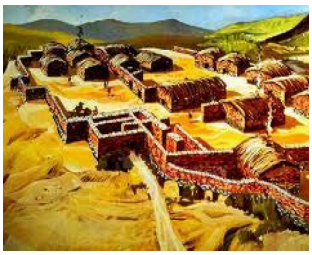
SUSTAINABILITY HOLISTIC CIVIL ORGANISM

City's Evolutionary Survival guide beyond the 21st Century



Lure of the Community

Early Human Settlements

With the advent of formalized agriculture humans left their risky hunter gatherer lifestyles for a more certain and successful existence in larger communities.

Settlements of farmers, located around wells or water sources, developed specialization and soon gave way to villages, towns and eventually cities.

Cities became special because they formed the source of the advanced social and cultural development we know today as societies!

Villages and Towns

Villages and Towns as Civilization Developed

Villages, towns and proto-cities were all focused on the central economy of a specific region. For much of human history, that was agriculture or aquaculture.

As trade was established, ports, rivers and roads became important.

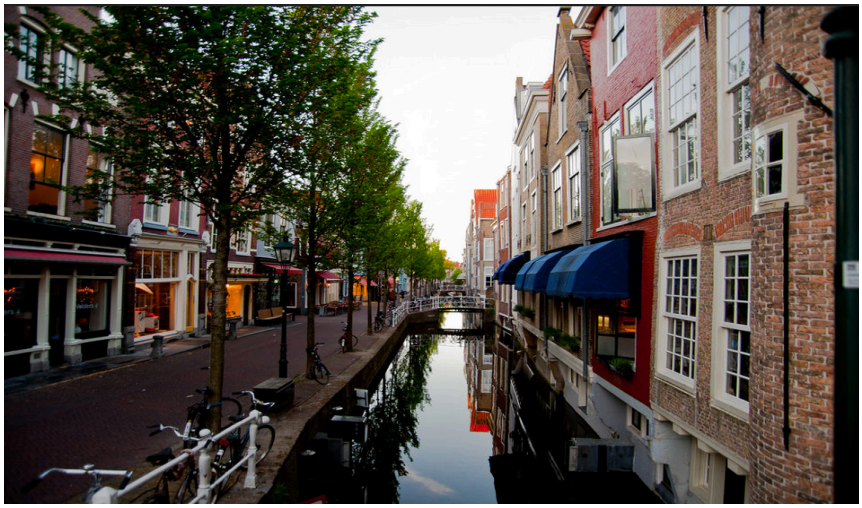
Today, most of the great cities of the world are located on rivers deltas where was the most fertile, food production areas of land existed.

Proto-Cities and Cities

Cities Becoming Central Unto Themselves

Proto-cities become cities when independent areas within the city were clearly defined specifically for:

- Administration and Security
- Commerce and Trade
- Infrastructure and Transportation
- Residences
- Public Spaces



Cities and the Industrial Revolution

Industrialization of Cities

The Industrial Revolution introduced a new factor to cities that would forever change their nature. Now cities would be a center of manufacture and were not necessarily linked to the natural world or resources the way previous cities had been.

The power behind this radical change was from fossil fuels, starting with coal. Now people themselves became a resource as well as a reason for a city to exist.

The Hope for Utopian Cities

The Gleaming Promise of Tomorrow

Ultimately, we've turned to the same technology that brought us to the Industrial Revolution to hold out a promise for the future of our cities. Relying ever more on pure technology to control our environment and sanitize our existence, we've created some unintentional results such as:

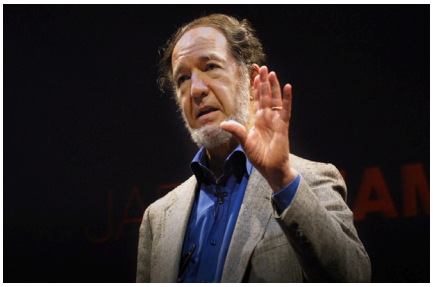
• Climate Change • Environmental Degradation • Species Decline

The Reality of Modern Cities

The City of Tokyo – Population 32,450,000

Cities have grown to astronomical proportions. The world's largest city has a population that is just slightly less than Canada, which is the second largest country by area in the world. Other cities like Seoul, Mexico City and Beijing are not that far behind.

The question that needs to be asked: Is this sustainable?



Collapse

Author Jared Diamond's book on ***How Societies Choose to Fail or Succeed*** otherwise titled ***Collapse*** tells a story of how other, earlier societies outstripped their resources that was the original genesis of creating some of the largest cities known to early history. His cautionary tale provides a potential glimpse of the future given the mounting evidence that is all around us today. ***What defines resources?***

Urban Decline

Evidence of Unsustainable Urban Economics

Evidence already exists in many of the previously great cities of America that unsustainable cities can happen.

Traditional centers of manufacturing might have seen some of the largest decline, such as Detroit and Chicago.

Other centers that are extremely sensitive to climate change are also struggling or on the verge of struggling, such as New Orleans, Miami, Phoenix and Las Vegas.

Ten Commandments for Cities of the Future

1. They MUST be Environmentally Friendly
2. They MUST promote Mobility
3. They MUST be Socially Integrated
4. They MUST use Technology
5. They MUST be a source of Energy
6. They MUST be a source of Food
7. They MUST promote Biodiversity
8. They MUST have Resilient Infrastructure
9. They MUST have a Balanced Use of Land/Space
10. They MUST be Economically Viable

Environmentally Friendly

A broad statement of where today's society needs to be...but what does this really mean?

Since cities are a microcosm of the local civilization as a whole, the answer is different for each city. The important thing is that cities everywhere are developing policy and programs that are part of their overall approach to make their city models of 'Environmentally Friendly' places in which to live, work and play.

Environmentally Friendly Example A

City of Edmonton – Integrated Waste Management

Back in the 1970's the City of Edmonton realized that its current landfill would reach capacity by 2015. As a rapidly growing prairie city, affordable land was still available, but that wasn't the solution. Policies changed and the City made a large, long term investment to become a leader in Integrated Waste Management. As of today, the City can claim the following:

1. Diverting 90% of residential waste stream from its landfill
2. Diverting the majority of its commercial, institutional, construction and demolition waste for recycling and reuse
3. Providing enough bio-fuel to heavily compensate its fleet of municipal vehicles
4. Delivering 4.8 Megawatts of power from its Integrated Waste Management facilities

Environmentally Friendly Example B

Greater Vancouver Regional District – Use of Recovered Materials in New Buildings

1. Vancouver's Asphalt Plant Testing Laboratory uses almost 90% recovered building materials and built it under the budget of a new, lower quality building
2. Chan Centre for the Performing Arts right at UBC uses a high ratio of recovered building materials
3. Surrey's Central City complex uses disposed plywood plant cores to make space frame roof

Mobility

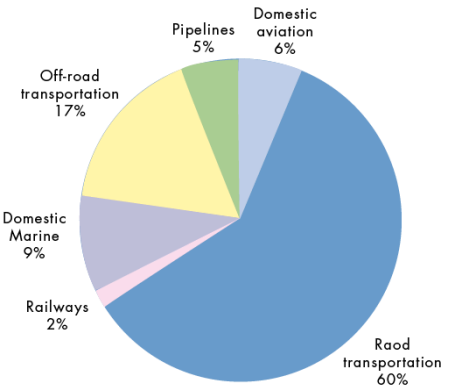
Cities are living organisms, and their lifeblood is carried by its transportation systems deriving in mobility and integration of its people and commerce. After WWII the car became king, and its domain is the paved road. Today, cities are dominated by automobiles which are dominated by paved roadways, both which have created an unsustainable future and a variety of problems.

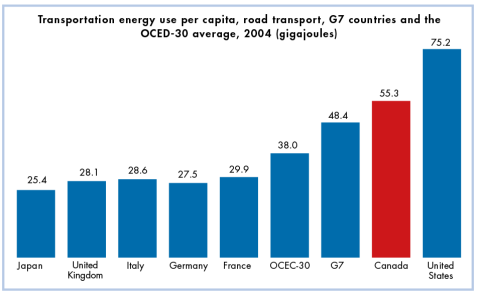
Automobiles are an extremely resource expensive and inefficient method of transportation. They are anchored to an excessive reliance on petro-chemicals and fossil fuels (ie each car tire consumes 7 barrels of oil throughout its entire life cycle, each kilometer of road 160 barrels). Vehicles themselves are a huge environmental investment with many toxic or rare materials used. It's unlikely that we can completely eliminate the automobile…so how do we drive a GREENER vehicle?

Paved roads create unwanted micro-climates and major roadways cut off established communities. Roads are also a barrier to nature, interrupting natural migration and are a major contributor to habitat loss. More roads haven't made mobility and integration any easier. The average one way commute for the city of Toronto is 80 minutes, the worst in North America. Streets and highways are unavoidable…so how do we find a route to a GREENER road?

Part of the solution has been looking at an integration of other methods of mobility. Today, environmentally conscious cities have given priority to pedestrians and have done as much as possible to marginalize the single occupant vehicle. Public transit is taking a larger proportion of the mobility equation with a goal to eliminate the single occupant vehicle. Ideal as this is, it's not a political reality. However, it is an opportunity.

Let's rethink the road. In North America, the per-capita energy expended by the populations of the US and Canada onto its roads is the highest of any of the other G7 countries. The highest concentration of this traffic is in our cities. Even with the growth of electric and hybrid vehicles, the roads will still be supporting an increasing amount of vehicular traffic.





Developing technologies will capture the waste energy and heat from traffic to produce thousands of Megawatts of electric power. By harvesting this destructive energy, vehicles will run even more efficiently, and the entire system will last longer (roads, tires, vehicles, etc). Furthermore, the roads will become even safer, and can become adaptive to the immediate conditions. Where traffic is not the issue (ie parking lots) both waste heat from cooling engines and solar power can be harvested.

Social Integration

The fundamental element of cities are its people! How these people interact with each other and their environment defines the liveability of a city. The most successful cities adopt a community of communities approach. Natural nodes develop and are connected with links to the nodes of other communities. In the future, these communities will become more self sufficient as the suburbanization of cities prove to be unsustainable.

Technology

Throughout this presentation you will notice that technology is an extension of a modern city, but should the city itself be sacrificed to technology? Advancements in communication, information and upgradeable material science are suggesting this is not the case. The focus of technology on today's city is a continued integration of natural processes and environmental sustainability meshed with the demands of the ever-changing economies based within a city.

The majority of the operations for modern civic maintenance and administration is either automated or technologically enhanced in some manner. That level of technology reaches all levels of activities in a modern city, so much so, that our standards of living, working and playing in a city have also changed. It's becoming common not to have a head office, but hotel your staff or have them work from home. The service industry has grown dominant and tourism today is a leading sector of the economy. All sustainable.

Manufacturing in a city, where it still exists, is tech based. All logistics are controlled by advanced computer systems. The re-integration of 'craft' industries use technology to allow them to be viable in efficient multi-use spaces. Residences are getting smaller, but are more useable, efficient and comfortable. Emphasis is growing on morphing spaces to deal with the changing demands of the population. This is evident in public buildings from hospitals, schools and even public parks.

Developing technologies will capture waste energy from appliances, equipment, lights and even people to re-purpose or convert to electricity. Rogue EM radiation will be scrubbed from environments to harvest energy and clean the environment for living things. Every day surfaces will exist that could change transparency, color or even project images and sound. These same surfaces will be able to work as sensors to monitor heat, light, air quality and even the health of the occupants.

Technologies will replace the sewage treatment plants we see today with multi-chambered process oriented piping. Sewage, depending upon its content will be circulated to be processed en route to final finishing that will exceed today's most stringent tertiary treatment requirements. Usable elements will be extracted along the way, including energy. Similarly, water will be processed en route to be purified and desalinated.

Developing technologies will eliminate 90% of piping used in our buildings by incorporating channeled conduits within our structures, saving materials, weight and time while increasing usability and robustness of the systems. Developing technologies will eliminate fragile power grids within cities. Electrical energy will flow through a robust, wide dispersal net. This will lead to more efficient transfer of energy and information which will be less prone to overload or collapse.

Energy

Cities take a great deal of power of all types to work efficiently. The problem is that they don't take the opportunity to harvest the power that they create naturally. The future of cities is that they will produce more electric power than they use and be an economic renewable source for other fuel systems. Common alternative sources of energy include wind, solar and geo-thermal power sources. However, we will explore other sources of energy exist that aren't commonly considered.

Small urban land areas can now produce viable quantities of diesel fuel. Renewable energy processes are used to break down cellulose into smaller molecules to allow for fuel production from this and other organics. No atmospheric or liquid emissions are created and what's produced meets US and EU standards for transportation grade fuel. This is a step beyond technologies that produce ethanol from organic wastes as diesel is twice as energy intensive. Plastics, rubbers and waste oils combined with organic waste will produce renewable fuels using the excess hydrogen derived from those organic wastes.

Energy

Unconventional sources of alternative energy in the city include:

1. Sewage: Geo-thermal, micro-hydro and bio-fuels (bio-diesel and ethanol)
2. Storm Water: Geo-thermal and micro-hydro
3. Solid Waste: Geo-thermal, heat recovery, bio-fuels and co-generation of electricity
4. Roads and Sidewalks: Piezoelectricity and solar
5. Buildings: Heat recovery, EM harvesting, geo-thermal, piezoelectricity, solar, wind and micro-hydro
6. Parks and Urban Agriculture: Geo-thermal, wind, solar and micro-hydro

Food

As the cost of producing, storing and shipping food becomes more expensive, the concept of vertical and urban farming is beginning to take hold. Cities have a natural advantage when it comes to the production and harvesting of high value crops. Cities naturally produce high levels of CO2 which is a natural plant stimulant. Furthermore, ambient temperatures within a city are typically a degree or two higher than the surrounding countryside, providing longer growing seasons for high value cash crops. Finally, the smaller growing areas are an opportunity to provide a very diverse urban crop and food production plan that would support the needs and cultural preference of the residents of the city.

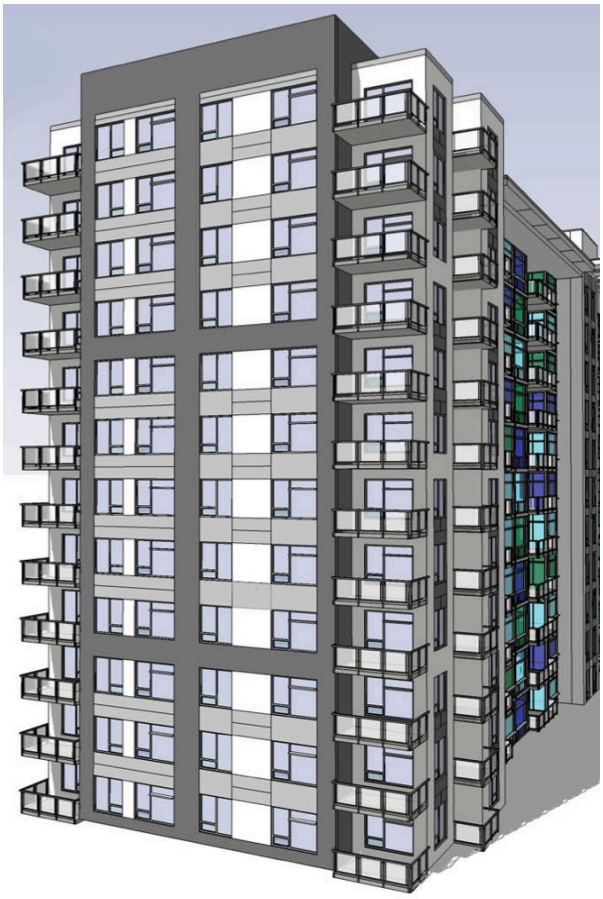
Food

Successful examples of urban food production exist in many cities around the world. In Montreal, the University of McGill employs their Edible Campus program to help feed those who cannot easily afford the cost of fresh foods in their city. By working with their design and architectural specialists, they are able to convert green spaces throughout the campus into food producing gardens that are also pleasing to the eye. Also in Montreal are the Lufa Farms. These are greenhouse based farms that are built atop existing warehouses. Not only does Lufa provide urban organic foods at a profit, but they provide another source of employment in Montreal. Finally, the conversion of their bio-waste produces another 2 Megawatts of power.

Finally, central to the success of urban agriculture is the bee, which is also fortunate for the bee. Current agriculture is highly mono-cultured, and as such, is part of the problem with Colony Collapse Disorder. Experts believe that bee colonies are essentially starving to death, with primarily one source of pollen for their food. This is not only a problem for the bees as 40% of the food that we eat require pollinators, namely bees. By promoting urban agriculture and apiary services, cities can be a critical center of food production and bio-diversity within the city and for rural areas surrounding the city. Cities may be the key to agriculture for the future in defending key elements of nature that mechanized farming does not support.

Bio-Diversity

There is a growing understanding that cities need to be a haven for a wide variety of living things, not just people. There are some practical limits to this, but aside from some very large or dangerous animals, many species could successfully co-exist with people in their cities. In London, the Wetlands Centre is a haven for the cities diverse bird life. In North America, there are a number of examples where cities are taking similar steps.



Resilient Infrastructure

One of the biggest challenges to cities in the future is the unsustainable approach to building and development. Buildings and other systems will need to be created with robust products that can be updated and reused, not just recycled. This is not only choosing the right materials, but also choosing the right way to build. As this situation becomes more evident, modularization of common building elements will be key.

In this example designed for a project in Alberta, the project's skeleton would be assembled from modular parts on site, while the finished units would be completed in a factory off-site. Once complete, the units are inserted into the building and the only finishes necessary on site are in the connections made in the common space. A less advanced version of this program assembled 9 buildings of 150,000 SF with 6 men and a crane in 55 calendar days each. The savings are obvious.
The hidden benefit for this system is that anytime in the future, any one of these units could be extracted and a fully updated unit could be installed into the existing skeleton. Also, if you wanted to move or add to the building, all the pieces are fully de-constructible and re-usable. Apply this to schools and an elementary school could convert to a high school. Hospitals could eliminate superbugs by removing the contaminated areas. Commercial buildings could customize.
Updating any building would be a simple matter of getting the latest version of unit and changing parts. Suitably built, structures could be financed as a lease with a suitable term on the lease as the fundamental elements of the structure would be fully re-usable. It would be easy to stay in your community as your unit could be changed to meet your current needs. Modules to your unit could be added as you needed space, or sold, as you wished to release space.

Balanced Use of Land/Space

For those that live in cities, and for those who choose how their city will evolve, a new understanding of land and space must exist. Shared ownership or rights will need to be given to public spaces, interior public spaces, rooftops, building exteriors, roads, etc. What rights does the individual warrant? What rights does society warrant? What rights does nature warrant?

Economically Viable

Regardless of the GREEN initiatives that any city decides to follow, they need to make sense economically. It's important that there is not an unrealistic expectation of a quick return, but there needs to be a real expectation of a long, sustainable return. The following are two examples, one small, one big, as to the economic efficacy of greening a city.

Resource Matrix

Need/Issue	Source	Impact
Food	Mono-cultured mass produced agriculture	Habitat loss, species depletion, rising transportation costs, reliance on fossil fuels and food supply instability
Water	Centrally sourced from a distance or desalinated	Diminished resources, inefficient infrastructure, high transport and treatment costs
Energy	Coal, fossil fuels, nuclear and hydro electric power	Climate change, pollution, habitat loss, resource depletion, political exposure and inefficient distribution
Space	Urban expansion	Urban sprawl, habitat loss, arable land loss, expanding road network and unsustainable infrastructure
Waste control	Sanitary treatment plants and landfills	Pollution, climate change, resource depletion, public health issues, arable land loss and declining property values
Micro-climates	Roads and buildings	Severe weather events, climate change, flooding, urban heat sinks and public health issues

Economic Matrix

Need/Issue	Option	Impact
Food	Urban agriculture, aquaculture and bio-culture	Lower production costs, reduction in CO^2, minimal transportation costs and the development of new business models
Water	Diverse supply matrix from both internal and external sources	Preserved resources, highly effective infrastructure, lower overall cost
Energy	Energy harvesting, geo-thermal, bio-diesel, wind, solar, piezo and micro-hydror	Net electrical power generation, cleaner environment, self-reliance, business generation and resilient distribution
Space	Densification and alternative/multiplier focused space usage	Community development, habitat gain, arable land gain, efficient transportation network and sustainable infrastructure
Waste control	Integrated sanitary treatment systems, recycling and re-processing	Alternate resource harvesting, improved public health, more resilient infrastructure and sustainable job creation
Micro-climates	Intelligent roads and multi-role sustainable structures	Climate moderation, public safety improvements, energy harvesting and longer lasting more comfortable cities

The ‘Imagine’ Challenge

with appologies to the late great John Lennon

Imagine no pollution
It’s easy if you try

Clean soil below us
Above us only sky

Imagine all the people
Healthy every day

Imagine future cities
It isn’t hard to do

A place of home and commerce
And even nature too

Imagine all the people
Living life in ease

You may say we’re all dreamers
But we’re not the only ones

We hope one day you’ll join us

And with nature we’ll live as one
Imagine boundless power

I wonder if you can

No need for want or hunger
A masterwork of man

Imagine all the people

Sharing in the dream

End