the neighboring towns of Qiaotou, Qishi and Hengli, which, in turn, will create a manufacturing center and growth hub in the eastern part of Dongguan.

Others include Zhongshan Torch Hi-tech Industry Development Zone, Zhaoqing Metal Resources Recycling Base, and Foshan Nanhai National Demonstration Eco-Industrial Park.

4.2 A Model for Performance

Hong Kong's circular economy cannot succeed in isolation. It is clear that it must link up with the PRD regional network to close the loop.

A model circular economy would comprise:

²⁰ <http://www.dgep.gov.cn>

| | |
|---|--|
| <ul style="list-style-type: none"> • Entry – only goods that have re-usable or recyclable components are allowed into the region i.e. DfE products. • Mid-stream – wastes are sorted so that reusable or recyclable materials are extracted. • Value-added processing – the sorted waste is processed in facilities in the PRD and/or Hong Kong (maybe a few times back and forth across the boundary) to become useful. • Eco-efficiency – at each stage efficiency gains are made in water and energy as well as avoidance of secondary pollution through stringent environmental controls. • Manufacturing – the materials (which were originally waste) now become valuable resources to be fed into primary or secondary manufacturing workstreams to produce remanufactured/reconditioned goods or secondary materials respectively. • Market re-entry – stimulating a demand for remanufactured/reconditioned goods and recycled materials either in Hong Kong or in other parts of the PRD. | <div>Entry</div> <div>Mid-Stream</div> <div>Value-Added Processing</div> <div>Eco-Efficiency</div> <div>Manufacturing</div> <div>Market Re-Entry</div> |
|---|--|

However such a model can only work if the following conditions are satisfied:

- Efficient trans-boundary supply chains moving waste from Hong Kong into the PRD and shipping back remanufactured/reconditioned or recycled products;
- Recycling companies and processes that are organized and coordinated to match the types of wastes shipped out and the recycled goods shipped back in;
- Support from businesses in the form of compliance with PRS to ensure take back of used products;
- DfE that enables products to be recovered and re-used or recycled into primary and secondary processes respectively;

- Demand for remanufactured/reconditioned or recycled goods over virgin goods through the right incentives or penalties for consumers; and
- Attractive locations conducive to the recycling business where investments and paybacks can be realized over reasonable time periods and profit margins will be sustainable.

4.3 Trans-Boundary Supply Chains

Hong Kong runs several efficient supply chains transporting goods back and forth into the mainland. Sophisticated logistics systems drive this business. Waste hauling however does not enjoy such attention as transporting waste into China is commercially unattractive. Even within the PRD, hauling waste between cities is not widely carried out. However, with the right incentives to make this activity profitable, there is no reason why these supply chains cannot be adapted for the circular economy.

4.4 Recycling Processes

Currently, much of the recycled materials are of low value such as paper and plastics, with the exception of metals which command some premium. On the whole, the value of recycled materials is quite low.

The recycling of electronic appliances as part of e-waste however offers opportunities particularly if the shell components can be re-used instead of being dissembled. This would mean that equipment such as computers should be designed according to DfE principles so that key components can be reused intact rather than being broken down after use. The EcoPark concept hence should be used to develop R&D initiatives for remanufacturing and reconditioning as well as recycling.

4.5 Producer Responsibility

As each product has economic, social and environmental impacts at different stages of its lifecycle, producers and the users of products should be held responsible for the products they produce and consume respectively. A well-designed PRS should steer producers towards designing products that

result in less waste, or that can be reused or recycled. An extended PRS pushes the concept further to a shared responsibility for all the impacts of a product over its lifecycle among consumers, the industries and the distributors that are involved in that product so that not only the commercial and the industrial sectors rethink the way they approach a product from design to disposal, but also consumers can make better decisions on purchasing, reuse and recycling of products.



Figure 4.2 Playing a Role in the Circular Economy

A PRS thus plays a key role in sustaining a dynamic local recycling industry. By establishing a long-term, stable and local source stream of reusable products and recyclable materials through PRS, it is possible to develop and sustain local recycling industries that put the circular economy concept in practice. As in most countries that have successfully adopted a circular economy, PRS should be mandatory otherwise producers and consumers will have limited interest despite its obvious environmental benefits.

As stated earlier, putting in a PRS without consideration of the products targeted has risks, as commercial products often do not lend themselves to standardized designs or are made of homogenous materials. Without these two factors, the economies of scale are missing to make a remanufacturing/reconditioning or recycling business viable. PRS must work therefore hand in hand with DfE and producers must coordinate their products so that ultimately components and materials can be recovered and re-used or recycled at profitable and sustainable levels.

4.6 Demand for Recycled Goods

The demand for remanufactured goods or recycled materials over virgin products can only be achieved by incentives (offering attractive and competitive prices) and disincentives (such as waste charges). Incentives should not be subsidies as these are not sustainable in the long run; separately, setting charges for waste as a disincentive must be high enough to discourage consumers from wasteful habits demonstrating that that recycling is more economic than disposal. These measures should be supported by a program of public education designed to allow people to make informed choices on buying such goods. This will help both the primary and the secondary manufacturing industries in the PRD who would be prepared to invest in setting up or expanding businesses provided they know that demand for their goods is assured.

In keeping with this line of thinking, producers who practice DfE should also be preferentially favored by being allowed to use green labels on their products to show to consumers that the latter are sustainable and in doing so thereby gain an advantage over other producers offering one-trip non-re-usable or non-recyclable goods.



Figure 4.3 A Green Label for a Circular Economy?

A further activity that could be considered is the widespread leasing of equipment so that users, through renting equipment (like flatscreen televisions, computers, printers etc.) can enjoy the benefit of receiving upgraded products periodically and the used versions can be returned to the manufacturers for reconditioning. This would involve the combination of private enterprise endeavor coupled with support from public policy mechanisms.

4.7 Attractive Locations

Setting up a complementary site or sites in the PRD to Hong Kong's EcoPark would be logical and clear.

There are two main options:

- Option 1 – developing links with a series of ecoparks in PRD cities to identify specific types of waste to exchange
- Option 2 – setting up a bilateral exchange with nearby Shenzhen, a prospering city that is already running into waste problems of its own

(a) Option 1



Figure 4.2 Option 1 of the Circular Economy for the PRD

For option 1, the circular economy would depend on efficient supply chains able to move the right type of waste from Hong Kong to the relevant primary or secondary facility in a PRD city in a timely manner and

returning the processed goods. There is no reason why the recycled material should not pass across the boundary a few times to be processed at different stages much like China's processing trade approach. Processing trade refers to a preferential export mode whereby all or part of the raw and auxiliary materials, parts and components, accessories and packaging materials needed for production are imported in bond and the finished products after processing or assembly by enterprises on the mainland are re-exported²¹. In this case the imported materials are waste materials which eventually become a resource for remanufactured goods or recycled materials.

(b) Option 2



Figure 4.3 Option 2 of the Circular Economy for the PRD

For option 2, the advantage of a bilateral arrangement with Shenzhen would be the proximity with Hong Kong cutting the logistics problems in responding quickly and accordingly when certain materials are in demand. Shenzhen was one of the first cities which passed regulations on circular economy in 2006. Currently the government is focusing on ten Industries: electronic communication, energy, architecture, biotechnology and pharmaceutical, fine chemicals, textile dyeing and printing, electroplating, transportation, logistics and catering. As there are several recycling facilities in Shenzhen, the approach is to link up Hong Kong's EcoPark with them. The setting up of a transfer centre on the Hong Kong-mainland boundary should be considered. This centre would serve not just as a logistics facility in holding materials and goods until needed but would also be strategically located to avoid complicated trade constraints.

²¹ "Implications of Mainland Processing Trade Policy on Hong Kong" (2007) Greater Pearl River Delta Council and HK Trade Development Council

If either option were successful – there is the possibility that Hong Kong could use a hybrid of the two options – then there would be no reason why the government should not set import regulations on the types of goods accepted into Hong Kong and only picking ones that suited its circular economy.

Particular items would be:

- Electrical appliances that can be disassembled and reassembled for re-use according to DfE principles. If this is not possible then the composition materials should be able to be safely stripped for recycling with no damage to the environment.
- Food substances that can be converted to organic waste for use as compost in farmed areas in the PRD to encourage local food production.
- Packaging such as glass, plastics and paper that can be recycled. In some cases, it would be recommended to turn away products that have excessive packaging which does not fulfill any hygiene or safety function.
- Building materials that can be re-used such as wood and composites.
- Used clothing and textiles.

In each of these cases, it is imperative that the economics are favorable according to scale and ease of processing, whether it is back into primary remanufacturing or channeled into secondary products.

4.8 Discussion of Options

For Hong Kong's circular economy to work, the city needs the right partner. Going alone is not the answer.

If pursuing Option 1, the question arises as to which cities should Hong Kong work with? Would the supply networks be robust enough with the chosen partners? Would the demand and supply be adequate if spread so widely. Obviously the advantages for Hong Kong would be the diversity and choice of materials to be recycled available across a broad spread of primary and secondary manufacturing facilities located in cities within the region.

With a bilateral focus such as pairing with Shenzhen in Option 2, the advantages are:

- The proximity of the two cities leveraging the established business relationships;
- Eco-parks in Shenzhen already exist that can be coupled with Hong Kong's EcoPark;
- Potential for setting up a transfer centre on the Hong Kong-mainland boundary where it would serve as the hub for shipment and receipt of recycled goods between Hong Kong and Shenzhen; and
- This hub would be in a control zone that could be free of jurisdictional constraints to allow free flow of trade.

On balance, Option 2 could be slightly more attractive from the viewpoint of set up costs but Option 1 offers greater choice and flexibility. As mentioned earlier, the final proposal could be a hybrid of the two options in the end. What is apparent is that for Hong Kong's circular economy to work, a system could be set up but this must be linked to strong legislation driving the need to re-use or recycle together with a shift in consumer mindset to consume less and continue to use what we have instead of following the current disposal routes.



Figure 4.5 Workers seeking employment in PRD

Further benefits to consider would be the creation of much-needed jobs for China's population many of whom are vulnerable to the effects of global downturns and economic crises. The shocks of the last financial meltdown have reinforced the fear of unemployment in the minds of many. Setting up a circular economy that has supply and demand models that match and are consistent will help remove some of this uncertainty. Furthermore, it is important that with the oversight of government, the situation of damaging recycling practices which emit secondary pollution will no longer reoccur and that the jobs that emerge are clean, safe and reputable.

5. Chamber's Recommendations

The Chamber offers the following recommendations:

- Hong Kong must work with the complementary primary and secondary manufacturing industries in the PRD to create the closed loop for a circular economy. Further research needs to be done on which cities house these industries and how the logistics of moving resources between Hong Kong and these places will work.
- These clusters of activity should work closely together in the sharing of knowledge, technologies and skills.
- Hong Kong's EcoPark must play a key role in this circular economy in attracting the right companies dealing with the materials of interest. Hong Kong's focus should be the mid-stream value-added processes but working closely with PRD counterparts so that resources (such as land and labor) and skills are aligned.
- Hong Kong's EcoPark should serve as a platform where overseas technologies (including remanufacturing and reconditioning) could be applied and validated for use in the region; further opportunities could lie in the re-use of energy and water resources in developing eco-efficient utility services for manufacturers that support the circular economy.
- Legislation must be passed in regard to PRS and waste charging in Hong Kong and elsewhere to drive the initiative towards more re-use and recycling. Additional legislation should be considered in the future to favor the import of goods into Hong Kong that are suitable for recycling once used. This should cover packaging materials as well.
- Producers that practice DfE should be favored. Even amongst such producers, convergence of DfE should be encouraged e.g. standardization of designs and homogeneity of materials used, so

that the recyclers face less challenges in achieving the right scale to be profitable and sustainable.

- Regional supply chain businesses should be encouraged to consider the opportunities arising from setting up supply chains for the circular economy using existing systems and logistics.
- A market should be promoted to persuade consumers of the merits of using remanufactured/reconditioned products and recycled materials in Hong Kong and elsewhere. Green labeling should be introduced to distinguish such goods. For commercial practices, green procurement should be made mandatory.
- Setting up leasing and rental arrangements for appliances and equipment should be considered in Hong Kong and elsewhere so that producers can close the loop on the recovery of intact products for reconditioning when providing upgrades to rental customers.
- Capital and land to develop the circular economy must be set aside in Hong Kong and the PRD to host the facilities needed to carry out the processing, storage and shipment of materials around the region. If pursuing Option 2, the bilateral exchange with Shenzhen, the setting aside of land in the boundary area for a logistics centre should be considered to negate trade restrictions.
- Clear lines of governance controlling the different parties involved in the cross-boundary processes are called for – this is where Hong Kong’s well-established legal systems can be most effective.
- Lastly, for the circular economy to work, leadership and vision is called for. The Chamber extends this proposal to set up Hong Kong’s circular economy not just to its member companies but also to the Greater Pearl River Delta Council, a cross-boundary organization, to establish leadership lines to drive the circular economy model in the PRD. Political will is clearly needed to set up this bold enterprise as well as an astute awareness of the social and economic

implications. Harnessing the resources of Hong Kong and the PRD in this strategic manner is surely the way forward.