Local Food Systems: A Sustainability Review

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ABSTRACT

The evolution of global food systems has led to industrial food production processes that have environmental and social external costs. Consumer awareness about sustainability issues brings a heightened awareness of general consumption impacts in our food choices. This paper explores sustainability factors within local food systems in order to understand the impact on sustainability issues within the local food economy. A review of environmental, economic, and social issues within a sustainability context in the local food system will help consumers to increase the knowledge and discussion around supporting and critical arguments. Understanding the sustainability impacts of a local food system on a local economy can assist consumers in making more informed food choices.

**Keywords:** Sustainability; Sustainable Consumption; Consumption (Economics); Local food systems; Local food economy; Food Habits.
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1: INTRODUCTION

The evolution of food plays a significant part in the development of society, and affects almost every aspect of our lives. It is a basic building block of human life, a necessity for survival, and an everyday consumption, and yet the average food consumer has little comprehension of complex systems that bring that food to the table. The evolution of our food system has benefited consumers by increasing the quantity of food at lower prices, but over time, it has also resulted in unexpected impacts on environmental, social, and economic systems. In the modern supermarket, consumers can expect to find over 30,000 items, from all over the world, with over half those products made by a small number of multi-national food companies (B. Halweil, 2005). However, in order to deliver those products to market, we have built a food system enables health problems, including salmonella, e. coli and listeria, to spread more easily in our food supply chains. (Salatin, 2007) In regards to food production, global climate change and extreme weather patterns increase the threat to our existing agricultural production base as farmers struggle with risk of spoiled crops and rushed harvests. (World Watch Institute, 2008) In addition, the global food price increases in 2008 have heighten the awareness of food price sensitivity to higher fuel prices, commodity markets, and the impact on both local and global food supplies (Streitfeld, 2008). Some environment scientists claim that our current industrialized food production processes require an unsustainable consumption of resources, and result in externalities that not captured in our economic system.(World Watch Institute, 2008) While there are various perspectives
regarding the sustainability issues within our current food system, the future direction remains at a crossroad when we are unable quantify and capture the costs those externalities.

As the general environmental awareness of climate change and pollution increase, more consumers seek information regarding the effects of their own consumption choices. As food consumption is a significant part of the consumption basket, some concerned consumers are seeking more knowledge on the impact of food producers, distributors, and food companies. While some turn to local food systems to satisfy their environmental and sustainability concerns, it is often unclear how these systems impact issues of sustainability. As sustainability issues gain mainstream attention, standards are emerging regarding guidelines and measurement, but the related costs of reporting and compliance are still high. Producers within local food systems are commonly small family farms, producers, and processors who serve a local community or region, and do not have the resources, systems, or the expertise to measure sustainability issues to those standards. Recognizing the gaps and difficulties in measuring sustainability in food systems, researchers at the University of Michigan created a list of preliminary indicators designed to assist sustainability assessments within the US food system (Heller & Keoleian, 2000). As there are no two food systems that are exactly the same, it is difficult to compare and evaluate sustainability impacts.

This purpose of this paper is to examine the sustainability aspects of local food systems in North America. Food systems encompass enterprises along the
food supply chain from producers to retailers, and a greater knowledge about this supply chain can help consumers achieve a better understanding the impacts of their consumption. While sustainability issues encompass common economic, environment, and social factors, the sustainability evaluation of food systems are limited to the local effects of the system, as inputs and outputs are different and local for every region (McDonough, 2002). This paper will not provide detailed sustainability analysis of any specific food system, but will address some of the sustainability issues concerning local food systems. The first section will provide an overview of existing local food systems and issues of sustainability within them. The second section will provide a overview of sustainability issues including different approaches to evaluation, measurement and reporting. The third section will provide a review of sustainability issues concerning local food environment in the context of environmental, economic and social factors. As we realize the sustainability impacts of local food systems on local economies, we can better understand the role they place in the greater global and national economic systems.
2: OUR LOCAL FOOD SYSTEMS

Food is an interesting topic, not only because it is a necessity to human survival, but because it touches so many different aspects of our society. Food intersects health, culture, social, environmental, and economics at a personal and business level, and as a result becomes an ideal intersection of society in the general discussion of sustainability. As consumers, our personal food choices are influenced through our cultural biases, environmental awareness, health concerns, personal beliefs, and economic status.

Our food system evolved from a hunter-gather system, in pre-historic times, to a modern system that delivers a large of foods from all over the world to the local supermarket. The large part of our modern food system is dominated by large global companies that utilize industrial systems, processes, and inputs to produce to larger quantities of food in an economically efficient matter. Over half of the products found in larger modern supermarkets are supplied by ten multinational food and beverage companies (B. Halweil, 2005). While supermarket chains and food distributors are consolidating and getting larger, other industries within the food system are following the same path, ranging from agricultural farm operations, livestock breeding, and meat processing plants to seed and fertilizer companies (Roberts, 2008).

With so much of our modern food system consolidating to a smaller number of food companies, food safety issues have more opportunity to spread to larger population and cause serious health problems. Although large food companies make an effort to minimize food health issues, the size and breath of
their operational systems make the distribution of health problems more likely (Roberts, 2008). In regards to large farming operations, the production stress on the natural capacity of the soil leads to issues of diminishing productivity where larger amounts of farming inputs, such as water, fertilizer and pesticides, are having trouble maintaining and increasing current yields (Tasch, 2008). Awareness of industrial farming issues leads to questions regarding the viability of these operations in the long term, and the need for alternative food systems to provide alternative food choices for local consumers. The alternative to the modern industrial food supply chain is the local food system.
2.1 What is Local Food?

The local food concept has been promoted by special interest groups, such as environmentalists and nutritionists, for many years, and is gaining interest among general consumers. As a result, governments at regional, national, and international levels are taking greater interest in these concepts. Large supermarket chains and grocery markets have recognized this interest and many have included the promotion of local food products in their strategic marketing plans (Martinez, 2010).

There is no universally accepted, or legal, definition of local foods, but general concepts and common ideas have emerged. According to Canadian Public Policy Report (Chinnakonda & Telford, 2007) on foods, there are four ways to define a local region: 1) geographical distance, in terms of a distance measurement, 2) temporal distance, in terms of a distance traveled within a time period, say 24 hours, 3) political, legal and administrative boundaries, and 4) bio-regions or natural boundaries of an ecosystem. In any discussion of the local concept, the definition of “local” takes on a different context as the definition will vary based on opinion, geography, economics and political concepts of a local area (Martinez, 2010).

In recent food publications, some definitions of “local foods” are becoming more accepted. In The 100-mile Diet (Smith & MacKinnon, 2007), Smith and McKinnon defined “local foods” as those found within the radius of 100 miles because it was easy to remember and wide enough to include the nearest agricultural regions. In the U.S., some farmer’s market associations have defined
“local foods” as those originating, processed, and traded within a 30 to 50 mile radius. (Martinez, 2010) The 2008 Farm Act allows farmers to market their products as “local foods” if their products travel less than 400 miles to market (Martinez, 2010). Government entities, in turn, use political and administrative boundaries to define “local” areas, in order to help determine the impact current and future investments in grants, incentives, tax breaks, and other policy changes on the existing tax base. In an environmental context, “local” definitions are related to bio-regions and natural boundaries within an ecosystem.

In Europe, some local food systems are associated with sustainable production practices, environmental stewardship, animal welfare, and support of the local and artisan food economies, and others are associated with regional aspects of culture, quality, soil, protectionism and pride of the people (Chinnakonda & Telford, 2007). In culinary circles, real food begins as an expression of local or regional food products sourced within a definable ecological framework, where the cooks and eaters eat the same foods prepared in the same way with local ingredients (Wilk, 2006). In France, where local food and wine have a long history, the concept of terrior is the idea that the food taste is strongly linked to the local environmental climate, soil base, and methods of production (Trubek, 2008). In the early 1900’s the French government formed a certification system called Appellation d’origine controlee (AOC), or “controlled destination of origins, to certify and guarantee that specific French food products are produced on French soil in highest quality artisan traditions (Trubek, 2008).
On a personal level, some consumers are exercising their consumer’s rights by choosing to eat local foods. Local food enterprises enable consumers to interact with food suppliers and present an opportunity to learn about their foods directly from the producers. The farmer’s market is an increasingly popular way for consumers to interact with producers, as there has been a 92% growth of U.S. farmer’s markets from 1998 to 2009, to 5,274 markets (Martinez, 2010). Given a greater opportunity to connect with consumers, farmers can discover consumer’s interests and are able to plan better for it in the next growing season. This two way interaction enables a rebuilding of the food relationship between consumer and producer, that is largely absent in the modern supermarket. As a local food system thrives on the opportunity to provide a wider diversity of product, often from artisan methods, the modern food system thrives on a monoculture of industrialized processes for ease of production and economies of scale to produce the same food at a lower cost (Albritton, 2009).

Some consumers are turning to local foods as a response to the realization of the distance that our food travels, or food miles. A study from Leopold Center for Sustainable Agriculture, at the Iowa State University, found that food traveled an estimated distance of 1,500 miles from farm to plate (Pirog, 2002). The concern of food miles is related to the corresponding carbon footprint, fuel consumption and pollution of the transportation related to food travel. As the possibility of rising fuel cost and globalization of our food supply chain increases the risk of the food price increases due to energy prices, some consumers are making efforts to minimize that risk by supporting a local and
regional food infrastructure. (DeWeerdt, 2009a) Using food miles as a representation of energy, and carbon footprint, in our food system is deceiving, as the energy used in transportation only accounts for 14% of the energy use within the food supply chain. (Heller & Keoleian, 2000).

Navigating information about local food system can be challenging, as there are numerous special interest and advocacy groups promoting different perspectives of local food systems. Nevertheless, researchers are recognizing that there is a lack of information about local food systems, and are exploring the possibility of local food systems as part of an overall solution to the larger sustainability issue.

In addressing the misinformation, Born and Purcell challenged the assumption that local food systems are better, where consumers are caught in a “local trap” of supporting local food systems in an effort to solve sustainability, social, and local economic issues (Born & Purcell, 2006). They found that the scale of the food system - local (small) vs. conventional (large) - is not a good measure of the ecologically sustainability nor social justice, because it does not automatically address or improve those issues (Born & Purcell, 2006). While it is common for smaller producers to have a more ecological sustainable and social agenda, producers may be using this agenda to differentiate and market their products.
2.2 Need for Sustainability in the Food System

Given all the level of economic growth in the last 100 years, it would be hard to argue the benefits of wealth creation, medical progress, convenience, and opportunity to the world. In a world of economic progress, we have created diverse risks that threaten the status of the world’s economies, many which were non-existent over 25 yrs ago (World Watch Institute, 2008). Most risks were driven by modern economic activity, such as climate change, water pollution and chronic disease in developing and industrialized nations (World Watch Institute, 2008). Given that some of the developing world’s developing economies, such as India and China, have an emerging middle class, economic development and consumption issues only increase the possibility of these risks and problems. Unfortunately, the current rate of global consumption already requires a the bio-carrying capacity of 1.5 Earths to absorb and regenerate the resources used on an annual basis (World Wildlife Fund, 2010). In an world of finite resources, the current level of consumption with in a world where goods and services are well-distributed is not sustainable, and issues about sustainability are issues about consumption (Stern, 2000).

Food, a commodity that we need to consume everyday, becomes a central focus on issues of consumption and human sustainability. With the expected global population expected to grow to 9 billion by 2050, there are concerns about the ability of our current food systems to provide enough to feed the world (Roberts, 2008). Habits of unsustainable consumption threaten the renewal of the same resources needed to provide for future generations, and an
ignorance of that consumption also threaten the long term viability of human survival in the interest of short term gain (Tasch, 2008). The global food system, which has challenges in eliminating world hunger, will continue to have issues, big in both size and complexity, to increase production to a level that can meet the projected global demand, while keeping an ecological balance (Brundtland, 1987). Sustainable development requires long term balances between economic, ecological, and social processes at the level of society as a whole, but the international community has such diverse interpretations of sustainability that it can not agree on specific solutions.” (Aiking & de Boer, 2004)

A brief review of our modern food system reveals that there are numerous sustainability issues along the food supply chain. In order to address sustainability issues, we need to explore production and consumption issues within the food system, such that solution can be identified resolve those issues. To help identify sustainability issues within the food system, researchers at the Center of Sustainable Systems, at the University of Michigan, have identified a list of sustainability indicators, as well as unsustainable trends in our modern food system (Heller & Keoleian, 2000). (See Appendix 1) According to environment scientists, our modern industrialized food production processes requires an unsustainable consumption of resources, and result in externalities that not captured in our economic system.(World Watch Institute, 2008) The inherent natural state of the agricultural systems is the presence of risk and uncertainty in every annual harvest, which is not suitable for the corporate industrialized system, which requires certainty. (Albritton, 2009)
Unfortunately, our economic systems are still measured in terms of financial and economic numbers without consideration for the externalized environmental and social costs of our economic progress. GDP measures the economic value of consumption and is not an indication of quality of life or sustainability, and fails to account for the value and depletion of human and natural capital. (World Watch Institute, 2008) Navigating sustainability issues is complex and determining the next course of action has always been a struggle at an international level; it is easier to engage the general society at a local and personal level with ideas that have an impact directly on the individual (Aiking & de Boer, 2004). As consumers gain a perspective on global sustainability issues, engaging individual efforts, such as the promotion of local food consumption, can empower consumers to realize how their consumption choices can have a positive local impact while contributing to overall sustainability goals.
Sustainability discussions in the context of food are often related to discussions about traditional artisan farming traditions and methodologies used on small family farms where access to external inputs, such as pesticides and chemicals, are limited. Traditional farming methods were sustainable out of necessity, as historical farm operations were forced to be self-reliant. These methods are now considered artisan, as the need to maintain these methods emerge from political, philosophical and environmental perspectives, rather than productivity and operational perspectives. Although there are different classifications of sustainable farming methods ranging from organic to bio-diversified, but the common thread is the reliance on natural inputs, and an effort to minimize modern chemicals in the food production process. While some consumers and farmers believe traditional and “sustainable” farming methods produce better quality produce, grains, and meat, the requirements for labor and attention prevent these methods from scaling up to an industrial level of production.

In order to discuss sustainability issues, we need to establish why there is a growing concern for sustainability, why it is important in the modern context and what can be done to improve our current sustainability situation.

When large corporations take an interest in reporting, measuring and evaluating sustainability, the issues have reached mainstream attention. In 2010, KPMG advised their corporate clients to expand their current reporting practices to include non-financial items, such as sustainability impacts, as these...
issues help shareholders and stakeholders to determine the true financial and long term value, and profitability, of a company (KPMG, 2010). With the 2008 credit crisis and global recession, global and local companies found their profits squeezed from all sides, as product demand falls, pricing pressures increases, and the cost of fuel, grains, and other raw materials were increasing. In order to remain competitive, companies need to navigate, recognize and address complex sustainability issues, in order to provide confidence to shareholders that they have continued access to customers, raw materials, and capital resources (KPMG, 2010). As the attention to sustainability issues increase, companies are realizing the era of unlimited access to global resources, regardless of price, may be threatened if issues of sustainability were not addressed. Defining and setting sustainability goals, action plans and policies is difficult because there is an overall uncertainty of long term impacts can impact whether current products, processes, and services should change or be completely replaced and redesigned (Aiking & de Boer, 2004).

Despite the recognition that organizations need to redefine the economic progress beyond current financial and economic methods; there are no defined or accepted standards to do so (World Watch Institute, 2008). Some governments recognize the environmental damage that corporations are making, and have established guidelines regarding transparency, reporting and governance on environmental issues. In some cases, the requirement of disclosure has been enough to bring attention to issues previously disregarded, and to drive a focus on exploring those impacts. In the US Superfund legislation,
companies were required to report annually about the amount of hazardous chemical in their facilities, and this attention has resulted in a 59% reduction of hazardous chemicals stored onsite by these companies, which, in turn, lower risk and exposure to the environment and the general public (World Watch Institute, 2008).

The discussion surrounding sustainability issues and its concepts revolve around the intersection of three main sectors: Environment, Economics, and Society (Giddings, 2002). As seen in Figure 1, success in addressing sustainability issues depends on the ability to improve on all three sectors, and positive contributions in the environment and society can contribute to positive economic growth. As a new corporate awareness on sustainability increases, companies who are able to address all three sectors can be more competitive, and contribute to a “restorative economy” where sustainable companies help fix our current environmental issues while making more money, having more value, and being more productive (Hawken, 2005).

Figure 1 - Sector Dependencies of Sustainability (Giddings, 2002)
In order to address sustainability issues in the food system, and specifically the local food system, we will explore various approaches to accepted sustainability concepts, tools and its indicators.
3.1 Approaches to Sustainability

With economics as the main driver to our society, our economy relies on the abundance and availability of environmental and social resources to absorb the externalities not captured by traditional economic measurements, such as pollution or unemployment (Giddings, 2002). According to the Worldwatch Institute, environmental economists recognize that global sustainable development requires new reporting requirements to help determine the real status of our economy, and new indicators are needed to make that determination (World Watch Institute, 2008). Economic indicators serve three basic functions: (1) to measure wealth, (2) to determine the distribution of resources for development, and (3) to inform citizens on how their economies are being managed so they can take the most appropriate political actions to exert control in their governments (World Bank, 2007). Environmental indicators serve to measure progress of our consumption, absorption and renewal of our natural capital, the status of our stewardship of that natural capital, and the effectiveness of our environmental actions. Society indicators serve to measure our success as a society in the global, regional, and local community, and how we are interacting with each other. While some indicators are quantitative, such as GDP and carbon emissions, and measurable to globally accepted standards, other indicators are more qualitative, abstract and subject to interpretation, such as knowledge development or community strength.

One sustainability reporting concept evaluates includes economic, environmental and social impact of a company, project, or policy, over a specific
period of time, similar to standardized financial reporting concepts, and thus called Triple Bottom Line reporting (Straton, 2009). This approach implies that the effectiveness of the resource allocations on each factor of sustainability is reflected by period end results. According to KPMG, global companies should be thinking about “triple bottom-line” reporting as shareholders, and stakeholders are looking beyond financial assessments to determine the true value of a company (KPMG, 2010). Economic measurements are more obvious as indicators of GDP, economic value, pricing, costs, and profits. Environmental measurements include impact on land use, pollution or water use. Society measurements can include evaluations on building communities, health and well being.

The Triple Bottom Line approach is effective in providing a general sustainability overview, but there are limitations and criticisms in its implementation. Beyond the standard economic indicators, most sector evaluations are not equally comparable across different industries and environments, and can cause confusion regarding the decision making regarding resource allocations, priorities and focus. While revenue and costs are easily measured and have direct impact on a company’s financial bottom line, but environmental and social factors can be difficult to quantify and compare financially as costs are often externalized, and measurements are relative and contextual (Giddings, 2002) Sustainability impact studies and assessments involving the Triple Bottom Line approach can span over a broad range of quantitative and qualitative measurements regarding economic, environmental
and social factors, and as a result, consultants specializing in sustainability often develop customized reporting guidelines. A Triple Bottom Line approach can be applied to measuring sustainability in the food system for general discussion purposes, but a detailed sustainability analysis of local food systems would be cost prohibitive.

Another sustainability reporting concept evaluates companies, projects and policies from an environmental impact perspective. The Life Cycle Assessment (LCA) is a “cradle to grave” approach, originating from the manufacturing industry that analyzes environmental impacts of products, services, and processes as it moves through its various stages of product life (Martin, 2009). The LCA methodology focuses on the biophysical impacts of a product system, such as resource depletion, energy consumption, water and air pollution, human health impacts and waste generation, but it does not include cost evaluation or other economic indicators (Heller & Keoleian, 2000). The LCA approach is used to deeply evaluate a single specifically defined product, service, and processes around an accepted framework within a corporate environment. In the food system, even small producers maintain numerous products, services, and processes that make the LCA approach too costly to justify the time and expense.

One of the key difficulties in measuring sustainability is the ability to quantify the costs of environmental and social impacts. Although standardized environmental indicators are emerging to measure economic impacts, such as greenhouse gas emissions and carbon footprints, these measurements are only
best estimates. Social impact indicators are more difficult to quantify into costs, as social impacts, positive or negative, may not be realized until a future time. Current economic structures, however, are not good at capturing cost externalities of our consumption. In an evaluation of our daily energy consumption, researchers predict that factoring in social and environmental costs into the price of gasoline would the result would be a four-fold price increase (Brown, 2008).

In order to be successful, sustainability efforts in the environmental and society factors need to correspond to economic impacts. Efforts to improve environmental and social factors should help to lower costs, increase profits, and create economic value while non-compliance should result in higher costs, lower profits and lost opportunity. While current sustainability efforts have been driven mostly from an advocacy perspective, a realization that our consumption levels have a cost impact on our natural and social capital may help direct efforts to nurture those resources. Consumers with a better understanding of the sustainability impacts are better equipped to make consumption choices, especially within their food choices.
3.2 Review Perspective

With a variety of sustainability evaluation concepts and approaches, the standards of reporting sustainability are emerging around general guidelines rather than specific measurements. Evaluating sustainability issues will be different for each industry, grouping and company, and can be dependant on specific situations, environments and conditions.

The Life Cycle Assessment approach and methodology have established evaluation standards, but requires the focus on a specifically defined product, service or process in order to evaluate specific impacts. In recognizing the diverse conditions within a food system, researchers at the University of Michigan developed a list of Life Cycle Assessment indicators designed to measure sustainability; however, these indicators are better analyzed at a local or regional level in order to provide meaningful results (Heller & Keoleian, 2000). (See Appendix 2)

As a local food system encompasses a wide diversity of products, producers and enterprises, it is necessary to take a general approach in evaluating its sustainability. In this sustainability review, we will be using a Triple Bottom Line approach by exploring sustainability issues related to local food systems within an environmental, economic and social context. The purpose of this review is to increase the sustainability knowledge base within a local food systems environment, and encourage additional discussion on foods and sustainability within the general food environment.
4: SUSTAINABILITY IN THE LOCAL FOOD SYSTEM

Increased awareness on sustainability issues among consumers brings an increased awareness to local food systems. As consumers take an interest in local food systems, food chains and policy makers are also taking note. Food is an engaging topic as we are all consumers, regardless of our economic status, profession, or geographic location. Similar to “local food” discussion, “organic” foods also have some variation on definition and meaning, and has evolved over many years into the current government legal definitions and certification standards. Even though the food industry been promoting “organic” food production for many years, it has taken several decades of discussions to establish legal and government legislated definitions only passed in the US in 2002, and Canada in 2009 (U.S. Department of Agriculture, 2002)(Canadian Food Inspection Agency, 2010). Even with established legal definitions, grassroots “organic” food producers consider these definition and guidelines to be lax and impractical. Given the challenges in establishing “organic” definitions and guidelines, efforts to get the “local” definition standards would be challenging. Despite those challenges, some enterprising non-profits recognize the need to educate consumers about local food guideline and designed accompanying certification processes for local producers. (Local Food Plus, 2010) While “local” certifications have yet to catch on with local producers, consumers have a better opportunity to learn about sustainability issues in foods by connecting with local food sources. With better knowledge, consumers are
free to make informed choices regarding whether to buy and consume local foods. Or not.
4.1 Environmental Factors

In this section, we review environmental factors within the sustainability context in local food systems. Environmental issues include the consumption and depletion of natural resources, both direct and indirect, the disposal of waste, and the effects on our natural capital. Our modern food system poses environmental challenges when industrial food processes cause problems in our environment. Local food systems supporters claim that local food enterprises deal with these environmental issues more sustainably. The first issue we review is food miles and the energy consumption in food systems. Next, we review the environmental issues within local farms in the local food system. And finally, we explore the cradle to grave approach in local food enterprises in addressing environment issues.

4.1.1 Food Miles and Energy Use

“Food miles” is a simplistic concept to describe the distance travelled by food from source to consumption, or farm to plate. Early local food supporters started to promote local foods when they realized the long distances that the majority of our food travels to market (Elton, 2010) For the concerned environmental citizen, food miles are related to the corresponding consumption of fossil fuels in transportation, and the resulting green house gas pollution and carbon footprint. Due to its simplicity, “food miles” enables the media and various food sustainability groups to bring attention and awareness to the sustainability issues in our food system. One study found that fresh produce in the modern food system traveled an average of 1,500 miles from farm to plate
within the US (Pirog, 2002). Using food miles as a representative of energy use in the food system is deceiving, as it only addresses the transportation portion.

In a study about food miles, researchers at Iowa State University examined the transportation of fresh produce to the Chicago Food Terminal, and found that food trucks traveled an average of 1,518 miles in 1998, a 22% increase over the 1,245 miles traveled in 1981, and over 30 times over the 44 miles that local foods traveled to market (Pirog, Van Pelt, Enshayan & Cook, 2001). Researchers compared food transportation in a convention, regional (Iowa-based), and local food systems, and found that conventional food systems used 4 to 17 times more fuel and released over 5 to 17 times more carbon dioxide emissions than regional or local systems (Pirog et. al, 2001). Canadian food mile researchers found food imports into the Waterloo Region in South West Ontario traveled an average of 2,794 miles (4,497 km) to market and contributed over 51,000 tons of greenhouse gases emissions (Xureb, 2005). If imported food products can be substituted with locally sourced food products, switching to a local food supply system can save in transportation fuel costs and minimize green house gas emissions.

Using food miles as the main representation of energy use in our food system is misleading because it only measures the energy use in the transportation portion of the food system. In a National Sustainable Agriculture Information report, researchers found that limiting the study of energy consumption in our food system to distance also fails to consider other
complexities such as mode of transportation, production methods, packaging processes, and diet choices (Hill, 2008). In regards to energy use in the food system, food transportation only accounts for 14%, with largest energy usage in agricultural production, processing and packaging at 44%, and home storage and refrigeration at 31% (Heller & Keoleian, 2000). (See Figure 2) Accordingly, consumers can make a greater impact on energy savings in their food choices by focusing efforts on dietary choices and food storage issues, rather than food transportation issues.

Figure 2 - United States Food System Energy Use - (Heller & Keoleian, 2008)

In the global food market, the food miles concept can threaten net food exporting countries, like New Zealand, Australia, Chile and Mexico. Countries in tropical regions, with more agriculturally friendly climates, have a longer growing season, and have a higher level of productivity with less energy use.
Recognizing the threat of the food mile concept, the New Zealand government sponsored a study of energy use of their food exports to the U.K. and found New Zealand food exports were more sustainable than U.K. local farming production (Saunders, 2006). New Zealand’s favorable climate, efficient production, packaging and processing enabled their products to use two to four times less fuel and energy than similar U.K. food products, even taking into account the transportation distance (Saunders, 2006).

Researchers at Washington State University studied food miles in egg transportation from food source to home and found that grocery store purchased eggs used less than 0.20 gallons of fuel, in comparison to farmer’s markets eggs at 0.63 gallons, while local farm purchased eggs used 2.41 gallons of fuel (Capper, Caddy, Bauman, 2010). The economies of scale in industrial food transportation enable a more efficient use of fuel, and local food system can not compete in regards to fuel use in food transportation.

As such, the reduction of food miles by turning to local food systems does not make a significant impact on a consumer’s overall energy footprint. As each local food region will have a differences in energy usage, due to geographic features, food supply situations, and access to agriculture food basins, food miles and energy statistics will also be different as well. Although food mile reduction is a poor justification to reduce energy use in the food system, local food supporters continue to use the reduction of food miles as a marketing and promotional factor in support local food systems (Hill, 2008). Although the support of local food
systems does not help reduce energy use in food transportation, there may be other environmental benefits.

4.1.2 Local Farmers – Back to Traditional Farming

The support of local food systems is often linked to the promotion of local farmers and local producers using traditional methods of farming. Traditional methods of farming evolve from the traditional concept of land stewardship where farmers, over many generations, take ownership of the evolution of their farm land using only those resources that are locally available. These concepts were historically necessary as traditional farms produced for and served only the communities in their local area. Traditional farming methods and concepts include farming methods, skills and techniques for agriculture and livestock farming that minimize the use of fossil fuels, pesticides and fertilizers. By reverting back to, or continuing the use of, these traditional farming methods, local farmers are making efforts to differentiate their product from industrially farm products, and to produce higher quality food, in an environmentally sustainable and economically profitable manner. In this segment, we explore some of the environmental impacts on local food producers who have turned back to traditional farming methods, and some of the environmental impacting their farms.

The large portion of traditional farming practices fall under the umbrella of “organic” agriculture. Organic agriculture encourages the minimization of off-farm inputs and promotes agriculture practices designed to restore, maintain, and enhance ecological harmony (Keupper & Gegner, 2004). Some organic
agriculture enthusiasts take the natural world concept into further into holistic concepts, such as biodynamic farming, by adjusting planting cycles according to moon phases to encourage higher quality and productivity (Society for Biodynamic Farming and Gardening in Ontario, 2010). The general organic agricultural concepts include crop rotation, cover crops, composting, intercropping, natural pest control, and natural plant nutrition as natural tools to encourage quality plant growth, in place of industrial fertilizers and pesticides (Keupper & Gegner, 2004). Organic concepts in livestock include use of organic produced feed, open air access, humane animal processing similar to the way farm animals were traditionally raised. The “organic” certification process enables organic food producers, who meet the requirements, mark their products so consumers can understand and trust the way they are produced. Certification process is important for large producers with larger market distribution, but may be impractical to smaller local producers who can not afford certification cost.

While local farmers may turn to traditional and organic farming methods to improve quality, marketability and sustainability of their products, it does not ensure the absence of environmental challenges.

With the emergence and evolution of the industrial food system, the average price of food and the profitability of farming decreased over time, thus leading some family farms to be consolidated into large commercial farming operations (Pollan, 2006). In order to compete with commercial operations, other family farms struggled to lower operational costs and boost production through the use of industrial inputs, like fertilizer and pesticides. Using industrial farming
methods on family farm operations, and competing with large commercial operations, have left many farmers with large operational debts, less profitability, and a high dependency on the industrial agricultural chemicals (Pollan, 2006). With the increasing consumer interest in local sustainable produce, some local family farmers are looking into options of converting back to traditional farming methods. The conversion from industrial farming practices to traditional sustainable farming methods may be more profitable, but it also takes several years, large capital investment, and intensive labor to return to productive farm land using traditional agricultural processes; this commitment is something most small family farmers are unable to afford (Tasch, 2008).

Using traditional farming methods, in a certifiable “organic” manner, does ensure that the food production to be entirely environmentally sustainable. Earthbound Farms, the largest organic mixed salad supplier in the U.S., ensures all their produce is grown organically, but in the interest of freshness, they still use conventional trucks and refrigeration methods that run off the conventional fossil fuel economy (Pollan, 2006). Despite best efforts to minimize their carbon footprint, environmentally conscious food producers, like Earthbound Farms, do not have any alternatives to using the established conventional food distribution system to get their products to market.

On the other hand, some farmers have given up the efforts to be organically certified in the efforts of local sustainability. In Virginia, Joel Salatin uses a local non-organic chicken feed for his chickens because the closest certified organic fee supplier is over 500 miles away (Salatin, 2007). In the
interest of environmental stewardship concepts, farmers, such as Joel Salatin, are finding the all-or-none approach to organic certification impractical, and would rather make more practical efforts in support of his own local economy.

There is fear that the conversion back to traditional farming methods would ignore the productivity gains from industrial agriculture, and further threaten global food supplies. Researchers from the University of Michigan reviewed sustainable and alternative agriculture studies and found that organic agriculture can realistically produce at the same levels as global levels of industrial agricultural production, and has the potential to have 50% higher productivity than the global average of agricultural production (Chappell, 2007). Although sustainability advocates believe traditional farming methods are better, there are other environmental and operational challenges to prevent wide-spread conversions.

The cost of operating a family farm using traditional farming methods involves a larger crop management system and higher labor inputs. Industrial farming practices, using high levels of fertilizer and pesticides, have contributed to the declining soil fertility and soil erosion, and threaten the existing productivity of existing farmland (Tasch, 2008). Traditional farming methods may advocate crop rotation and composting, but also requires a larger management and planning effort to coordinate multiple crop products over different lots to ensure the right balance of soil nutrients.

Despite the interest in local family farms using traditional farming methods, the price of locally produced food still remains higher than industrially farm
The economics of small family farms makes a wide-spread conversion to traditional methods impractical. Despite the positive environmental impacts of traditional farming methods on farming sustainability, the local family farm remains only as an alternative to the modern industrial food production system.

### 4.1.3 Cradle to Cradle Issues

Consumers of local foods at farmer’s markets feel it was important to support vendors with products that are sustainable, both environmentally and socially (Farmer’s Market Canada, 2009). The “cradle-to-grave” process is an environmental reporting approach that analyzes the inputs and outputs of a particular product, process or system. The “cradle-to-cradle” process build upon that approach with the view that there is no such thing as waste, and that one system’s waste to be another system's inputs (McDonough, 2002). In nature, one ecological system feeds another in a cycle where resources are used, absorbed, recycled, and regenerated. Carbon dioxide exhaled by humans and animals help feed plant growth. Animal manure and rotting plants become compost for the future plant growth. Considering that we live in a globally closed natural system, our current economic models have not been able to capture, nor price, the true cost of living; however new models are emerging in an effort to capture those externalities.

In an industrial system, such as our modern food system, inputs are broken down specific items, and sourced from systems that can provide them as quickly at the lowest possible price. Raw materials and other inputs are
harvested from natural resources with the expectation of immediate benefits, but little consideration is given to the assumption that these resources are endless, or that time is needed to re-generate those resources in the natural system (McDonough, 2002). Industrial systems rely on the ability to focus on a monoculture of defined inputs that simplify the production process. However, natural ecosystems thrive on the presence of diverse environments with complex systems that find balance naturally. Sustainability in the food environment similarly requires a presence of diverse systems that find a balance in local resources, energy flows, water supply, soil productivity, local customs, consumer needs, and local food consumption (McDonough, 2002).

Problems in the modern food system, from production to processing, emerge from very things that make it cost-effective and efficient, the centralization of inputs, production and outputs. These processes are designed to be cost-effective, do not take ecological and sustainability considerations into account unless there is a cost issue. In industrial farming operations, over-fertilization leads irrigation to spill excess chemicals into rivers and waterways, leading to algae blooms that choke off fish habitats (World Watch Institute, 2008). In industrial livestock operations, manure lagoons are built to capture the manure buildup from factory-like livestock conditions, where small problems in operations could lead to large environmental problems (Salatin, 2007). The centralization of inputs, processes, and outputs require additional attention to consider the upstream and downstream effects on the surrounding environment.
One reason industrial livestock operations and fish farms have become ecological disasters is that they have moved away from mimicking the environment that animals naturally exist (World Watch Institute, 2008). Traditional livestock operations and fish ponds played a complementary role in farming by providing fertilizer, providing labor, or even just feeding off the agricultural waste of an agricultural farm (World Watch Institute, 2008). In industrialized operations, livestock and fisheries production required large quantities of inputs to be acquired and stored, and waste products are allowed to accumulate in large quantities in one location.

As more environmental problems emerge from the industrialized food production system, consumers, companies are policy-makers push to develop better solutions. Governments may endorse best environmental best practices, but we forget that solutions are designed for specific industrial process problems, and are not full systems evaluations including further upstream and downstream considerations (Salatin, 2007). Government and private industry research solutions focus on large industrial solutions that are funded based on cost and economic activity, and often fail to consider other sustainable impacts, such as social and environment issues (Salatin, 2007).

There many potential solutions to specific environmental issue, the difficulty in identifying problem sources leads to difficulty in finding specific solutions. Between food producers and consumers, there are serious gaps regarding the understanding of sustainability, the different concepts about what is environmentally sound, economically viable or what is socially acceptable (Aiking
& de Boer, 2004). Consumers inherently have a distrust of large companies and their claims of sustainability and environmental initiatives, and generally have wider concepts of sustainability that include other social goals like fair wages and ethical practices. (Aiking & de Boer, 2004) As a result, consumers need to continue to educate themselves, and make their sustainable food choices, and large companies will make sustainability efforts that will follow consumer demands.
4.2 Economic Factors

In this section, we review economic factors within the sustainability context in local food systems. Economic issues deal with transactional money flow, value propositions and the economic development that drives the growth in our general society. In order for environmental and social efforts have some lasting effect, sustainability efforts need to have a positive and lasting economic impact. As industrialized concepts, such as centralized processing and economies of scale, entered into the food environment in interest of higher profits, lower costs and higher productivity in our food supply chain, and has led a small number of large companies to dominate the industry. From 1980 to 2008, the four largest beef companies were able to their control from 40% to 80% of the US market (Roberts, 2008). In the breakfast cereal market, four multinational food companies control over 83% of all sales and have considerable influence of the health of children’s nutrition (Albritton, 2009). Our modern food system discourages local food production because it centralizes food production to a small number of large processing plants in order to make food cheaper, more convenient, time saving, and labor saving to consumers (Wilk, 2006).

The modern food system has benefited consumers by lowering the price of food through economies of scale in food production, better production technologies, and centralized processing. However, the evolution of big food companies has contributed to the erosion of farm’s profitability by lowering the portion of the food dollar for farms from 40% in 1910 to less than 8% in 1997 (B. Halweil, 2004). Industrialized food companies have access to more technology
and financial resources to take advantage of new technology and processes, but fail to capture the cost of externalities, such pollution from manure ponds in livestock operations, or the destruction of local food system infrastructures. Locally produced foods are often unable to compete with the modern food system on price, and differentiate their product on other qualities such as freshness, variety, and production methods.

Although local food is usually priced higher than supermarket foods, the consumer interest in local food is rising. A USDA report claims the number of farmer’s markets have increased 300% from 1,755 markets in 1994 to 6,132 in 2010, and are estimated to have generated over $1 billion in sales in 2005 (U.S. Department of Agriculture, 2010). In the following sections we address some of the economic issues related to local foods in relations to the local regions, the local food producer and the consumer.

4.2.1 Local Multiplier Effect

In the US, over 40% of all food is purchased in the supermarket, with the five largest supermarket companies controlling over 42% of all grocery sales (Albritton, 2009). When consumers spend a dollar in a supermarket, most of this dollar is transferred to head office locations and out of the local community. Money that leaves the local community no longer has any positive economic impacts to the local economic base. As supermarket suppliers are not likely to be from the local area, payments to supermarket suppliers are also unlikely to bring any impact to the local economy.
A New Economics Foundation study reported that every $10 spent on local food businesses generates a $25 economic impact versus a $14 economic impact for the same amount spent at the local supermarket (B. Halweil, 2005). Money that stays within a local community can have big impacts, as money changes hands locally as locally-owned businesses tend to re-spend those dollars locally as well (DeWeerdt, 2009b). However, as our modern economic structures, including local economies, do not exist in isolation, and trading with other economic regions is essential to the survival of most economies. Shifting to local markets is a zero-sum game, as localized purchasing and job creation only takes away that income opportunity and job from another market (DeWeerdt, 2009b). However, in a post financial crisis environment, some regional governments with struggling economies are encouraging local spending in hopes keeping local dollars local and assist in the recovery process.

While some studies promote the benefits of local spending, they also highlight the economic impact missed by the lack of local spending. Researchers at the University of Minnesota set out to study the economic leakage in their agricultural farming region by looking at the economic flows in and out of their community. In 1997, they found the 8,400 regional farmers spent $947 million to grow farming products, and only to receive $866 million, resulting in a loss of over $80 million for the year (Meter, Rosales, 2001). In addition, these regional farmers spent an additional $400 million on farm inputs from non-regional suppliers, while regional families spent over $500 million on food from non-regional producers, and this added up to over $800 million leaving the local
economy per year (Meter, Rosales, 2001). Given the Minnesota region contains a large agricultural base, researchers determined if consumers shifted only 15% of their food dollars to local food sources, it would generate 2/3 as much economic impact as the regional farmer’s farm subsidies (Meter, Rosales, 2001). While this study does not examine consumer’s local food purchase patterns, there is an understanding that there is only a limited local food infrastructure and minimal support for local business in this regions, which is similar to issues in other agricultural regions in the US that are also struggling economically.

Although the encouragement of local food economy can have help to re-vitalization of a local economy, the basic economic theory of import substitution also applies. (DeWeerdt, 2009b) Local farms that change their products from corn to soybeans would forgo the income potential from one product for the risk and potential of another product. Local farms, currently supplying distant markets, that shift to local markets would forgo the income opportunity of that distant market, and risk the development of success of the local market and possibility less demand.

In reviewing various economic studies in Minnesota, Iowa and Washington regions, DeWeerdt projected that local economies shifting their food consumption to local sources should be able to create additional jobs and significantly increase the economic output in the region; however the local food movement is still new and too small to have impact on local economics in larger metropolitans like Seattle where only 1 to 2 percent of food purchases are local. (DeWeerdt, 2009b)
4.2.2 Local Food Local Farms

In order for the local food economy to flourish, consumers need to have access to from local farms and food producers. In the *End of Food*, Roberts describes the history of food production where production has increased as the food prices have fallen. Small food farmers and producers are being replaced by industrial farms and producers who have better resources to achieve more efficient outputs and to endure market uncertainties due to weather or global price changes (Roberts, 2008). By the mid-1980’s, over 2/3 of the US farming production was supplied by 1/3 of the farms, and further consolidations in the industry forced small farmers to be price-takers, who had little control over prices at the end of the season relative to the actual costs of production (Roberts, 2008). As a result, small farmers were being forced out of the farming business due to increased risk of price uncertainty, less access to resources, and lower profitability. The Tuttle family farm in New Hampshire, with a 400 year farming history, closed its doors in 2010 because it was unable to compete with large industrial farms with government subsidies and the modern food production systems, and found little support for local businesses that would have helped family farms and strengthen local communities (Klinkenborg, 2010).

The increasing interest in local food systems has renewed the consumer interest in food from local farms and other food producers. While one of the largest challenges from local farms has been the ability to connect and sell to the consumer, these channels are increasing with the grown of local farm markets, direct sales opportunities, and community supported-agriculture schemes. In
2009 study by Farmers Market Canada found over 500 farmers markets operating around Canada that were generating over $1.03 billion in sales, and contributed up to $3.09 billion economic value (Toneguzzi, 2009). A study from the USDA on Local Foods found that 6% of farms sold over $1.2 billion of food directly to consumers. (Martinez, 2010) It is clear that there is consumer demand for local farm market products.

Another challenge experienced by local farm producers in connecting with consumers is access to government resources and regulatory issues. Government food regulations, guidelines and rules designed for large industrial food producers, and provide a discriminatory high threshold for compliance to small local farm producers (Salatin, 2007). Industrial food producers have the ability to spread out the cost of regulatory compliance over a larger volume of production, and have the ability to weather food product issues, recalls, and poisonings (Salatin, 2007). Food legislation are often designed punish large industrial producers who violate public food safety issues. In reality for small farm producers is that any food safety issues would cause large financial distress as they would lose customers and revenue, where large producers would only suffer the hassle of large fines and product recalls.

Another challenge experienced by local farm producers is the availability of an affordable labor pool. As economies industrialized, farming labor jobs became less desirable, and local labor pools moved to higher paying manufacturing jobs in the urban areas. While a local small family farm always has jobs for the local labor pool, it is difficult to fill low paying jobs that require
hard labor (Salatin, 2007). In many ways, the small family farm is an important part of the infrastructure of a local economy, as it requires the support of the community as much as it needs community support. A family farm can not survive without the support of its neighbors, customers, and local community, and that support is essential in the preservation of expert local agricultural knowledge regarding its soil, land stewardship and local culture (Salatin, 2007).

4.2.3 Power of Consumer Choice

With the industrialization of the modern food system, an important factor enabling the economies of scale is the standardization of the product. As a result, the industrialization of food production encourages a food monoculture where food production companies minimize the variety of raw food products for easier production. This leads to a diminishing level of biodiversity in our crop production. According to the Global Crop Diversity Trust, in the last 100 years, the number of apple varieties grown in the US has declined from 7,000 to 1,400, and in that same period, we have lost 95% of cabbage varieties, 91% of corn varieties, 94% of pea varieties, and 81% of tomato varieties (Tasch, 2008).

According to Wilk, the contradiction of food capitalism comes when consumers strive to “decommodify” food by making it a personal, meaningful, cultural and social experience, while the food businesses struggles to make food into a generic easy-to-substitute commodity (Wilk, 2006).

Large industrial farming operations tend to grow large tracts of the same food product, while small local family farms tend to grow a large variety of produce. Although small local family farms have maintained their traditions and
continue to produce high quality products, and there are consumers interested in supermarket alternatives, the national infrastructure of agribusiness and large food producers have replaced the local economic network that once connected retailers with producers (Wilk, 2006). As consumers are becoming more educated and proactive, and technology has lowered the cost of marketing, local farmers are finding more ways to connect with their customers, such as farmers markets, direct-to-consumer sales, and community supported agriculture (Martinez, 2010).

Food distribution is one of the largest challenges for local food producers. In some regions, the local or regional governments invested in an environment where producers and consumers can connect. In Ontario, the provincial government founded the Ontario Food Terminal in 1956 to address issues of food distribution as the rising post-war population led to suburban growth and supermarket chains (Elton, 2010). In modern Ontario Food Terminal operates as a wholesale distribution point for fresh produce from international and local producers, and enables large and small businesses to have access to the same produce at large and small quantities at an equal level of access (Elton, 2010). While other large cities such as New York and Chicago have similar food terminal operations, many less densely populated areas in North America rely on large supermarket distribution operations to provide their fresh produce, and thus have less access local produce.

As consumers realize the control of large supermarket chains have on the availability of products, they are searching for ways to access alternative fresh
food from local vendors at local markets. As consumer interest in local foods increase, 7 of 10 of the largest grocery chains in the US have listed local foods as part of their strategic product plans, including such companies as Walmart and Kroger (Martinez, 2010).

As consumers are exercising their consumer choice by searching out for local foods, local farms and food producers are finding opportunities to build their business and connect with the local community. Surveys conducted at Canadian farmers market found that consumers were interested in local foods not only for their variety and high quality, but also in support of local businesses that operate in a sustainable manner (Toneguzzi, 2009). Although sustainability interested consumers spent a majority of their fresh food dollar at the farmer’s market, at least 20% of their food budget is still spent at supermarkets for other food items due to seasonal availability and other unavailable products (Toneguzzi, 2009).

While there are many benefits to encouraging a local food economy such as the ability to retain economy impact of the consumer spending dollar and to help local food producers, the increase of a local food economy is not sustainable if only economic aspects are considered. As a result, the discussion around the promotion of local food economies extends beyond the issues of money into sustainability, security and community. (DeWeerdt, 2009b)
4.3 Social Factors

In this section, we review social factors within the sustainability context in local food systems. Social issues arise from people’s interaction and relationship with other people, the community and the world around them. These issues include topics such as health and nutrition, education, community development, environment awareness, and happiness and well-being. Our current economic models pursue the concept of continuous growth and profit, but this pursuit can have a cost to our social, community and knowledge assets. Unfortunately, the loss and impact to the value of these assets can not be understood until we can quantify and measure those impacts in economic terms. In terms of driving, researchers at the Economist estimate the annual social costs of driving at over $300 billion, or 5% of GDP, and that includes costs from road construction and maintenance, loss of economic activity due to accidents and congestion, medical costs from pollution and accidents, and did not include any environmental costs from pollution and global warming (The hidden costs.1996). The continuous economic growth model requires a continual increase in global consumption, but a recent UK study shows that the 1961 was the last year that increased consumption led to increased happiness (Thompson, Abdullah, Marks & Simms, 2007). If increased consumption no longer brings our society a higher level of happiness, a new economic model may be required to include social factors.

When social issues can have a positive or negative impact on our economy, we begin to think of social issues as a form of capital. Social Capital is the value of our network of our social connections with people, our community
and our governing bodies, and can have a significant impact on how people live their lives (Nanetti, Leonardi, & Putnam, 1993). Knack and Keefer found that a higher level of trust in our governing bodies and our neighbors can also lead to a stronger economic performance in our community (Knack & Keefer, 1997).

Supporting the local food movement leads to an examination of our social values. As individuals, we desire to live a community with better social benefits, with better health, less crime and a greater sense of community, and we need to make an effort to ensure our economic activity helps meet those goals. Unfortunately, our current economic models do a poor job of measuring social capital, and also a poor job in measuring stability impacts on our financial or economic systems (DeWeerdt, 2009b). Even if we fix our economic models and get our environment priorities straight, business and governments can not function without the interaction of people dealing with culture and knowledge issues in their general community. (DeWeerdt, 2009b) The difficulty lies in the ability of measure social change, whether in progress or decline. Some social issues such as incidents of disease are easy to measure, while other issues such has the loss of the local knowledge base of soil and plant growth are difficult to measure. In the following section, we address some of the social issues in the context of local food systems including community, knowledge and security issues.

### 4.3.1 Food and Community

In the post World War II economy, when industrialization processes were applied to the food industry, the cost and availability of processed food
increased, ranging from fast food to frozen ready-made dinners. The onset of processed foods freed consumers from the time and expense of home food processing, with the hopes of more time to spend on family, culture and community, but the result is increased incidents of eating alone at a desk, on the run, in a car, and in front of a television (Roberts, 2008). Culturally and socially, many of the things we cherish about quality of life surround food and community, such as family, traditions, ethnic diversity and community identity.

As the modern food system directs consumers towards processed foods, these lower cost food products can only be found at larger supermarkets. These supermarkets are dominated by a small number of large food companies who can only survive by selling larger volume of products at a lower product cost, and including a portion of marketing cost designed to influence the consumer behavior (Albritton, 2009). The capitalistic instincts of the corporate food companies include lowering raw product costs, higher sales, and profit maximization without consideration of consumer education, health and community (Albritton, 2009). The capitalist nature of these companies also highlights the inefficiencies of the modern food system in capturing these external costs, and shows how the consumer ultimately pays for these costs, whether directly through health and environment, or indirectly through government enforcement and taxes (Albritton, 2009). As consumers experience more health incidents in their food system, they begin to lose trust in the ability of those systems to provide for them.
As the modern food system has added many layers of middlemen between food production and consumer, consumer relationships with food have become disconnected. In order to secure a level of trust in their food system, some consumers are seeking alternative food systems that enable them to connect directly to producers (Wilk, 2006). Local food movements, such as farmer’s markets, farm direct sales, urban gardens, and artisan food producers are providing these opportunities, and consumers are able to access the knowledge directly from food producers, and fellow food enthusiasts are able to share their knowledge about food as well.

In almost every culture, food serves as a social and pivotal function in the family and community. Not only is food an everyday occurrence, it is serves as an essential theme in every holiday and celebratory gathering when people gather to interact and share their time. According to Minsk, the social role of food is part of the re-evaluation process when people start to examine their own quality of life in terms of time spent with family and friends, as the value of good food, consumed with good company, has been taken for granted (Wilk, 2006). In addition, when food is no longer integrated with kin groups, communities and regions, there is a loss of the rich texture of daily social interaction contributes and supports the production, local distribution and consumption of food (Wilk, 2006).

As the interest in local sustainable foods gains momentum, the reasons extend beyond environment and economic into community concerns. According to Pinkerton, a successful local food movement needs to encompass every facet
of a community’s relationship to food, from sustainable farming practices to fair farm wages, and from nutritional value of produce to agricultural effects on local bird populations (Pinkerton, 2009). In addition, a local foods community aspect empowers consumers to determine their own food supply, to eat healthier, and to communicate and network with other people in the community to achieve these goals. Local foods businesses that understand the consumer’s need to connect with the community will be able to meet cater their product offerings to meet those needs and build a stronger community.

4.3.2 Knowledge Issues

With layers of middlemen and food companies between the food producer and the consumer, it is not surprising to find that people have become disconnected from their food. Beyond the retail price of food, most consumers do not comprehend the system of food production, distribution or processing. The increased consumption of processed foods in the western diet leads to higher instances of obesity, and other related health issues such as diabetes, heart conditions and cancer (Albritton, 2009). The modern food system has enabled the ignorance of consumers regarding the effects of food on their health, their community, and the environment. Although our market economy is based on the concept of free choice, there is a basic assumption that consumers make well-informed choices and have many options. The reality is much different.

In our modern food system, consumers may be upset to learn the real information regarding their foods. At the supermarket, an average 12oz. box of cereal selling for $3.50 contains less than 25 cents worth of grain (Roberts,
Processed foods have less nutritional value than natural foods, and need chemical additives for nutrients, taste and extended shelf-life (Albritton, 2009). Large food companies have an interest minimizing consumer awareness about their foods, and are only interested in increasing food consumption.

The food knowledge disconnection has possibilities to extend into the local agricultural farm knowledge basin. In local farming regions, many generations of family farms have handed down a deep knowledge base of the local climate, soil and growing conditions and this knowledge enables them to produce high quality food products (Trubek, 2008). As these small family farms struggle economically and large agribusiness companies put them out of business, this effectively erodes this knowledge base (Salatin, 2007). With the decreasing number of farmers with this knowledge base, large agribusiness is still experience crop losses, and despite additional pesticides and fertilizer, they fail to understand the regional environmental knowledge may hold good solutions (Tasch, 2008). With renewed interest in local food systems, the value of the knowledge base of a local farming community becomes more valuable. As each regional farming community will encounter different problems and issues, they will need to explore their own local food systems, and develop their own solutions.

As health problems from obesity are linked to the consumption of food, there is erosion to consumer trust in food information from large food companies. Consumers, however, have also off-loaded the personal responsibility of food safety to government agencies as it is difficult to access the knowledge and the information needed to make decisions regarding the food in the modern food
system (Salatin, 2007). In order to reclaim that responsibility, consumers are searching for opportunities to access that information from their food producers and other trusted information sources. Local food economies enable consumers to interact directly with food producers, and increase the opportunity to be educated. As with any market, there is no guarantee that food producers are telling the truth about their product. In a farmer’s market in Los Angeles, one farmer was unable to identify the local farm location of his produce, and his organic food was found with traces of pesticide (Parker-Pope, 2010).

Local food economies do not correct the knowledge gap problems in consumer’s relationship to food, but provide an opportunity for consumers to be educated to about their food production. As consumers increase their knowledge of food, local food economies, they are more equipped to make informed decisions regarding what they eat.

4.3.3 Food Security

The discussion of local food policies leads to discussion about food security. The food security issues are often linked to developing countries where civil unrest, climate issues, or social issues cause disruption to people’s access to food. In developed countries, food security issues are related to poverty, income, and access issues. In a “food secure” household, all members have assured access to enough food to live an active healthy lifestyle (Che & Chen, 2001). Alternatively, a “food insecure” household has problems or limited access to securing nutritionally adequate and safe foods in a socially acceptable manner (Che & Chen, 2001).
In 2009, 14.7 million U.S. households, or 1 in 6 people, that lived in food insecure households, with over one-third of those households containing children (Nord, 2010). In 1999, 1 in 10 Canadian families also lived in food insecure households (Che & Chen, 2001). Higher incidents of food insecurity were found in lower income households, both in Canada and US, where stability and access to money, resources and assistance were limited (Che & Chen, 2001). The presence of food insecurity is predominantly found in urban areas, rather than suburban, rural or outlying area, as urban citizens have less access to resources to grow their own food (Nord, 2010). Price and affordability are not the only factor contributing to food security in urban areas. In some cities, the absence of supermarkets in urban areas has contributed to the growth of urban food deserts, where there is limited access to affordable fresh food and food choices (Proudfoot, 2008). Urban food deserts usually appear in lower income neighborhoods where people have less access to transportation, and consumers can pay upwards of 1.6 times for groceries at local convenience stores (Proudfoot, 2008). As government officials recognize these problems, city planners are encouraged to explore policies that increase inner-city planning policies, such as transportation and zoning, to create opportunities for alternative food markets, such as farmer’s markets (Mead, 2008). Other local food solutions, such as urban community gardens and community supported agriculture, would also help to decrease urban food insecurity.

Factors contributing to food insecurity extend beyond the food chain. The real threat to agricultural land is urban development and the expansion industrial
development into traditional regional agricultural infrastructures in favor of railroads, warehouses and highways (Roberts, 2008). As the demand for global agricultural production increases, the amount of productive agricultural land decreases and further increases global food insecurity.

Another important risk factor in food security is the access to safe food supply. Modern food supply distributors often combine fresh food products from two or more farms, and rely on third party certifications to ensure food safety, which results in complicated trace back issues when there are problems in the product consolidation process (Martinez, 2010). Even in an era of heighten awareness of bioterrorism, there is little attention given to the potential threats in our food system. The vulnerability in the centralization of food production, food processing and warehousing enables the easy distribution both internal mistakes and external tampering in our food system (Salatin, 2007). Eating locally grown foods may be the best defense against hazards in our food system, whether introduced intentionally or not (B. Halweil, 2005). Local food producers are more vested and knowledgeable in the food production process, and have more to lose with bad food products. At local food markets, consumers can take ownership of their own food security issues by learning directly from food producers.

Local food systems may not be the solution to food security issues, but it provides an opportunity to reduce the food insecurity within any local area. At the local and region level, local foods enterprises, such as farmer’s markets, can help to minimize the presence of urban food deserts by providing mobile food markets for inner city residents. At a larger regional and national level, local food
systems can help diversify the risk from larger mainstream food systems in the event of a disaster by providing alternate food access to existing areas. Local food systems, currently at risk due to the mainstream food industries, are slowing rebuilding due to consumer and civic interest in the added value to the community, and the decrease in food insecurity.
5: CONCLUDING REMARKS

As we become aware of the sustainability issues in our modern food system, it is clear that our current level of consumption has an impact on our environmental, economic and social factors in our economy. A British Cabinet discussion paper reported that our existing patterns of food production do not align with the need for a lower carbon society with increasing resource constraints, and these issues, in light of climate change, will continue to threaten global and local food security (Pinkerton, 2009) The promotion of local food systems encourages consumers to take a greater ownership of their consumption choices through their food consumption.

Local food systems can have positive effects on economic, environmental and social issues and can provide some balance to sustainability issues arising from the modern food system. At a global level, every community is affected by local food security issues arising from price affordability, access to quality and quantity. Consumers in North America should be concerned about preserving food traditions in Africa, as we face the same type of issues in our own food environment (B. Halweil, 2005). In the past, these food traditions served an essential role in providing food to the local population, and by rebuilding those traditions, we can assist to bring some balance to a current food economy dominated by large food companies.

Local food systems can have a restorative impact on environmental, economic and social factors in local community. There are numerous advocacy groups that have promoted different aspects of the local food movement in the
past, and those numbers are growing to the benefit of consumers and neighborhoods (Elton, 2010). This growth has attracted a new class of entrepreneurs that are guided by sustainable goals that include social, environmental and economic goals (Hawken, 2007). Local food systems will not solve the world’s sustainability problems, but it can empower consumers to make better choices, and provide a balancing force in the efforts of sustainability.
Reference List


APPENDICES

Appendix 1- Summary of Key Indicators of Unsustainable Trends

<table>
<thead>
<tr>
<th>Economic</th>
<th>Social</th>
<th>Environmental</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Production</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Rapid conversion of Prime Farmland</td>
<td>• 52% of farm workers are illegal</td>
<td>• depletion of topsoil exceeds regeneration</td>
</tr>
<tr>
<td>• 84% of farm household income earned off-farm</td>
<td>• Age of farm operators increasing: declining entry of young farmers</td>
<td>• rate of groundwater withdrawal exceeding recharge in major agricultural regions</td>
</tr>
<tr>
<td>• Increasing number of farms report a net loss (48% in 1997)</td>
<td></td>
<td>• losses to pests increasing</td>
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<tr>
<td></td>
<td></td>
<td>• reduction in genetic biodiversity</td>
</tr>
<tr>
<td><strong>Consumption</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• costs of diet related diseases increasing</td>
<td>• obesity rates rising</td>
<td>• 26% edible food wasted</td>
</tr>
<tr>
<td></td>
<td>• diet deviates from nutritional recommendations</td>
<td></td>
</tr>
<tr>
<td><strong>Total System</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Marketing is 80% of food bill</td>
<td>• relations with food and its origins have been lost</td>
<td>• heavy reliance on fossil fuel energy</td>
</tr>
<tr>
<td>• Industry consolidation in food system threatens market competition.</td>
<td></td>
<td>• 7.3 units of energy consumed to produce one unit of food energy.</td>
</tr>
</tbody>
</table>

(Heller & Keoleian, 2000)
# Appendix 2- Life Cycle Sustainability indicators for Food Systems

<table>
<thead>
<tr>
<th>Stakeholders</th>
<th>Life Cycle Stage</th>
<th>Economic</th>
<th>Social</th>
<th>Environmental</th>
</tr>
</thead>
<tbody>
<tr>
<td>Farmers</td>
<td>Origin of (genetic) Resource</td>
<td>- degree of farmer / operator control of seed production / breeding</td>
<td>- diversity in seed purchasing and seed collection options.</td>
<td>- ratio of naturally pollinated plants to genetically modified / hybrid plants per acre</td>
</tr>
<tr>
<td>Breeders</td>
<td>Seed production, animal breeding</td>
<td></td>
<td>- degree of cross-species manipulation</td>
<td>- reproductive ability of plant or animal</td>
</tr>
<tr>
<td>Seed Companies</td>
<td></td>
<td></td>
<td></td>
<td>- % of disease resistant organisms</td>
</tr>
<tr>
<td>Farm Operators</td>
<td>Agricultural growing and production</td>
<td>- rates of agricultural land conversion</td>
<td>- average age of farmers</td>
<td>- rate of soil loss vs. regeneration</td>
</tr>
<tr>
<td>Farm Workers</td>
<td></td>
<td>- % of return on investment</td>
<td>- diversity and structure of industry, size of farms, # of farms per capita</td>
<td>- soil microbial activity, balance of nutrients / acre</td>
</tr>
<tr>
<td>Ag. Industry</td>
<td></td>
<td>- cost of entry to business</td>
<td>- hours of labor / yield / and / income</td>
<td>- quantity of chemical inputs / unit of production</td>
</tr>
<tr>
<td>Ag. Schools</td>
<td></td>
<td>- farmer savings and insurance plans</td>
<td>- avg farm wage vs. other professions</td>
<td>- air pollutants / unit of production</td>
</tr>
<tr>
<td>Government Animals</td>
<td></td>
<td>- flexibility in bank loan requirements to foster environmental sustainability practices</td>
<td>- # of legal farm laborers / ratio of migrant vs. local farm laborers.</td>
<td>- number of species / acre</td>
</tr>
<tr>
<td>Animals</td>
<td></td>
<td></td>
<td>- % of workers with health benefits</td>
<td>- water withdrawal vs. recharge rates</td>
</tr>
<tr>
<td>Food Processors</td>
<td>Food processing, packaging and</td>
<td>- relative profits received by farmer vs. processors vs. retailer</td>
<td>- # of active agrarian community orgs</td>
<td>- # of contaminated or eutrophic bodies of surface water or groundwater</td>
</tr>
<tr>
<td>Packaging Co.</td>
<td>and distribution</td>
<td>- geographic proximity of grower, processor, packager, retailer</td>
<td>- % of Ag Schools that offer sustainability programs</td>
<td>- % waste utilized as resource</td>
</tr>
<tr>
<td>Wholesalers</td>
<td></td>
<td></td>
<td>- # of animals / unit, time animals spend outdoors (animal welfare)</td>
<td>- veterinary costs</td>
</tr>
<tr>
<td>Retailers</td>
<td></td>
<td></td>
<td></td>
<td>- energy input / unit of production</td>
</tr>
<tr>
<td>Consumers</td>
<td>Preparation and consumption</td>
<td>- portion of consumer disposable income spent on food</td>
<td>- food safety</td>
<td>- ratio of renewable to non-renewable energy usage</td>
</tr>
<tr>
<td>Food Service</td>
<td></td>
<td>- % of food dollar spent outside the home</td>
<td></td>
<td>- portion of harvest lost due to pests, diseases</td>
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<tr>
<td>Nutritionists</td>
<td></td>
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<td>ibling</td>
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<tr>
<td>Health Professionals</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Consumers</td>
<td>End of life</td>
<td>- ratio of food wasted vs. consumption in US</td>
<td>- ratio of food wasted vs. donated to food gathers</td>
<td>- energy use in preparation, storage, refrigeration</td>
</tr>
<tr>
<td>Waste Managers</td>
<td></td>
<td>- $ spent on food disposal</td>
<td></td>
<td>- packaging waste / calories consumed</td>
</tr>
<tr>
<td>Food Recovery &amp; Gleaning Orgs</td>
<td></td>
<td></td>
<td></td>
<td>- ratio of local vs. non-local and seasonal vs. non-seasonal consumption</td>
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</tbody>
</table>

(Heller & Keoleian, 2000)