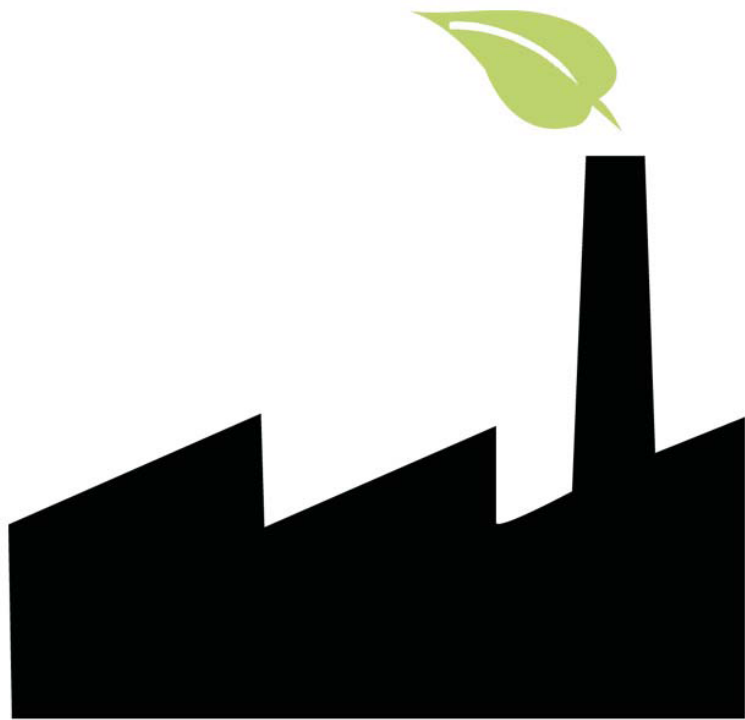


# 2012

## EVDS 683.21 Sustainable Design: Assignment 3: Manchester District Design Concept, Driving Industrial Evolution



MANCHESTER

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**1. Executive Summary: in one page provide summarize the document (1 page)**



## 2. Current Context: What are the current standards and modes of delivery (1 page)

### Calgary Industrial Activities

Industry: “economic activity concerned with the processing of raw materials and manufacture of goods in factories: (Oxford Dictionary 2012)”

In practice, the word Industry is often used to classify wide economic sectors into groups to allow their analysis and comparison. The Calgary Economic Development Office classifies industrial activities into 19 sectors in which public, financial, agricultural and other service oriented activities are included.

For the purpose of this section we will include two main industrial sectors of the 19 defined by Calgary Economic Development for their relevance to our definition of industry: 1) manufacturing: which is considered the main industrial activity and 2) Transportation & Logistics: which plays an essential role on supply and distribution chain management for manufacturers.

In the Calgary Economic Region the Manufacturing and Transportation & Logistics sectors play an important role, representing a 12.9 % of its GDP, providing 12.1 % employment and enclosing 6.7% of all business establishments, impacting on other economic sectors by offering required products and services and by demanding materials and services.

#### *Manufacturing*

“Calgary's manufacturing industry drives the demands for goods and services from other sectors of the provincial economy.” **(Calgary Economic Development 2010)**

#### *Transportation & Logistics*

“Providing a variety of integrated logistics solutions, Calgary is the North American hub for the Pacific Northwest by road, rail and air and is able to move products and people in a manner unparalleled elsewhere in region.” **(Calgary Economic Development 2010)** \*The transportation and logistics sector is focused in industrial requirements and does not include public transportation such as Calgary Transit.

### Industrial Productivity

GDP growth, employment opportunities and growing population are key drivers of industrial development and in Calgary’s context the existence of these three factors are considered important opportunities for the industrial and manufacture sectors. However, there are also existing challenges that have to be addressed by corporations in the quest of being competitive, such as rising costs and labor shortages in the market. According to Calgary Economic Development, productivity improvements can be directly linked to sustainable economic growth and business retention and is one of the main ways to take advantage of existing opportunities while overcoming the challenges.



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According with Calgary’s manufacturing sector, there are four key factors that allow them to increase productivity.

- awareness
- company culture
- research and investment
- training and labour

### 3. Manchester’s Industrial Scales: how much, how many, how big, how tall? 3-4 pages

#### Economic Scale

Having in mind an expected population of **75,000 people** in Manchester District and our goals to maintain an equal distribution of overall city indicators (Considering Calgary’s population of **1,365,200** and the gross numbers for GDP and employment by sector provided by Calgary Economic Development, the manufacturing and logistics sectors should generate around **\$505 million CAD** in GDP and **5,000 jobs**. (Calgary Economic Development 2011)

According to general assumptions for the project, land use and population will be distributed in 5 different Sub-District areas according to the following chart:

**Table 2.1: Sub-district population and land use mix**

Sub-District	Population	Land –Use Mix %		
		Residential	Retail/Commercial	Industrial
NE	5000	30	20	50
NW	30000	60	30	10
SW	30000	60	30	10
SE	5000	30	20	50
Central	5000	20	20	60

The most densely assigned area for industrial activities in the Manchester District contemplates the three Eastern Sub Districts, which have higher connectivity to transportation and logistics infrastructure such as Blackfoot Trail and access to Railroad Spurs. The core of industrial activities will be located at the Central Sub-District and will be the most densely industrialized area. Having in mind this Sub-District’s higher connectivity to the city and region as well as the Southeastern and Northeastern sub-districts it could play an important role in the coordination of industrial activities when contemplating the District as a whole.



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The layout of building structures will be dependent on the relationships and linkages amongst existing and entering firms to operate in the district. Increased industrial densification and building enhancement to elevate industrial land use building ratio will be promoted aiming to increase by at least **30%** the productivity of industrial land in the district.

While industrial buildings are generally one story high with high ceilings and large spaces, new technologies, productivity and competitive advantages, and the increased land value expected on the district derived from its re-development, could have an impact on rising factory layouts to two or more floors depending on the industrial activity or manufacturing process being carried in each facility.

### Production Capacity and District's Needs

Manchester District's industrial activities should be able to provide sufficient production to satisfy its internal demands in terms of its population consumption, retail, and service activities. In this matter, Manchester's industrial sector ought to have an understanding of its main needs and demands and promote industrial activities that can be consumed locally.

Trade activities, material and product exchanges with other districts, cities or regions around the world will also be included into this equation, as outside connections and integration with outside actors is recognized; however, in order to complement existing production the district will encourage a positive trade balance, where the added value of the district's sustainability principles incorporated to its products, technologies and expertise will play an important role.

By incorporating "cradle to cradle" product design and the consideration of materials and products as "technical nutrients" and the effect these principles could have on the district's industrial sector to easily re-incorporate materials and products after their intended life cycle into other production processes, could also help to increase the industrial capacity to comply with the district's needs.

### Industry Typologies

Industrial activity in the Manchester District will be a key economy driver and an important part of its cultural landscape by representing up to 60% of the land use mix in the central sub-district. In this sense, the design and planning of industrial activity will be taken into consideration as a part of a broader and integrated community.

On the other hand, the incorporation of industrial ecology principles will place Manchester District in the cutting edge of industrial practices, promoting its identity as a leader in the world's trends towards sustainable development and setting references for future developments in the City of Calgary and in other urban settings and regions around the world ([View section XX Industrial Ecology](#)).

### Open Source Industries

[Open source information and sharing](#)



## Anchor Industries

Anchor industries will be Manchester's most representative industries and will play an important role as ambassadors of the district's sustainability principles and practices. Anchors will be selected regarding their relevance, influence and process connectivity with other industries and actors of the community and could be integrated by light or heavy industries, art craft co-operatives or logistic management firms. Anchors industries will also serve as drivers for incorporating industrial ecology principles and practices by consuming or providing other industries by-products as part of their added value chains. (see Section XXXX)

## Complementary Industries

Complementary industries serve as harmonizers of the industrial ecology system. They generally consume or produce by-products in smaller smaller amounts than anchors' and have less influence and relevance in the development of Manchester's industrial activity.

## Heavy Industry

Heavy industry is characterized by high capital and lower labor oriented operations. High industry products are less likely to target end consumers and are generally have less acceptance to be nearby residential and commercial areas. Their operations normally require larger spaces and have bigger ecological footprint, however, by incorporating sustainable design practices, they can significantly reduce their negative effects and be incorporated into urban and mixed land use. For their size and material consumption they make good prospects for becoming anchor industries.

## Light Industry

Light industry is characterized by high labor-intensive and low capital operations with a focus towards end consumers rather than other businesses. Light industries tend to have lower environmental footprints than heavy industries and are normally more suitable to place near residential and commercial zoning.

Having in mind the land use mix of the district's vision, incorporating mixed use zoning and multifunctional spaces, this industry will be the most suited for development. In addition, and considering the objective of focusing the industrial sector of the district on provide as much of its internal needs by locally district manufactured products, light industries can help to provide

## Art and craft

The incorporation of art and craft industries and supply chains will provide an opportunity for local businesses creation and entrepreneurship at a personal level. The manufacture and sales of art crafted can serve as self employment opportunities and provide enhance the creation of an organic local cultural identity.

## Logistics and distribution



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Logistics and distribution industries play a key role to the functional capabilities of other industries by providing them with specialized management and material flow optimization. A good implementation of supply chain or distribution chain management strategies can be the difference between the success and failure of industrial activities.

### Centralized logistic network

The district will incorporate a specialized and centralized material flow management structure as one of its core industrial designs. Centralized logistics can provide many benefits such as cost reductions, reduced times and automated inventory management in material and product flows. The logistics structure will incorporate a centralized logistic center which will be administered by a coordination agent and will enhance connectivity amongst firms in the district and outside actors while providing customized logistics services and solutions that best apply to different industrial activities. Sub district distribution stations will serve as support for the distribution network and will allow accessibility for industries with high material or product inputs and outputs localized further away from the main distribution center. (See section XXXX)

### Multimodal Logistic Operations

In the logistics' industry definition, multimodal logistics involve more than one mode of transportation in the transportation of a product by the same logistic operator. In this sense, and considering that industrial logistic operations in Manchester District will be managed by a centralized organization, multimodal logistics will be an important component of distributions systems. In this context, different depending on their characteristics, raw materials, by-products and semi processed or finished products can have different optimization possibilities regarding handling and logistics management, in that sense the main material and product management methods that will be incorporated into the logistics center operations are briefly explored.

### Fixed Infrastructure

The installation of industrial bands, pipelines and stationary tanks as fixed infrastructure will be considered for industries requiring the movement of bulk materials. These connections will be made available from the main logistics center or sub distribution stations to specific industrial firms or between directly between firms, the construction and operation of these types of fixed infrastructure will be analyzed on a strategic level and will have to be operated or monitored by the central logistics management structure.

### Specialized Equipment

Lifts, cranes and other specialized equipment will form part of the multimodal logistic operations and will be allocated inside the main logistics center, sub distribution stations and individual firm facilities as required. Individual firms will be able to manage their own specialized equipment. The logistics management structure will be able to provide with training, technical assistance or trained personal under agreement with central logistics management.



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### **Rail transportation**

Heavy rail and streetcars will constitute the main basis for heavy material flows inside the district. The heavy rail operations will be managed by the rail company and will only deliver materials to the logistics center for mode exchange or directly into industrial facilities with existing spurs. Streetcar logistics will be based on the logistics center and managed in coordination with the **streetcar transit system management**, delivering materials through the sub district stations or through specialized streetcar rail spurs going into particular industries.

### **Road motorized vehicles**

Large trucks and tank trucks only access to the district will be through a connection from Blackfoot Trail to the logistics center to perform unloading or transferring operations. Solid carrying trucks will be able to unload into bands or assisted by lifts to unload into the streetcar network, smaller vehicles or warehousing facilities. Tank trucks will be able to transfer their product into pipelines, stationary tanks or smaller truck tanks which will later do the final delivery. Small trucks will have limited access to industrial facilities through the district and final deliveries will be provided by the streetcar system, vans, carts, small scale tows or human powered vehicles.

### **Human powered vehicles**

Carts, tows, bicycles and other human powered tools and vehicles will be included into the equation of industrial transportation and logistics. assist on small scale logistics operations and final deliveries. Small product art craft industries or small local retail stores could be the most frequent users of this service.

### **Product typologies**

For the purposes of industrial production in Manchester, products will be classified according to their usability or recyclability after their intended life cycle.

### **Cradle to grave**

Cradle to grave are those products in which where designed with not much consideration to any further use after their intended life cycle. These products are normally “thrown away” or disposed into a land fill and the process for recovering them for recycling or further usage is often complicated and degrades the materials from which they are made, diminishing their quality as technical nutrients.

### **Cradle to cradle design**

Products designed in a cradle to cradle approach are normally designed considering the possibility of further processing after their intended cycle. They are normally constructed with easily separable parts or materials which can be integrated into productive processes maintaining the quality of the materials as technical nutrients.





## Multi Functional Industrial Spaces and Land Use Mix

The districts' industries will consider the entire district as a multifunctional and integrated entity, recognizing that a wide variety of activities are taking place in their surroundings and promoting a healthy community integration and urban environment.

Some types of industrial activities such as art crafting or light industrial processes may be viable to healthy coexist within mixed land uses, providing more accessible jobs to population and closer access to the market. Some types of heavy industry might also integrate offices and retail showrooms, incorporating them into a more multi functional approach.

## Industrial Connectivity

At the district scale, industries will be connected with outside actors through the district's logistics center, which will be connected to heavy rail and truck transportation national networks to have access to regional, national and international markets, including other industrial complexes and retail activities.

Inside the district, industries will be connected to each other at different scales; industrial firms with more inter related processes will be set closer together at the block scale, while inter related industrial sectors might be set in different sub districts and connected through the logistics center and sub distribution stations.

## 4. Alternative technologies or configurations for delivery of your component 4 pages

### Industrial Ecology

Systems that utilize the emission and waste flows of industry and consumption (**Roberts 2004 Application of Eco-Industrial Principles**) with the goal mimicking natural ecosystems by transforming the waste of one firm into valuable inputs of others. (**Desrochers 2002 The application of industrial ecology principles**).

In other words, industrial ecology introduces the possibility to learn from natural ecosystems to design and engineer industrial systems to reduce the ecological impact of human activity to levels natural systems can sustain. In ecological systems the flow of materials is cyclic, the wastes are recycled and energy is cascading. [http://www.medmeid.eu/wp-content/uploads/2011/04/ECO-INDUSTRIAL-PARKS\\_Rantasalmi.pdf](http://www.medmeid.eu/wp-content/uploads/2011/04/ECO-INDUSTRIAL-PARKS_Rantasalmi.pdf)

The principles of industrial ecology are similar to taking a “cradle to cradle” approach which incorporates design principles into all parts of the life cycle of products and processes with the objective of maintaining the quality of products and materials to take advantage of them in further processing at the end of their expected life cycle, considering them “technical nutrients” inside wider and complex industrial systems.



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The history of resource recovery indicates that the goal of cheap production drove much of it. (Desrochers 2001). We can assume that Calgary's Industrial Sector efforts on material reductions have been driven by normal industrial operations and practices on cost and efficiency effort, such practices normally incorporate principles of material reduction and tend to try to minimize waste and if possible sell their by-products as an extra source of income. These strategies, even though mainly profit driven, they have contributed to promote in some degree less harmful environmental practices, establishing improvements towards the setting the basis for the application of industrial ecology and a more sustainable industrial sector.

### Rationale

Applying the industrial ecology concept into Manchester District Industries is consistent towards achieving some of the district's objectives such as promoting a healthy environment and achieving zero waste generation.

### Challenges

Multi company integration and cooperation is often difficult in capitalized economies, as the objective of maintaining competitive advantages drive firm management structures regularly in a firm only oriented way and sometimes include confidential information or other closure policies. Furthermore, industrial processes frequently use harmful or toxic materials which are difficult to re-use or incorporate into further processing. The shift to more sustainable materials and a more cradle to cradle design orientation involves an important change in paradigms which will most likely encounter resistance to change and will take time to implement.

### Financial opportunities

Industrial and corporate responsibility trends and the leadership of large companies on corporate sustainability, driven, in some degree by marketing strategies and the generation of "goodwill" towards their firms promote investment towards environmental initiatives. These represent an opportunity for advertising the districts principles of industrial ecology and attract investment of firms with shared interests and sustainability values.

### Eco Industrial Parks

Eco Industrial Parks or EIPs are communities of companies, in specific geographic locations, that exchange and make use of each other's byproducts or energy. Currently, EIPs are being promoted as a way of encouraging sustainable development. Proponents argue that such a symbiotic community of businesses produces more environmental benefits than each company can realize on its own. Numerous EIPs have been planned in North and South America, Southeast Asia, Europe and Southern Africa. (Desrochers 2002)

By integrating principles of industrial ecology with principles of pollution prevention and sustainable design, such regionally localized firms should provide one or more of the following benefits over traditional, non linked operations:



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- Reduction in the use of virgin materials;
- Reduction in pollution;
- Increased energy efficiency;
- Reduction in the volume of waste products requiring disposal;
- Increase in the amount and types of process outputs that have market value (Gertler 1995).

An eco-industrial park should provide support and promote improvement in environmental performance of individual companies and the park as a whole.

### Rationale

By developing an EIP configuration of the industrial sector in the district, industrial ecology practices will be more easily promoted and administered. Multi firm integration and cooperation under a broader management structure will enhance communication and teamwork towards the accomplishment of shared goals.

### Challenges

The creation of an industrial park can face challenges related with accessibility, logistic management and infrastructure as well as management and structural coordination amongst participating actors. On the other hand, the close proximity of residential and commercial activities could create some resistance on the idea of having a large scale industrial sector nearby.

### Financial opportunities

Eco Industrial Parks can attract investment by providing an overarching framework of industrial operations, which provides certainty, a shared management structure and required infrastructure while acting as a development strategy that may be consistent with corporate visions and objecting towards becoming more sustainable.

### Principles for Designing new Eco Industrial Parks

New eco-industrial parks can be constructed around already existing operations or built from scratch. Cooperation that develops over time is needed to implement and keep eco-industrial parks running. Therefore an evolutionary approach should be adopted. It can be useful to start constructing eco-industrial parks around already existing materials and by-products exchanges.

In this stream-based approach linkages are made based on the flow of specific physical resources. In the business-based approach the companies come first. The developer looks for companies that are interested in the project and tries to fit them in the eco-industrial park concept. The idea is to utilize existing organizational relationships and cooperation networks. The model preferred would combine both stream-based and business-based approaches and companies



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would be proposed to join the park on the basis of their streams. The network can also be built around one large industry. It can work as a central element, as an anchor tenant for an eco-industrial park. Power plants are often good examples of this (Chertow 2000).

### Rationale

Even though the district currently counts with an industrial base, the re-design and organizational structure of its industrial sector into a more participative and integrated approach through the establishment of a new Eco Industrial Park will provide an umbrella effect to attract companies which values are consistent with the district's vision.

### Challenges

Considering that there are existing businesses and industrial corporations in the district that might not fit or want to participate in a more integrated approach of an Eco industrial Park, creates a possibility of resistance from existing stakeholders which might want to continue with their current operation schemes and maintain their facilities inside the district. In a free market economy it might be difficult to displace existing firms if they do not want to participate in the development.

### Financial opportunities

City funds could be attracted for infrastructure installations by promoting the development of the district. Infrastructure development on the other hand, can be used to promote investment of private firms in the district. Research institutions, industrial park developers, and logistic operators could be interested in investing into the industrial park development with profit driven objectives or to build on their expertise and participate in similar project in the future.

### Anchor Industries in Eco Industrial Parks

Anchor tenants are important actors in the industrial network of Eco Industrial Parks, usually being the largest firm or firms in the network. Anchors provide incentives to the symbiosis network by incorporating or providing sufficient by-product material flows into their production systems. They can also have a motivational function to promote the involvement of other actors and stakeholders such as politicians, citizens, businesses, research centers and other organizations. Anchors are also called “champions” of the network and can serve as leverage for park management activities by securing sufficient financial resources.

Champions often have facility to gain the trust of other actors in the network and enhance integration and cooperation of the network as a whole. However, the importance of anchors in the system creates the possibility of an unbalanced power relationship, where anchors can try to influence in the network towards their particular interests. In this sense, cooperation standards and agreements should be set amongst all stakeholders in an eco industrial park. (Mirata 2003, Starlander 2003, Fichtner et al. 2005).



## Rationale

By including anchor industries into the industrial park development, it will be more attractive for other industries to participate into the development as they will be able to take advantage of possible linkages and other industrial relationships. Anchors will also serve as representative stakeholders of the system and will form part on the promotion of the industrial park's development.

## Challenges

Attracting anchor industries will represent a significant effort of the industrial park's development and might require special incentives as they will be the base for industrial ecology in the district. Power relationships of anchor industries should be balanced and taken into consideration given the importance of their role in the system.

## Financial opportunities

Economic incentives such as agreements related with the district's functions such as the operation of public transit, infrastructure building and maintenance or promoting local policies to generate a base consumption of their products or services could provide an important financial opportunity for anchor industries to participate. On the other hand, anchor industries will also be able to benefit from normal private funding and investments for the establishment of their operations.

## Eco-Industrial Park Coordination Agent

In addition to anchor tenants, a park management structure or coordination agent is a feature often applied by eco-industrial parks. A coordinator facilitates communication between the actors in the network. The park management organism can be one of the companies or an independent structure, such as an academic institution, a consultancy company, a public institution, or trade, entrepreneurs or employers' associations formed by firms from within the park. (Starlander 2003, Heeres et al. 2004).

In the planning phase, the park management structure should find new connections between existing companies in the geographic area, the selected anchors and look for new firms to enter the network, promoting value-adding functions amongst all existing and new parties.

Active community cooperation and encouraging dialogue between interest groups should be widely promoted by the park coordinator.

Promoting, supporting and maintaining exchange of materials and energy among companies is one of the most important tasks in an eco-industrial parks coordinator. Its mission should be to enhance the flow exchanges between the companies in the park, maintaining the diversity of the companies and the compatibility of by-products as companies change over time, for instance through its recruitment responsibilities, when a supplier or customer goes out from the network etc.



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Administrative duties of a coordination agent include standard park service, recruitment, and maintenance functions. The management structure should also decide which services will be provided by the park management and which are bought from public utilities or external contractors.

The management agent should incorporate and administer information systems and databases to identify new linkage and material flow possibilities, which could also serve to enhance inter-company communications, inform members of the state of their local environment and to provide feedback on the eco-industrial park's performance. **(Starlander 2003)**

In addition, the management should develop efficient marketing strategies and techniques and keep up-to-date on legislation and regulations and communicate with regulatory bodies.

The park can also maintain shared support services such as a training centre, cafeteria, day-care centre, a purchasing department or logistic operations.

The main functions of a park coordinator agent are:

- Finding new connections for cooperation
- Enhancing the dialogue between shareholders
- Maintaining and managing services
- Supporting material and energy flows
- Recruiting new companies
- Improving the environmental performance of the park and individual companies
- Maintaining an information system
- Informing companies in the park
- Linking companies and public organizations
- Developing marketing

### Rationale

A park management structure or park coordinator will provide an umbrella effect, providing an overarching organizational, regulatory and facility framework under which firms and industries participating in the system can operate. By operating inside a broader organizational structure, cooperation and integration of industrial activities in the sector and linkages with outside actors will also be enhanced.

The park coordinator will be formed in a participatory and multi stakeholder structure which will allow the opportunity for all the members of the system to contribute for achieving common goals.

### Challenges



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Designing and generating the park management structure and installing the park coordinator is one of the main challenges of the industrial park. Leadership and stakeholder participation will be required in the creation of the structure. On the other hand, balancing decisions and establishing common ground is frequently an emerging challenge when undertaking participatory initiatives.

### **Financial opportunities**

Anchor industries could provide a base for the funding and operations of the park coordination, however, all members of the system should participate and assist with the park management financial needs to avoid power unbalances.

There are several ways in which the financial needs of the park management could be satisfied and they should be of agreement by all participants. A membership or co-operative approach could promote fund diversion from industrial firms, or the management of services and infrastructure could also prove to be a successful strategy on maintaining healthy park finances. The city government might also be interested in participating in a more active financial way on the park management structure.

### **Eco-Industrial Park Logistics Management Center**

Logistic management and operations represent an important subject on industrial activities. The scale and scope from which this subject can be approached varies from particular production lines of small industrial processes to international large scale operations with the participation of multiple firms and business types.

The complexity of industrial ecology systems and its closed loop material approach with multiple linkages amongst participants requires an equally complex logistics approach, in which the relationships and trade procedures should be optimized to increase efficiency on the operations.

Considering the variety of possible interchanges of firms within the system and their relationships with outside factors, having uncoordinated logistic operations can contribute to the creation of unnecessary operation problems. On the other hand logistic operations normally generate important costs on industrial operations and having a logistics department requires hiring expert personal. If every participant of the system manages their own logistics there is a risk of duplicating functions, or under using assigned recourses which, added to other factors such as business specialization can contribute to undermine logistic systems efficiency.

Centralized logistic operations can provide important benefits to independent firms or industrial parks by themselves by providing specialized functions and product management, reducing costs and increasing productivity. Furthermore, when logistic functions are centralized, firms' main facilities can focus on their core businesses and into the development of better business practices and strategies.

In an industrial ecology systems approach, sharing a logistics management center can also provide important features such as increased material exchange processes between businesses with multiple material linkages and relationships, providing services such as inventory management, warehousing and enhancing just in time operations by managing multiple interrelated input and output systems.



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The Eco Industrial Park logistics management center could be managed entirely by the park coordinator agent or by one or multiple logistic management firms. In the first case scenario, the park coordinator will take advantage of its relationship with all the system's participants and could hire logistics firms according to the systems needs. In the second, the logistic firms would have to build a relationships with all actors in the system and report mutually to the hiring parties and the park coordinator agent.

The main functions of the logistic center are:

- Facilitating relationships and exchange between businesses
- Specialized Multi-Modal Logistics Management
- Managing material and products inputs, outputs and transfers
- Performance and productivity enhancement
- Creating ad-Hoc High Efficiency Solutions

### Challenges

To build and support a logistics management center there will be a need to maintain of sufficient logistics movements, taking into consideration internal trade operations as well as external inputs and outputs. On the other hand, the coordination and management of a large variety of linkages, processes, exchanges and inventories can represent a significant challenge and will require advanced information systems and logistics experience. Another challenge derived centralized logistics centers is creating emergency response systems in case of unexpected events that could affect the system.

### Research and Development

Promoting a highly innovative and co-evolutionary industrial sector towards sustainable industrial practices and processes is one of the objectives of the eco industrial park. (Malerba 2006 **Innovation and the evolution of industries**)

It is understood that private firms will continue to invest individually in research and development to gain or maintain competitive advantage. However, to promote joint district innovation and co evolutionary development, cooperative research initiatives should be pursued. In an effort to create shared knowledge and improved processes that can provide the district's industrial sector with superior positioning in the markets.

By cooperating with a research and development institution or creating a cooperative research center, the Manchester District could work on the generation of new approaches and solutions to existing and emerging problems, increasing the district's industrial resilience to external factors by being able to respond to risks and opportunities in a timely and innovative matter.





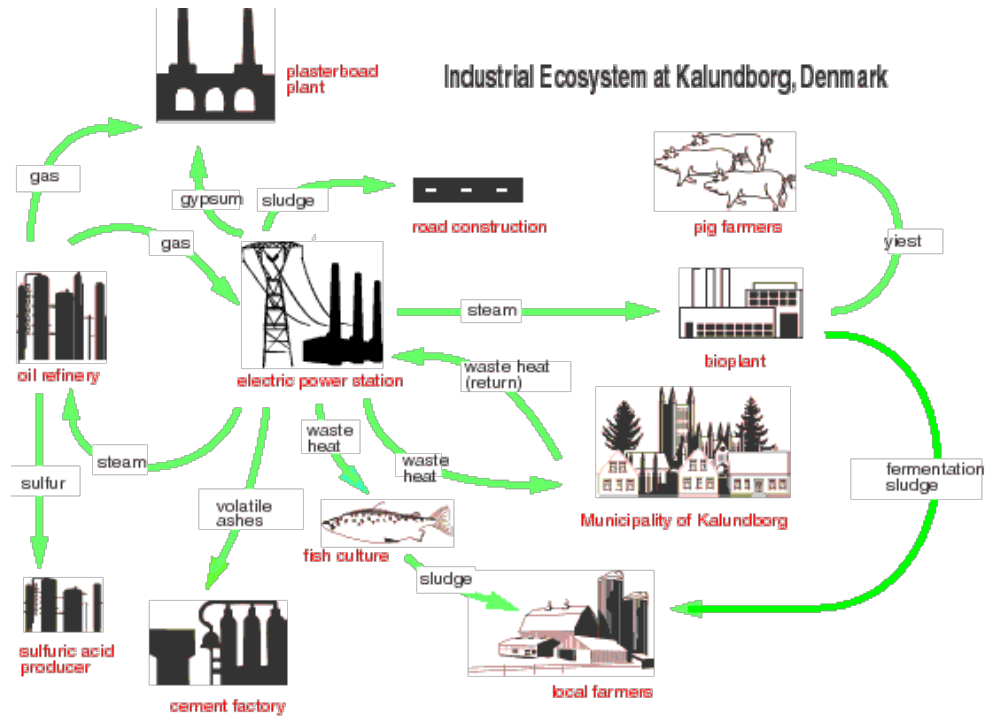
## 5. Eco Industrial Park Examples

There are many examples of eco industrial parks in the world, the most studied ones, developed on a self evolutionary and organic process until a certain point after which they developed organizational structures which allowed them to follow material exchanges and inter relationships allowing for better understandings about the systems inter relationships and the development of new strategies and steps towards complex systems of industrial symbiosis.

Possibly the two most analyzed and representative cases of applied industrial ecology in the form of Eco Industrial parks are Kalundburg, in Denmark and Styriain Austria. Both these eco industrial parks emerged from natural exchanges between existence companies and mostly from bilateral agreements between firms. Another common characteristic is that they involve heavy industrial processes which normally have large byproduct material flows, allowing for significant

There have been suggestions on that industrial symbiosis is actually a natural process driven by productivity and cost reduction strategies from particular firms and that the only difference of Eco-Industrial Parks is related to the awareness of the exchanges and inter relationships.

Other review suggest that public intervention, such as imposing large disposal costs or subsidies can promote the favorable economics that can lead to the creation of recovery firms and ultimately lead to complex industrial symbiosis systems such as Kalundborg. Taxes on pollution, waste disposal, and virgin materials, combined with other positive incentives to promote resources circulation in a productive way, generating economic viability while reducing the environmental impacts of industrial activities.





## 6. Impact on Sustainability Indicators

The development and promotion of industrial ecology practices in the district will have a direct impact on sustainability performance. In this sense, the incorporation of indicators will help on evaluating the effects of the development through its different stages and provide information for feedback and future strategies.

### Community Indicators

**Crime:** Employment and the generation of good economic conditions can have a positive impact in the reduction of crime.

**Activity Leisure:** No significant impacts identified.

**Community Association membership:** Firms can promote

**Local Festival Attendance:** No significant impacts identified.

**Sense of Community:** By promoting a cooperation structure and a sense of community amongst firms, these attitudes can also gain importance in the local population, as well as a respect amongst different sectors of the economy.

**Valuing Cultural Diversity:** By developing industrial activities related with the district's principles and needs, the cultural identity and diversity of the district will be enhanced.

**Volunteerism:** By incorporating communication in their corporate responsibility strategies, the industrial sector could promote volunteerism in the community and particularly with in their employee force.

### Economic Indicators

**Housing Affordability:** The proximity of industrial activities and employment will promote the generation of new affordable housing initiatives.

**Economic Diversification:** Will be enhanced by promoting the entrance of new players into the system, strengthening existing economic activities and generating technology innovations in the district.

**Unemployment:** The strengthening and entrance of new industries will generate an important amount of jobs, reducing unemployment significantly.

**Hours of Minimum Wage Work to meet Basic Needs:** Highly technological industries are comparatively well paid and the working hours required to meet basic needs will be reduced.

**Food Bank Usage:** No significant impacts identified.

**Income Gap:** Because of the wide variety of direct and indirect employment opportunities with different income ranges, the income gap will be reduced.

### Education Indicators

**Adult Literacy:** Industrial training programs will incorporate literacy programs for low specialized positions.

**Average Class Size:** No significant impacts identified.

**Daycare Worker Salary Turnover:** Accessible day care centers will be promoted or managed by the eco industrial park coordinator.

**Grade Three Achievement Scores:** No significant impacts identified.

**Library Use:** No significant impacts identified.



### Environmental Indicators

**Air Quality:** By incorporating industrial ecology practices, the emission of harmful gases will be reduced, moreover, when processes require the emission of gasses they will incorporate capitation methods and will promote

**Food Grown Locally:** No significant impacts identified.

**Pesticide use:** No significant impacts identified.

**Water Quality:** Technology innovations will reduce water usage, while a reduction of chemical products in industrial processes and district's water treatment strategies are implemented, mitigating the current effects of industries in the watershed.

**Christmas Bird Count:** No significant impacts identified.

**Water Consumption:** Industrial processes will incorporate water recycling strategies in their design, and will be in line with the district's water management strategies, reducing consumption significantly.

### Resource use Indicators

**Ecological Footprint:** Industries will significantly reduce their ecological footprint by joining into the industrial ecology practice.

**Transportation Spending:** Employment and residency proximity will reduce people's transportation spending.

**Household Waste:** No significant impacts identified.

**Sprawl:** The development of the eco industrial park will result in higher industry densification as well as maintaining industrial activities inside the City of Calgary, reducing sprawl.

**Transit usage:** Employment and residency proximity will reduce the necessity of car ownership, promoting transit usage.

**Energy Consumption:** Industrial efficiency, efficient building design and energy recycling will promote a reduction in energy consumption.

### Health and Wellness Indicators

**Preventive Health Care:** Private firms will do an active job on promoting preventive health care to reduce lack of assistance and other employee health related issues.

**Youth Obesity:** No significant impacts identified.

**Healthy Birth Weight Babies:** No significant impacts identified.

**Income Support for the Disabled:** Social responsibility of some firms could provide support or specialized job opportunities for disabled people.

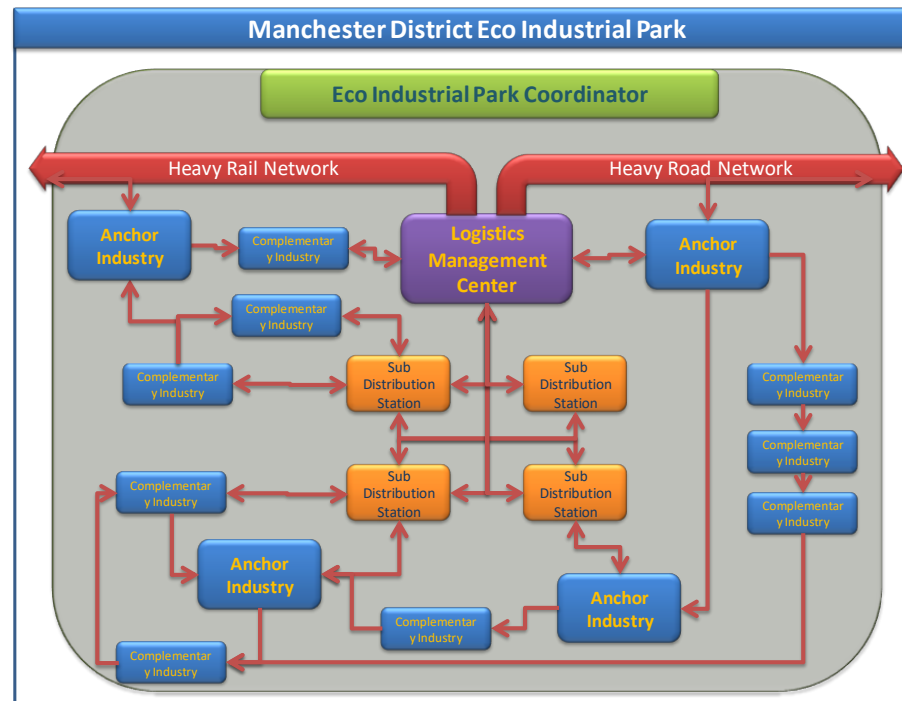
**Self-Rated health:** Positive motivation and good employment opportunities can promote self rated health issues.

**Childhood Asthma:** No significant impacts identified.



**7. Development Scenario: How might this design roll out? By what process? How would it start? Are there significant milestones (1-2 page)**

**Expectations**



Fully implemented industrial ecology ecosystem

Setting precedents for best practices

**The Process**



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End vision and back stepping

Establishing industrial baseline

Planned and organic processes needed

Political and institutional support

Multi stakeholder approach

## Milestones

Political support

Creating Development Plan

Attracting the correct anchor industries (Clean and sustainable products)

- Streetcars
- Bicycles
- Solar PV
- Anchor incentives: market driven

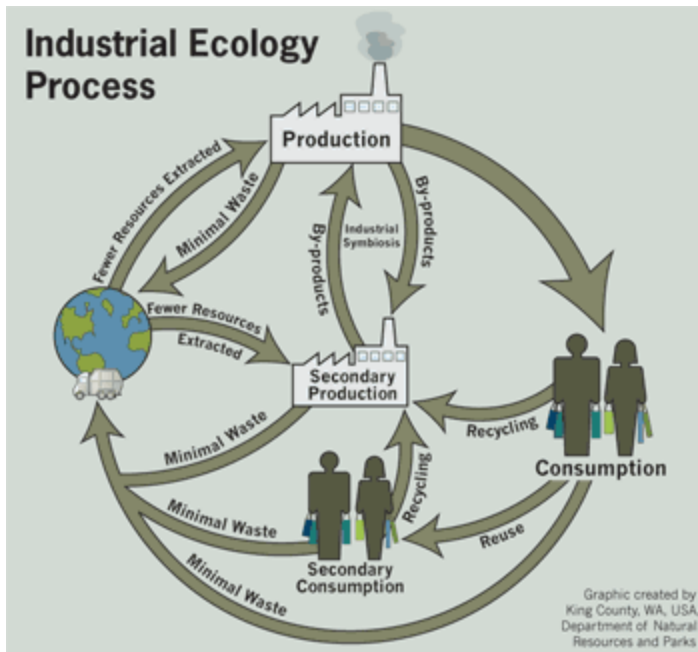
Stakeholder Identification

Set park management strategies

Creating a coordination agent

Attracting complementary industries

Adaptive management system



<http://www.is4ie.org/>

### 8. Critical Research and Development Questions... would have to be addressed in order for the Manchester Vision to be realized? (1-2 page)

Who should lead the process of developing Manchesters District as an Eco Industrial Park?



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Total Document length not to exceed 25 pages not including Title Page and Table of Contents. Sections 4 - 7 should represent about 2/3rds of the document.

Due Date: April 12, 2012

## 9. References

Gertler, N., and J. R. Ehrenfeld. 1996. A down-to earth approach to clean production. *Technology Review* 99(2): 48-54.

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Starlander, J.-E. 2003. *Industrial Symbiosis: A Closer Look on Organisational Factors*. A study based on the Industrial Symbiosis project in Landskrona, Sweden. IIIIE Reports 2003:4. Masters Thesis. The International Institute for Industrial Environmental Economics. Environmental Management and Policy. Lund, Sweden.

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### **IDEA Multi functional product customization**

Designing products and services to have more than one specific use and to include interchangeable parts that can serve as composites for different end use products could also promote the re-incorporation of used parts into the technical nutrient cycle.