Expanding the role of design: developing holistic food systems

Jasmine Singh

Iowa State University

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Expanding the role of design: Developing holistic food systems

by

Jasmine Singh

A thesis submitted to the graduate faculty
in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE

Major: Architecture

Program of Study Committee:
Nadia M. Anderson, Major Professor
Jamie Horwitz
James Spiller

Iowa State University
Ames, Iowa
2015

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DEDICATION

To My Mentor.
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ACKNOWLEDGEMENTS

I am most grateful and indebted to my best friend and Mentor for His unconditional love and guidance. He was my constant source of confidence while writing this thesis. Through this thesis, He taught me to serve with equanimity, determination and patience. It was His prayers that made possible the miraculous and timely completion of this thesis.

I am grateful to my major professor, Nadia M. Anderson for giving me the opportunity to work with her. Her diligent feedback and thought-provoking questions were important in achieving clarity of concept and communication in this thesis. I would like to thank Jamie Horwitz and James Spiller for their valuable input and time. I wish to thank Anna Prisacari for her help in structuring this thesis.

I am deeply grateful to my dear friends, Dr. Trishna and Dr. Venkat for being my home away from home and for giving me support at times when I needed it most. I am deeply thankful to Dr. Rangan and Dr. Siddhartha for their encouragement and guidance in writing this thesis.

I would like to thank my dear mom, Manjeet Kaur and rest of the Singh family for their loving support.
Post World War II, technological and political factors prioritized economic efficiency in food production, distribution and access. Although this currently delivers benefits such as the doubling of caloric production and food availability despite geographic constraints, the food system is becoming implicated both directly and indirectly with a host of environmental and social issues.

This thesis re-frames food system issues as “wicked problems” (Buchanan, 1992, 15) and develops a framework of design tactics. The framework is used as a matrix for analyzing past and current theory and practice based design approaches that engage the food system and two university food systems. The analysis reveals the practical potential in design tactics for creating incremental shifts towards holistic food systems that have environmental and social components, thereby addressing contemporary food system issues.
CHAPTER 1: INTRODUCTION

By re-framing the food system as a wicked problem, this thesis develops a framework of design thinking tactics that have potential to incrementally shift the industrial food paradigm towards holistic food systems.

The contemporary U.S. industrial food system is becoming directly and indirectly linked with a host of environmental and social issues (Wallinga, 2009, 258; Horrigan et al., 2002, 445; Lobao and Stofferahn, 2007). This is because currently the food system prioritizes economic efficiency over environmental and social considerations. For example, over the last forty years, the use of chemical fertilizers and pesticides has been critical in doubling of caloric food production (Tilman, 1999, 5995). While the increase in food production help meet per capita food demand (Waggoner, 2005, 17), the use of pesticides and fertilizers also contributes to increased oil-dependence, water contamination and loss of soil productivity (Berry, 2009, 24; Pollan, 2008, 2; Horrigan et al., 2002, 447). Likewise, in the stage of food distribution, long distance transportation of food provides benefits such as year round food supply while also overcoming constraints of geography and seasonality (Halweil, 2002, 6). This comes, however, at costs such as increasing GHG emissions, limiting potential for self-sufficiency and prioritizing food shelf life over nutrition and freshness (Hill, 2008, 2; Pirog et al., 2001, 6). These environmental and social costs are interconnected and complex and are not addressed by the current food system goal of maximizing economic efficiency. These costs are discussed in detail in Chapter 2.

Chapter 3 re-frames food system issues as “wicked problems” (Buchanan, 1992, 15) that are defined as “complex, interacting issues evolving in a dynamic social context. Often, new forms of wicked problems emerge as a result of trying to
understand and treat one of them” (Ritchey, 2005, 2). By re-framing food system issues as wicked, this thesis investigates how design thinking can be involved in developing and implementing holistic food systems. This is done by synthesizing methods from designers who apply design thinking strategies, such as Tim Brown, Bruce Mau and William McDonough. The synthesis creates a framework composed of five strategies: asking innovative questions, developing holistic goals, building participatory systems, designing for future upcycling and testing prototypes.

This framework is used as a matrix in Chapter 4 to analyze past and current theory and practice-based design approaches that engage the food system. The past examples analyzed are Ebenezer Howard’s Garden Cities of To-morrow, Frank Lloyd Wright’s Broadacre City, Ludwig Hilberseimer’s New Regional Pattern, and Andrea Branzi’s Agronica. The current approaches are Urban Agriculture, Agricultural Urbanism and Continuous Productive Urban Landscapes. The analysis reveals that Howard’s Garden Cities and Bohn and Viljoen’s CPULs best incorporate holistic food system goals. Following this is a discussion of common patterns and obstacles faced by current design approaches in practical implementation.

In order to better understand the role of design in overcoming obstacles faced by current approaches in practical implementation, two university food system case studies are analyzed in Chapter 5 through the design thinking framework: SEED Wayne at Wayne State University, Detroit, Michigan and UMass Initiative at University of Massachusetts, Amherst, Massachusetts. Universities are uniquely positioned to develop and apply holistic food systems that contribute to local economic development and community engagement while also improving local food accessibility and thus providing economic, environmental and social benefits. This analysis connects back to Agricultural Urbanism and CPULs and demonstrates how
holistic food systems proposed by designers can be incorporated into contemporary conditions by using the various design thinking tactics in order to begin addressing food system issues and incrementally shifting the paradigm towards holistic food systems.
CHAPTER 2: U.S. INDUSTRIAL FOOD SYSTEM

This chapter introduces a summary of technological and political factors that contributed to the post World War II industrialization of the food system. Following this is a discussion on the benefits and issues resulting directly and indirectly from the food system stages of food production, distribution and access. These stages are investigated because design can have an immediate impact on them. The discussion of the food system benefits focuses on the goal of maximizing efficiency. Whereas the discussion on issues focuses on environmental and social costs. The benefits and costs are supported by examples derived from multiple disciplines. Next is a summary of how primary issues lead to secondary issues. This discussion is important for re-framing the food system problems as “wicked” and for introducing the need for “design thinking” tactics to begin addressing them.

Development of the U.S. Industrial Food System

Post World War II, key political and technological factors contributed to the industrialization of the food system with the intent of maximizing efficiency (Ikerd, 2010, 1; Pollan, 2008, 4). For example, the munitions industry was adapted to develop fertilizer and pesticide technology with ammonia being the common ingredient both in bombs and fertilizer (Figure 1). Likewise, there was a shift from manual labor to mechanized input. Earl Butz, who was President Nixon’s agricultural secretary from 1971-76, supported these changes in response to the challenge of cheaply feeding the growing middle class and with the intent of expanding U.S. exports in the international food market (Philpott, 2008, 1). The agricultural secretary envisioned a hyper-efficient food system that could produce an abundant supply of commodity
crops like corn and soy and manipulate them to create inexpensive food options.

These change also allowed the U.S. to increase grain export to foreign markets. This proved lucrative for U.S exports in 1972 as unfavorable climatic conditions in Russia led to food shortages (Ganzel, 2009, 1). As a result, the U.S and Russia settled upon the Russian Food Purchase of 1972, which has since been the largest grain deal between two nations in the history of the world. In order to achieve his goal of boosting food production efficiency, Butz promoted farmers to consolidate farmland
to “get big or get out” and to grow commodity crops “fence row to fence row” (Pollan, 2008, 4).

As a result, farmers abandoned traditional land stewardship practices that “balanced extractive activities with the regenerative capacities of the land” (Elmquist et al., 2013, 7). Instead they adopted highly specialized crop monocultures (Ikerd, 2008, 1). Monocultures are defined as “fields planted with a single crop species over a given season, typically over a very large area” (Picone, 2002, 1). Each farmer adopted the principle that “he could limit his investment to the equipment and routine skills needed to perform his sole task more efficiently” (Ikerd, 2008, 1).

Likewise, the stage of food distribution saw technological innovations under President Dwight D. Eisenhower who authorized the construction of the National Highway System by passing the Federal Aid Highway Act of 1956 (Weingroff, 1996, 1). This provided efficient transportation of food via trucks over long distances (Halweil, 2002, 6). The stage of food access also saw technological innovations that maximized efficiency. For example, the overabundance of calories derived from corn and soy monocultures were manipulated to supply the food market with inexpensive food options. The idea of eating pre-packaged meals such as “TV Dinners” emerged during this time.

This model of development prioritized economic efficiency but did not factor in environmental capital- the ecological systems that support life and social capital- our relationships with each other. It calculated efficiency by factoring in “built capital” such as machinery, factories and other built infrastructure (Costanza, 2008, 32). At the time, it was assumed that natural and social capital would remain abundant. However, over time, along with delivering economic efficiency, the food
system has become implicated with a host of environmental and social or health issues.

**Current Food System Issues**

Following is a discussion on the costs associated with the food system stages of food production, distribution and access.

**Food Production**

The advantage of industrial food production is the increase in efficient caloric output, given the minimal input of labor (Kirschenmann, 2007, 373). Caloric production has doubled over the last forty years (Tilman, 1999, 5995), and has been an critical factor in meeting with per capita food demand (Waggoner, 2005, 17). As mentioned earlier, this efficiency has been made possible by adopting practices such as monocultures and fertilizer and pesticide application.

However, these practices are contributing to a host of environmental and social issues (Figure 2). For example, monoculture practices imply absence of crop rotation, which tend to erode biodiversity, deplete soil nutrients and increase the risk of pest outbreak (Horrigan et al., 2005, 445). As a result, “modern agriculture has also come to rely heavily on nutrient inputs obtained from or driven by fossil-fuel based sources” (Pretty, 2008, 454) to maintain soil fertility. Wendell Berry, environmental activist, cultural critic and farmer, argues this dependence to be a major drawback:

[…] chemical fertilizers are required in vast amounts, they are increasingly expensive, and most of them come from sources that are not renewable. Industrial agriculture is absolutely dependent on them, and this dependence is one of its fundamental weaknesses (Berry, 2009, 24).
The industrial food system’s oil dependence implies that each calorie of food is backed up by calories of oil, and hence obstructs the food system’s sustainability post the peak oil period. Food activist, Michael Pollan writes:

[...] chemical fertilizers (made from natural gas), pesticides (made from petroleum), farm machinery, modern food processing and packaging and transportation have together transformed a system that in 1940 produced 2.3 calories of food energy for every calorie of fossil-fuel energy it used into one that now takes 10 calories of fossil-fuel energy to produce a single calorie of modern supermarket food (Pollan, 2008, 2).

The heavy fossil fuel dependence of industrial food production poses urgent concern for the food system’s future sustainability, because as Manning puts it, “as there is more oil in our food, there is less oil in our oil” (2004, 51). While the global demand for fossil fuels rises, the global production capacity of fossil fuels has peaked or will do so shortly (Kirschenmann, 2005, 1).

Other environmental issues due to industrial food production include excessive water consumption, pollution and soil degradation. Research reports that irrigating
industrial agricultural fields contributes to water scarcity as it consumes excessive water with little concern for the natural hydrological cycle that maintains water availability (V. Gold, 1999, 1). Additionally, Horrigan et al. (2002, 447) state that the U.S. Environmental Protection Agency has blamed current farming practices for 70% of the pollution in the nation’s rivers and streams, reporting that more than 173,000 miles of waterways have been polluted by runoff of chemicals, silt and animal waste from U.S. farmland. This has led to high levels of toxicity in ground and surface waters, which in turn are connected to water purification costs and other expenses related to health and decreased recreational opportunities (Tilman et al, 2002, 671).

Water contamination due to chemical run-off from farmland has gained concern on the national scale, as the Mississippi River and its various tributaries are blamed to be a major contributor to the dead zone in the Gulf of Mexico. This has led to a condition called hypoxia in the Gulf, characterized by oxygen depletion, which is “killing off immobile sea dwellers and driving off mobile sea life such as fish and shrimp” (Horrigan et al, 2002, 446). In its largest size, the Gulf’s dead zone has been recorded to be 20,000 square kilometers (Heller, Keoleian, 2000, 22).

Additionally, the industrial food production is documented to have negative impacts on the soil. On the topic of soil erosion, Berry states that, “it has been estimated, for instance, that at the present rate of cropland erosion Iowa’s soil will be exhausted by the year 2050” (2007, 23). The Environmental Working Group states that even by 1975, Iowa had lost one-half of its topsoil to erosion because of bad tillage practices. In addition, research suggests that industrial agricultural practices have caused a decline in soil productivity due to soil compaction, loss of soil organic matter, water holding capacity, biological activity and soil salination (Horrigan et al,
which collectively inhibit the long-term self-regulating capacity of the ecosystem.

Berry comments also on industrial agriculture’s impact on community welfare, “I have seen no attempt to calculate the human cost of such [industrial] farming—by attrition, displacement, social disruption, etc— I assume because it is incalculable” (2007, 23). In an extensive case study analysis, Labao and Stofferahn evaluate a pool of 51 case studies investigating the effects of industrialized farming on community well-being from 1930s to 2007. The conclusion of the investigation stated that that 57% of the communities suffered largely detrimental impacts, 25% suffered mixed impacts and 18% experienced no detrimental impacts due to industrial farming in the community. The authors summarize their research as follows “these studies provide a great deal of evidence over many years by researchers using different research designs, about the risks of industrialized farming on community well-being” (Labao and Stofferahn, 2007, 19).

**Food Distribution**

Technological advances in the transportation sector have enabled the distribution of greater quantities of food over longer distances. The national and global food transportation routes have created a “global vending machine” (Halweil, 2002, 6) where foods from around the world travel across centralized production, processing, distribution and access centers to reach their consumers, while at the same time overcoming previous constraints of geography and seasonality (Figure 3). As a result, the average distance travelled by produce from farm to plate is 1500 miles (Mariola, 2008, 194). Long distance food distribution provides benefits such as
Figure 3: Collage showing how technological advancement in the transportation sector has improved food availability by overcoming geographic and seasonality constraints. Collaged by author, 2015.

supplying food to densely populated areas, which are otherwise unable to secure enough food locally.

However, despite the advantages, long-distance distribution of food is implicated with environmental and social issues, such as GHG emissions, global warming, climate change, peak oil, concern over food freshness, local food self-sufficiency and economic and communal instability of small-scale farming communities. Long distance food transportation is associated with food miles, which
Food Access

The industrial food system provides the market with a diverse range of low-cost and convenient processed foods. This abundance of inexpensive food options is connected to the goals of efficiency that drive the food system. The U.S. food system
has become the “most efficient in the world, at least in terms of the dollar and cent costs of production” (Ikerd, 1996, 1). What it does well is “precisely what it was designed to do, which is to produce cheap calories in great abundance” (Pollan, 2008, 3). The abundance of cheap calories has made its way up the food chain and driven down the price of processed foods (Figure 4). As a result, Americans spend less on food than any other country in the world (Gates, 2012, 5). U.S. spending on food has been declining since 1930s, when a quarter of the disposable American income was spent on food. Today, the fraction has been reduced to a tenth (Pollan, 2008, 3). This reduction has been made possible because of the abundant supply of calories derived from monocultures of corn and soy, which are keystone ingredients in pre-packaged meals, soda, cereal and other processed foods.

Figure 4: Collage of post World War II (left) and present (right) fast food advertisements. Collaged by author, 2015
However, in an interview, the food activist and journalist, Michael Pollan points out that the diversity of food items is rather superficial, “there’s really just a small handful of ingredients being reconfigured into this astounding abundance of seemingly different things—lots of them have corn and soy and the same sweet food additives” (Platt, 2013, 1). In other words, the abundant supply of cheap calories is processed to flood the market with inexpensive food options, rich in salt, sugar and fat contents but poor in providing nutrition. The consumption of such food items, which may be out of choice or affordability, is associated with increased risk of several diseases such as coronary heart disease, cancer, stroke, diabetes, hypertension, overweight and osteoporosis (Frazao, 1999, 5). According to Pollan, since the 1960, the percentage of personal income spent on food has plunged from 18% to 9.5% while percentage of national health care spending has inversely peaked from 5% to 17-18% (2008, 2). The negative health impacts are expected to continue into the future. The Journal of the American Medical Association predicted that a child born in 2000 has a one-in-three chance of developing diabetes and because of diabetes, obesity and other accompanied health problems (Woolston, 1). These trends imply that as we have spent less on food, we have spent more on healthcare, suggesting that inexpensive food has external costs. Pollan aptly recognizes the achievement of a food system that targets economic efficiency as its end goal, “What an extraordinary achievement for a civilization: to have developed the one diet that reliably makes its people sick!” (2009, 3). The negative implications of the industrial food diet are particularly severe for future generations.

In summary, industrial food production, distribution and access are technologically and politically supported by goals that prioritize economic efficiency. While the food system achieves this goal, it directly and indirectly contributes to a
host of environmental and social issues. These issues need to be addressed for ensuring the long-term sustainability of the food system. For the 21st century, the industrial food system and its myriad of complex problems pose great concern, suggesting that “we might have to reinvent the food system altogether if we want the world’s population to stay fed and healthy for another century” (De la Salle, Holland, 2010, 12).

In designing a sustainable food system for the future, a holistic approach that takes into consideration the complex and interconnected nature of the food system issues is needed. With respect to the current development model, ecological economist Robert Costanza holds the view that the future will require the reconceptualization of criteria that factor into measuring human welfare. This will require “new vision, new measures, and new institutions” that allow us to see “the interconnections between built, human, social, and natural capitals, and build real well-being in a balanced and sustainable way” (2009, 373). This will require the paradigm to shift from goals that primarily focus on maximizing economic efficiency to include goals that are more holistic and also account for environmental and social welfare.
CHAPTER 3: REFRAMING THE ISSUE: DESIGN THINKING

Wicked Problems

Food system issues are complex, interconnected and have broad economic, environmental and social implications (Wallinga, 2009, 258; Horrigan et al., 2002, 445; Lobao and Stofferahn, 2007). The previous chapter exposes the complexity of these issues by illustrating how prioritizing short-term economic benefits harbors long-term environmental and social problems. Complex, interconnected issues with widespread consequences, such as those associated with the U.S. industrial food system, are what Horst Rittel and Melvin Webber (1973, 160) call “wicked problems” (Figure 5). Rittel and Webber developed the wicked problem concept while seeking an alternative to linear, step-by-step problem solving. Richard Buchanan later brought the concept into the field of design and defines it as “a class of social system problems that are ill-formulated, with confusing information, where clients and decision-makers have conflicting values and the ramifications in the system are confusing” (1992, 15).

As a result, wicked problems cannot be successfully treated with “traditional linear, analytical approaches” (Ritchey, 2005, 1). Wicked problems are different from “tame” problems (Table 1). Tame problems have a relatively well-defined problem statement, a definite starting point, an objective wrong or right solution and they belong to a class of similar problems and therefore can be solved in a pre-defined manner (Buchanan, 1992, 16). On the contrary, wicked problems, by definition are:

Ill-defined, ambiguous and associated with strong moral, political and professional issues. Since they are strongly stakeholder dependent, there is often little consensus about what the problem is, let alone how to deal with it. Above all, wicked problems won’t keep still: they are sets of complex, interacting issues evolving in a dynamic social context. Often, new forms of wicked problems emerge as a result of trying to understand and treat one of them (Ritchey, 2005, 2).
Figure 5: Food system graphic showing social and environmental costs, supporting the case that food system issues are wicked. By author, 2015.
Traditional, linear and analytical problem solving approaches using conventional tools and methods are more suited to solving “tame” problems, while complex and interconnected problems require an entirely new approach to problem solving (Ritchey, 2005, 2). Wicked problems, such as the problems in the industrial food system, therefore require alternative, non-linear design approaches. The theory of design thinking offers one such non-linear method.

Table 1. Characteristics of tame and wicked problems (Ritchey, 2005, 2; Buchanan, 1992, 16).

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<thead>
<tr>
<th>Characteristics of Tame Problems</th>
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<tr>
<td>Solution can be evaluated as right or wrong</td>
<td>No correct or wrong solution</td>
</tr>
<tr>
<td>Problem contained within a singular disciplinary framework</td>
<td>Interdisciplinary and stakeholder dependent and - little consensus about problem definition</td>
</tr>
<tr>
<td>Problem has a definite end point</td>
<td>Understanding and solving one problem often leads to new problems</td>
</tr>
<tr>
<td>Problem is static and solutions do not change over time</td>
<td>Problem is dynamic; solution may yield short-term results but fail over time</td>
</tr>
<tr>
<td>Problem can be solved using pre-existing disciplinary data</td>
<td>Complexity of data gathering and analysis leads to “analysis paralysis”</td>
</tr>
</tbody>
</table>

According to IDEO President and Chief Executive Officer Tim Brown, design thinking begins with the integrative ability to reshape existing constraints in order to create innovative solutions (2009, 1). This requires an holistic understanding of the relationships within a system as a whole (Mascarenhas, 2009, 15). In order to facilitate a system’s holistic understanding, design thinking involves the creation of a project “brief.” Brown describes the project brief as “a set of mental constraints that
gives the project team a framework from which to begin, benchmarks by which they can measure progress, and a set of objectives to be realized” (2010, 33).

The project brief in design thinking is composed of design constraints and creates a framework of specific project goals. At the same time, the framework is flexible enough to allow breakthrough ideas to emerge (Brown, 2009, 1). This flexibility is needed for engaging wicked problems, which by definition have no objective solution and tend to evolve over time. The benefit of creating a project brief or framework is that it allows for “integrative thinking,” defined as:

 [...] the ability to constructively face the tensions of opposing models, and instead of choosing one at the expense of the other, generating a creative resolution of the tension in the form of a new model that contains elements of the individual models, but is superior to each (Rotman School of Management).

Within the context of the U.S. industrial food system, integrative design thinking requires understanding the food system as a whole across its different stages as opposed to an isolated approach to each stage. As mentioned earlier, a major benefit of the holistic design thinking approach is that it allows the designer to view interconnections and re-shape existing constraints to create innovative design solutions (Figure 6). For example, with a linear problem solving approach, the application of oil-based fertilizers during food production and the disposal of food waste in landfills during waste management are treated as two separate problems in two distinct stages of the food system. As a result, in 2010 food and packaging containers accounted for an estimated 45% of landfill waste (United States Environmental Protection Agency, 2002, 1) and fertilizer production consumes about 40% of energy in industrial agriculture (Heller, Keoleian, 2000, 40).
Design thinking approaches the same scenario by linking the issues of fertilizer and waste. For example, food waste can be used to create organic compost that can then be used in the food production stage as fertilizer, thereby reducing the need for chemical fertilizers as well as landfill size. The benefit of this holistic approach addresses not only the immediate problems in the food production and food waste stages, but also mitigates related problems such as GHG emissions due to rotting food in landfills and the production of oil-based fertilizers.

This example illustrates the benefits of a holistic and integrative design thinking framework that is integrative and holistic. This approach has potential for managing short-term and related long-term problems by re-shaping existing constrains to create innovative and sustainable food systems.

Design Thinking Tactics

Derived from the work of design thinking strategists Tim Brown’s *Change by Design* (2014), William McDonough’s *Cradle to cradle: Remaking the way we make*
things (2002) and Bruce Mau’s Massive Change (2004), the following list represents key characteristics of design thinking as a problem-solving tool:

- Asking Innovative Questions
- Building Participatory Systems
- Developing Holistic Goals
- Designing for the Future
- Testing Prototypes (Figure 7)

Figure 7: Design thinking theoretical framework. By author, 2015.
These characteristics correspond to the characteristics of wicked problems, formulating a strategy for addressing these problems (Table 2):

**Table 2.** Characteristics of Wicked Problems and Design Thinking (Ritchey, 2005, 1; Brown, 2009, 1; McDonough, 2002, 132).

<table>
<thead>
<tr>
<th>Characteristics of Wicked Problem</th>
<th>Design Thinking Tactics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Problem does not have a pre-defined solution</td>
<td>“Asking the right questions” that challenge pre-defined solutions</td>
</tr>
<tr>
<td>Stakeholder dependent: little consensus about problem definition</td>
<td>Building “participatory systems” and consumer involvement in decision-making</td>
</tr>
<tr>
<td>Understanding and solving one problem often leads to new problems</td>
<td>Developing “holistic measures of progress” that holistically address systemic problems</td>
</tr>
<tr>
<td>Solutions may yield short-term results but fail in the long-run</td>
<td>“Designing for the future” and understanding the design’s life cycle impact</td>
</tr>
<tr>
<td>Objective data gathering and analysis leads to “analysis paralysis”</td>
<td>“Learning through making” prototypes, experiments, pilot programs</td>
</tr>
</tbody>
</table>

**Innovative Questions**

Tim Brown, in his TED Talk, *Designers- Think Big!* encourages designers to “start asking the right questions” (2009, 1). Brown’s view is supported by the Canadian designer Bruce Mau’s statement that “it’s not about the world of design, but the design of the world” (2004, 11). Mau calls upon designers to ask questions that view design’s adaptability as a way of thinking by fundamentally reassessing existing systems and processes. This ability to ask questions about accepted processes is especially critical in addressing wicked problems, which by definition cannot be solved using pre-defined approaches. Brown argues that, “When we face intractable social ills we are doomed to failure if we simply ask the same questions over and over again, expecting to receive different answers.” The benefit in asking new questions is supported by Brown’s argument that, “the greatest entrepreneurs and creative
problem-solvers exhibit an ability to ask surprising and insightful questions” (2011, 2).

Brown provides another important reason for designers to ask creative questions. He argues that with the progress of industrial society, design’s focus has been reduced to an ever-smaller canvas (2009, 1). For example, design is becoming limited to the design of objects as opposed to the design of larger issues such as world hunger, environmental degradation, and health crises. Brown argues that design can have a much bigger impact if designers apply design thinking to address wicked problems.

In the context of the food system, “asking the right questions” encourages the re-evaluation of where and how food is grown, processed, distributed, accessed, consumed and finally disposed. This also includes the re-evaluation of processes, geographic scales of operations, and the long-term impacts of production inputs and outputs. These questions re-evaluate food system goals, asking whether or not results are satisfactory in terms of social, health, and environmental as well as economic outcomes.

**Holistic Goals**

Brown (2009, 1) also encourages designers to take a series of “divergent” steps (Figure 8) to ensure that they do not default to conventional choices but instead make innovative explorations. The intent here is to broaden the scope of considerations to

**Figure 8:** Sketch by Tim Brown
develop more holistic goals. Brown’s steps of divergence are similar to the Cradle to Cradle author and architect William McDonough’s approach of “considering a variety of isms” (2002, 147) and “diversifying” the scope of design considers (2002, 123).

McDonough emphasizes the expansion of design considerations beyond immediate economic benefits. According to McDonough, economics alone is too narrow of an indicator for a system or society’s overall prosperity and success. He writes:

[…] if prosperity is judged only by increased economic activity, then car accidents, hospital visits, illnesses (such as cancer), and toxic spills are all signs of prosperity. Loss of resources, cultural degradation, negative social and environmental effects, reduction of quality of life- these ills can all be taking place, an entire region can be in decline, yet they are negated by a simplistic economic figure that says economic life is good (McDonough, 2002, 36).

This is supported by Brown who anticipates that, “more forms of value beyond simply cash... is going to be the major theme, not only for design, but also for our economy as we go forward” (2002, 1).

McDonough points out the drawbacks of placing value exclusively on economic benefits. He argues that in the race for economic prosperity, other forms of value such as long-term social activity, environmental impact and cultural activity are being overlooked. In McDonough’s words, the neglect of environmental and social benefits is the “consequence of outdated and unintelligent design” (2002, 43).

While encouraging designers to broaden design considerations, McDonough takes the position that focusing on a singular goal for a project creates instability in the big picture. He gives the example that businesses focusing on economic benefits alone miss out on creating value in other sectors. According to McDonough, the real magic begins when the project begins with pronounced concerns for environment or social equity, and eventually turns out to be “tremendously productive financially in ways that would have never been imagined if you’d started from a purely economic
perspective” (2002, 154). McDonough calls upon designers to abandon the economic gain oriented “strategy of tragedy” and to implement “a strategy of change” by broadening the scope of design considerations and developing more holistic project goals (2002, 42).

In order to facilitate this strategy of change, McDonough creates a visualization tool in the shape of a triangular fractal and designates the each vertex for one of three project goals: ecology, economy and social equity (Figure 9). McDonough actively applies this to individual products and buildings as well as effects on towns, cities and countries. McDonough describes his design process: “as we plan a product or system, we move around the fractal [visualizing tool], asking questions and looking for answers” (2002, 151). The designer asserts that, “ultimately it is the agenda with which we approach the making of things that must be truly diverse” (McDonough, 2002, 138).

Developing holistic goals has similar value in the context of the food system. The industrial food system currently measures benefits primarily through increased economic efficiency. Developing holistic food system goals means accounting for environmental and social costs.

**Participatory Systems**

Design thinking explores the “potential of participation” by encouraging collaboration across a diverse range of stakeholders in the decision-making process.
In order to facilitate this collaboration, Brown proposes that designers develop “participatory systems” that invite clients and consumers to cross boundaries between public, for-profit and non-profit sectors. Brown makes the case that design can have the greatest impact when it is taken out of the hands of designers and put in the hands of consumers (Brown, 2009, 1).

According to Brown, the benefit of facilitating participatory systems is that it can shift design from being a “passive relationship between consumer and producer to the active engagement of everyone in experiences that are meaningful, productive and profitable” (2009, 1). An added benefit is that developing participatory systems can incorporate user-feedback into the decision-making process. The direct involvement of the end-users of a product or a system helps more effectively “address the needs of the people who will consume a product or service and the infrastructure that enables it” (Brown, 2011, 1). In this way, developing participatory systems also facilitates grass-roots solutions as “high-impact solutions bubble up from below rather than being imposed from the top” (Brown, Wyatt, 2010, 3).

Developing participatory systems creates interdependence among the various stakeholders involved. McDonough holds the view that recognizing interdependence within a system promotes diversity and makes the system more resilient, especially when responding to change. McDonough illustrates the value of creating resilience through diversity and interdependence through his discussion of ecosystems:

The vitality of ecosystems depends on relationships: what goes on between species, their uses and exchanges of materials and energy in a given place […] In such a setting, diversity means strength, and monoculture means weakness. Remove the threads, one by one, and an ecosystem becomes less stable, less able to withstand natural catastrophe and disease, less able to stay healthy and to evolve over time. The more diversity there is, the more productive functions- for the ecosystem, for the planet- are performed (2010, 121).
Developing interdependent participatory systems is especially critical for long-term sustainability. McDonough argues that simplified systems that ignore diversity create more underlying problems, impeding the system’s long-term sustenance.

Building participatory systems through consumer involvement and between different stakeholders is especially important for wicked problems in the food system. For example, it is widely accepted that national and global food industry decisions are controlled by a handful of transnational corporations (TNCs) that are self-regulating and driven by goals of maximizing economic efficiency. These corporations have control over the various stages of the food system through vertical integration (Clapp, Fuchs, 2009, 160).

By developing participatory systems, however, new kinds of food systems can encourage civic involvement by inviting consumers to join the decision-making process. This has potential for expanding food system goals to include environmental and social benefits. It can also build local resilience in the event of a global market failure. For example, a distributed set of small but many local food system players such as co-ops, community gardens and farm-to-institution programs is more resilient because they are regulated through local consumer participation (Viljoen et al., 2005, 218). The distributed local food system can also recover more effectively from shocks and changes such as the energy transformations that are expected to occur during the post peak-oil period.

**Designing for the Future**

Buchanan writes that the essential problem for designers managing wicked problems is that they are designing for an unknown result. This implies that the designer has to “conceive and plan what does not yet exist, and this occurs in the
context of the indeterminacy of wicked problems, before the final result is known” (Buchanan, 1992, 15). McDonough refers to a similar concept called “feed forwarding” (McDonough, 2002, 145) which adds a temporal dimension to his design approach. He describes this as a process of “asking ourselves not only what has worked in the past and present, but what will work in the future. What kind of world do we intend, and how might we design things in keeping with that vision” (McDonough, 2002, 145).

Designing for an unknown future involves thinking through the environmental and social life-cycle impact of a design. With respect to environmental “future upcycling” (2002, 140), McDonough refers to the concept of eliminating waste by discussing how nutrient flow and metabolism in nature eliminate the idea of waste altogether (Figure 10). He argues that it is the responsibility of designers to imitate natural systems that do not produce waste but in turn replenish interconnected

Figure 10: Cradle to Cradle Principle.
systems. He anticipates that, “Ultimately, we want to be designing processes and products that not only return the biological and technical nutrients they use, but pay back with interest the energy they consume” (McDonough, 2002, 138).

Eliminating or reducing waste within the food system creates “closed-loop” food systems that imitate natural systems and are self-regulating (Viljoen et al., 2005, 39). They neither require external inputs such as chemical and oil-based fertilizers and pesticides nor produce externalities such as water and soil pollution and health costs. Instead, they contribute positively to environmental health.

In considering the future social impact of the food system through “feed forwarding,” designers can consider how food proceeds from one stage of the system to another and how consumers interact with it. This is important because 81% of the U.S. population currently resides in urban areas and as a result is disconnected from most food system stages (The World Bank, 2014, 1). Most consumers are unaware of where their food comes from or goes after it is disposed of as waste (Berry, 2009, 23). The present disconnect of consumers from food can be potentially repaired if designers apply “feed forwarding” (McDonough, 2002, 24) and envision not only how people eat but also how they interact with food across all stages of the food system.

**Testing Prototypes**

Rittel and Webber’s definition of a wicked problem states that wicked problems cannot be defined without solving them, or by solving part of them (McConnell, 2004, 345). This paradox implies that the problem must be solved once to define it and then solved again to create solutions that work. It requires an open-ended
approach that allows for uncertainty where designers engage the problem by choosing a starting point, knowing that there is degree of uncertainty involved in this choice. Brown’s design thinking resolves this paradox through the testing of “prototypes” so that instead of, “thinking about what to build, [designers can] build in order to think” (Brown, 2009, 1).

The benefit of this step is that prototypes speed up the process of innovation. Brown states that, “it is only when we put our ideas out into the world that we really start to understand their strengths and weaknesses. And the faster we do that, the faster our ideas evolve.” In this way, prototypes help designers learn about the viability of their ideas. This is especially applicable for addressing wicked problems, which by definition do not have an objective solution and require an experimental approach. In this way, the testing of prototypes helps evolve the design hypothesis towards “fitter solutions” (Brown, 2009, 1).

Prototypes or experiments can be useful in testing the viability of alternative food systems as an incremental transition towards alternative systems is more practical than an abrupt change. In the context of the food system, prototypes can occur at the various stages of the food system and can range from food growing techniques to participatory systems that revise measures of progress.

In summary, food system issues are wicked problems that can best be addressed through design thinking as articulated by Brown, McDonough and Mau. Since industrialization in the nineteenth century began to change urban/rural relationships including the food system, designers have articulated a range of approaches that deal with these new relationships. Considering these through a design thinking framework provides opportunity to evaluate these methods and adapt components of them to proposals for alternative, holistic food systems.
CHAPTER 4: DESIGN THINKING ANALYSIS

The previous chapter identifies five design thinking tactics. This chapter utilizes the design thinking tactics as a theoretical framework and analyses past and current theory and practice based design approaches that engage the food system. The past examples analyzed are: Ebenezer Howard’s Garden Cities of To-morrow, Frank Lloyd Wright’s Broadacre City, Ludwig Hilberseimer’s New Regional Pattern, Andrea Branzi’s Agronica. The current approaches analyzed are: Urban Agriculture, Agricultural Urbanism and Continuous Productive Urban Landscapes. The aim of the analysis is to understand how these approaches apply design thinking tactics and to understand the role of design in developing holistic food system goals and in their implementation.

Past Design Approaches: Agrarian Utopias

Twentieth Century designers have typically engaged the food system through the spatial reconceptualization of the relationship between the “urban” and the “agrarian” (Waldheim, 2010, 1). Designers have proposed agrarian-utopian models that explore the possibility of a decentralized form combining components of the urban with the agrarian.

Following is a brief summary of four agrarian-utopian models proposed by eminent twentieth century designers: Ebenezer Howard (1898), Frank Lloyd Wright (1932), Ludwig Hilberseimer (1944) and Andrea Branzi (1995). Apart from Andrea Branzi’s proposal, the rest of the proposals were in response to uncontrolled urban growth and congestion since the Industrial Revolution. The uncontrolled urban growth had caused a “pervasive fear of and revulsion from the nineteenth-century
metropolis” (Fishman, 1982, 10). Fishman further explains that the “uncontrollable forces unleashed” by the industrial revolution and growth were perceived as a “frightening and unnatural” phenomenon (1982, 10). In response to the negative social perception of the industrial city, these designers proposed a “radical reconstruction” (Fishman, 1982, 4) of cities with the belief that physical reconstruction would not only solve the urban crisis, but also the social crisis of the time.

These design proposals considered various aspects of urban planning such as social equity, architecture, transportation, communication and other infrastructure. However, these proposals were specifically chosen because they engage the food system either in extensive detail or at least to some extent. In order to keep the discussion focused on the role of design thinking in developing holistic food systems, each approach is analyzed through the design thinking theoretical framework outlined in the previous chapter.

**Garden Cities of To-morrow by Ebenezer Howard**

The Garden City concept was proposed by the English town planner Sir Ebenezer Howard in 1898 (Figure 11). Howard’s statement summarizes the core Garden City concept: “Town and country must be married, and out of this joyous union will spring a new hope, new life, a new civilization” (Fishman, 1976, 209). In order to visually communicate this concept, Howard proposed a town magnet and country magnet diagram and combined them to create a town-country magnet. The town magnet was associated with advantages such as high wages, opportunities for employment and free of disadvantages such as “excessive hours of toil, distance from work […] fearful slums that are the strange, complementary features of modern cities” (Howard, 1898,
The country magnet was associated with nature’s beauty and wealth, “beautiful vistas, lordly parks, violet-scented woods, fresh air, sounds of rippling water” (Howard, 1898, 470). By combining the town-country magnet, Howard held the view that:

“Human society and the beauty of nature are to be enjoyed together. The two magnets must be made one [...] Town is a symbol of society [...] and country is a symbol of God’s love and care for man” (Howard, 1898, 48).

The town-country union resulted in the Garden Cities. The City’s design by Howard would be a circular form, 1,240 yards from center to circumference, composing of 6 magnificent boulevards, each 120 feet wide. The centers were circular spaces dedicated to beautiful gardens and public buildings, the rings away from the centers had excellent built houses with ample surrounding grounds. Sometimes, the houses had common gardens and co-operative kitchens for local food production, preparation and consumption.

**Figure 11:** Garden Cities (top to bottom):
- Town Country Magnet. At http://urbanplanning.library.cornell.edu/DOCS/howard.htm
- Garden City. At http://urbanplanning.library.cornell.edu/DOCS/howard.htm
(Reps. 1). The outer ring of the town was programmed with factories, warehouses, markets, coal yards, timbre yards et cetera.

In summary, Howard’s Garden City devoted systematic attention to food issues, by addressing food production, distribution, collective preparation and consumption (Pothukuchi, 2000, 114). Howard’s proposal was successful in asking insightful questions about uniting town with country (Fishman, 1976, 209) and facilitating participatory systems through agricultural cultivation, which according to Howard would require co-operation amongst farmers and other processonals. The city was designed to self-regulate for the future as it considered organization of labor, recycling of urban waste and water. The city’s various residents gained employment by supplying labor for food production. All the fertilizer input was supplied by composting the city’s food waste and urban waste water was recycled to provide agricultural irrigation. The environmental and social components of the Garden City created a self-regulating and local food system.

**Broadacre City by Frank Lloyd Wright**

Broadacre City was proposed by the American architect, interior designer, writer and educator, Frank Lloyd Wright (Figure 12). Wright proposed Broadacre in 1932 as part of his book *The Disappearing City*. In his article, *Notes Towards a History of Agrarian Urbanism*, Charles Waldheim writes that Broadacre was regarded as the “clearest crystallization of Wright’s damning critique of the modern industrial city” (2010, 3). It important to note that Broadacre was conceived by Wright during the Great Depression when owners of family farms were abandoning their mortgaged fields and migrating elsewhere (Waldheim, 2010, 4).
Perhaps in response to the urban and agrarian economic crisis, Wright proposed an organic settlement model across an “essentially boundless plain of cultivated landscape” (Waldheim, 2010, 3). Wright utilized the Jeffersonian grid as its principal ordering system within which, he designed varying scales of modern houses which were interspersed with light industry, small commercial centers, markets, civic buildings, communication and transportation infrastructure (Waldheim, 2010, 3). Wright envisioned Broadacre residents “to enjoy houses sited amidst ample subsistence gardens and small-scale farms” (Waldheim, 2010, 4). The architect believed that human rights included the right “to the ground itself” (Wright, 1932, 345).

Broadacre’s most convincing design

**Figure 12: Broadacre City**
(from top to bottom)
- Broadacre City for *The Living City*, 1958, by Frank Lloyd Wright. At http://www.mediaarchitecture.at
- A square-mile section of Broadacre City, proposed to be a continuous fabric of inhabited landscape across the American continent. Frank Lloyd Wright, 1934. At dkolb.org.
- Frank Lloyd Wright’s Broadacre City. Allen Memorial Art Museum. At Oberlin College. At http://amamblog.tumblr.com
thinking strategy was in asking innovative questions that seek to resolve complex social problems. The project aimed to resolve the urban and agrarian economic crisis that was happening at the time of its proposal. Wright’s Broadacre combined the urban-rural economic constraints to design a new pattern of agro-urban integration characterized by economic self-subsistence. This economic self-subsistence was made possible through land-ownership and agricultural involvement in Broadacre (Waldheim, 2010, 4). Wright allotted a one-acre (4,000 sq meters) plot of land from federal land reserves to each resident of the city. Through this, Wright encouraged universal participation in local food production. Wright also engaged the stage of food distribution. The architect envisioned a “system of roadside markets [which would] enable the trade, sale, and distribution of personally produced food” (Lapping, 1979, 11). Through landownership and agricultural involvement, Broadacre also fulfilled the step of building “participatory systems”. However, Broadacre failed to design for the future. The city’s plan based off of the Jeffersonian grid rarely relented to extant environmental features such as waterways and topography, thereby not accounting for future environmental impact. Additionally, Broadacre’s ubiquitous highway, which encouraged automobile transportation failed to consider designing for the future as it did not account for the future possibility of running out of non-renewable oil reserves (Waldheim, 2010, 4).

The New Regional Pattern by Ludwig Hilberseimer

Ludwig Hilberseimer, who was a German architect and urban planner, proposed the New Regional Pattern (Figure 13). Hilberseimer aimed for an urban decentralization as a remedy for the ills of the industry city. He proposed for the “ruralization of the city and an urbanization of the country.” The proposal intended to
replace the “figure” or “hierarchy” of the industrial city with the creation of a new development pattern of dispersed “settlement units” (Bevz, Papoullas, 2014, 4).

In his book, *The New City: Principles of Urban Planning* (1944), Hilberseimer presented a settlement pattern with a series of arterial roads, flanked by residential and work units on either side (1955, 267). Similar to Broadacre, the New Regional Pattern’s residential units were “adjacent to fields and facilities of recreation [...] with small farms and vegetable gardens” (Bevz, Papoullas, 2014, 5). Like Wright and Howard, Hilberseimer highlighted the mutual benefit of bringing together the city and country:

> What is pleasant in the city life could be combined with the pleasantness of country life. The disadvantages of each way of life would disappear. The woods and forests along the river and around the lakes penetrating into the settlements would become better recreation spots than costly recreation parks. With the adjoining fields and meadows they would form a productive landscape (Hilberseimer, 1955, 267).

However, Hilberseimer’s scheme differed from Wright’s abstraction of the Jeffersonian grid, which did not relent to environmental features. Instead, the New Regional Pattern combined “infrastructural systems

**Figure 13:** New Regional Pattern

with built landscapes and used environmental conditions to produce a radically reconceived type North American settlement” (Waldheim, 2010, 5). As a result, the New Regional Pattern was informed by environmental considerations of topography, hydrology, vegetation and wind patterns.

From the design thinking framework, Hilberseimer’s integration of agriculture as a source of food production and recreation incorporates the design thinking tactic of developing holistic goals. Additionally, the New Regional Pattern incorporates the strategy of designing for the future as the design is environmentally responsive.

**Agronica by Andrea Branzi**

The Italian architect and designer, Andrea Branzi, proposed Agronica (Figure 14). Agronica was part of Branzi’s search for models of “weak urbanization” (Waldheim, 2010, 6). The radical utopia proposed the introduction of permeable and weak urban infrastructure into the landscape for facilitating “fluid urban activities” (Bevz, Papoullas, 2014, 6). In other words, Branzi proposed a productive agricultural territory in which “single elements of architecture (roofs, walls, platforms) would flow and group together or were dispersed according to necessity. In this way, a semi agricultural territory would be created where temporary service structures could coagulate” (Bevz, Papoullas, 2014, 6).

Branzi’s Agronica delineated the potential in infrastructure and ecology as non-figurative drivers of the urban form. Both Branzi and Hilberseimer chose to illustrate the city as a “continuous system of relational forces and flows as opposed to a collection of objects” (Bevz, Papoullas, 2014, 6). Implying that Branzi’s work, in some ways, prefigured the current interest in mapping how financial and ecological flows shape the modern low-density metropolis (Waldheim, 2014, 8).
According to Waldheim, Agronica also explored the potential relationship between agricultural and energy production to give way to a “territory for the new economy” (2014, 8) in which agricultural production would shape the urban form. Branzi compared the new landscape of Agronica to the idea of a three dimensional agriculture which would “guarantee the penetration of territory and space, no longer marked by closed confines” (Branzi, 2006, 10).

Agronica proposed a weak urban landscape, which like agriculture would be free and have no insurmountable barriers “where architecture [would] become a free availability of components and no longer coincided with the concept of buildings and stable typologies” (Branzi, 2006, 132).

Branzi’s explorations on the need for weak urbanism is supported by Juhani Pallasma’s view on the impact of strong and weak design principles:

Figure 14: Agronica
The dominant trends of town planning have been based on strong strategies and strong urban form, whereas the medieval townscape as well as the urban settings of traditional communities have grown on the basis of weak principles. Strong strategies are reinforced by the eye, the sense of distant control, whereas weak principles give rise to the haptic townscape of intimacy and participation (Pallasmaa, 2000, 5).

By proposing a weak urbanism where the most resilient feature is participation, Branzi’s Agronica fulfills the design thinking tactic of building participatory systems and designing for the future. Branzi compares Agronica’s weak urbanism to the traditional Indian urban landscape, which is:

made up not of architecture but rather of people’s bodies, colorful textiles and the decorations of their dress, which create[s] a lively fluctuating backdrop that is seemingly fragile, but in reality very resistant to the impact of the cultural and technological changes in society” (2006, 26).

In this way, Branzi’s Agronica considers designing for the future by anticipating the future need for flexible systems that can remain resilient through cultural and technological changes in society.

**Table 3.** Design Thinking Analysis of Past Design Approaches

<table>
<thead>
<tr>
<th>Steps in Design Thinking</th>
<th>Garden City</th>
<th>Broadacre City</th>
<th>New Regional Pattern</th>
<th>Agronica</th>
</tr>
</thead>
<tbody>
<tr>
<td>Innovative Questions</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Participatory Systems</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Holistic Goals</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Designing for the Future</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Testing Prototypes</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>
Common patterns

Howard, Wright, Hilberseimer and Branzi form a “coherent intellectual genealogy” (Waldheim, 2010, 2), which offer possibilities for agro-urban integration for designing holistic food systems. The common pattern across all four models is the radical decentralization of the urban form. These designers are opposed to the possibility of “gradual improvement” (Fishman, 1982, 4) and propose the design of a completely new landscape. This new landscape is designed with no particular site context, implying that, “the setting of these ideal cities was never any actual location, but an empty, abstract plain where no contingencies existed” (Fishman, 1982, 6).

As a result, the common and primary drawback across these models is that they do not pay attention to retrofitting existing cities of their time. This lack of attention to a particular site is problematic because it does not allow the design to address a given site’s unique constraints and requirements arising out of distinct characteristics such as socio-cultural demographics, environmental features, economic situation et cetera.

Contemporary Design Approaches

This section discusses three currently available theory and practice-based design approaches that engage the food system. They are urban agriculture (UA), agricultural urbanism (AU) and continuous productive urban landscapes (CPULs). This section reviews each design approach through its definition, goal, geographic scale of operation and extent of food system involvement. Following this is an analysis of UA, AU and CPULs through the design thinking framework in order to better understand how these they utilize design thinking tactics for developing holistic
food systems. This is followed by a discussion on limitations and obstacles of each approach.

**Urban Agriculture**

Urban agriculture has been defined in a variety of ways over time. For the purpose of this thesis, urban agriculture will be referred to as an umbrella term that covers a wide range of food growing and distributing practices that can occur in urban areas (Kauffman, Baikley, 2000, 3).

The history of urban agriculture in the United States dates back to a century. As early as 1890s, cities like Detroit, New York and Philadelphia were converting vacant lots into community gardens to grow food for local residents. During historically critical periods such as the Great Depression (1930s) and post World War II (1945), communities were producing their own food for gaining employment and ensuring food security respectively. During the 1970s also, community gardens were being encouraged as a sign of urban renewal, again with the intent of providing food, but also for recreational and other social benefits (Lawson, 2005, 195).

Today, urban agriculture in the United States focuses on providing opportunities to improve food security and access to healthy, culturally appropriate food (Hodgson, 2003, 14) both economically and geographically. Geographically, urban agriculture provides healthy food access in “food deserts” (Whelan et al., 2002 2083), where food retail outlets stock only processed foods and do not carry fresh fruits and vegetables. Economically, urban agriculture provides food affordability for individuals and families living in poverty (Golden, 2013, 8). Healthy food accessibility is critical for society’s health. In the city of Detroit which is currently a leader in urban agriculture initiatives, Dan Carmody, who runs Detroit’s thriving
Eastern (food) Market comments on the importance of healthy food accessibility as follows:

Food is typically one of the central organizing elements. Food is where justice meets economic viability and environmental sustainability. If you don’t have those three things, you can’t have a society that endures [...] You can’t have a food system where 20% of the people at the lower end of the economic totem pole eat only one seventh of the amount of fresh fruits and vegetables that the people at the top eat. Society can’t afford the healthcare costs of treating diabetes and hypertension and coronary disease because of their poor diet. We as a society have to figure out a way that people of all incomes can afford and access healthy eating. Urban agriculture provides opportunities to create and increase healthy food accessibility by exploring the potential of food production and distribution within urban boundaries (Viljoen, Bohn, 2014, 131).

In order to better understand how urban agriculture delivers its goals, following is a review of urban agriculture through the design thinking framework. The review explores the adaptability features and the environmental and social benefits of urban agriculture.

**Urban Agriculture Typologies**

![Figure 15: Examples of various urban agriculture typologies](image)

Urban agriculture can be implemented in a variety of typologies (Figure 15) such as institutional farms and gardens (university, hospital, schools) to commercial farms, community gardens and farms (Five Borough Farm, 2015, 1). These typologies can be further categorized into demonstration gardens, food pantry gardens, learning
garden, edible school gardens, restaurant gardens, victory gardens, wellness gardens et cetera (Phillips, 2013, 94). Moreover, urban agriculture can be prototyped through a range of physical features, such as in-ground planters, rooftop gardens, portable panels, greenhouses, hydroponic and aeroponic systems, vertical gardens and so on. These features can be adapted and installed in indoor as well as outdoor spaces (Figure 16). The range of prototypes and typologies offered by urban agriculture advance the design thinking tactic of testing prototypes. Through the testing of prototypes, unlike past design approaches, urban agriculture can better adapt to a given site’s constraints.

Figure 16: Examples of various indoor and outdoor urban agriculture prototypes

Additionally, urban agriculture advances the design thinking tactic of developing holistic goals by offering a range of environmental and social benefits. The socio-cultural benefits include supplying low-income residents with healthier and
more nutritious foods, improving the image of troubled neighborhoods, and
developing self-sufficiency and “civic ownership” among urban residents who grow
their own food (Kaufman, Baikley, 2000, 69). In this way, urban agriculture
initiatives help foster community revitalization and social resilience. The
environmental benefits include local and organic growing of food in urban areas,
thereby minimizing chemical run-off and water pollution (Viljoen et al., 2005, 39).
Growing food close to where it will be eaten reduces food miles, as food has to travel
significantly less distance, thereby cutting down on GHG emissions. Moreover, urban
agriculture provides a positive use for urban waste, by composting and using it as
fertilizer for urban food production (Viljoen et al., 2005, 39). It offers environmental
services such as increasing urban biodiversity, reducing heat-island effects, filtering
and slowing run-off, and aiding in storm-water management (McClintock, Cooper,
2010, 5).

However, despite the site-adaptability features and the range of social and
environmental benefits urban agriculture offers, it faces limitations and obstacles in
practical implementation (Kaufman, Baikley, 2010, 54). The primary limitation of
urban agriculture is that it cannot fully supply the food requirements of a given city or
region. Even the best and most innovative practices of urban agriculture will fall short
of being able to produce enough food for subsistence (De la Salle, Holland, 2010, 23).
Cities will always need to import food from outside sources, however, they will do
“less of it, (and) in a more focused, need oriented way” (Viljoen et al., 2005, 12). The
contributors of urban agriculture’s limitations range from social, institutional and
technical obstacles, discussed as follows. Moreover, “insufficient infrastructure and
supporting services” greatly limit the widespread implementation of urban
agriculture. Successful implementation of urban agriculture requires supporting
services beyond just production sites, such as local distribution and access (Lovell, 2010, 2512). However, these supporting services are currently lacking due to lack of government policy and institutional support. For example, local foundations, community development corporations, neighborhood organizations, and key state and federal government agencies tend to offer little support to urban agriculture. This is because the representatives of these institutions are generally unaware about urban agriculture’s benefits and are skeptical about long-term durability and significance (Kaufman, Baikley, 2000, 6). The lack of infrastructure and institutional support calls for the building of participatory systems between urban agriculture proponents and key institutional leaders and organizations. Another obstacle in implementing urban agriculture is the limited access to land on short and long-term basis. This is because urban agriculture has to compete with other land uses such as industrial, commercial or residential development, which offer more lucrative incentives for landowners (Lovell, 2010, 2500). However, the payback needs to expand beyond finances to include health benefits. For example, research at Rutgers University reveals that under certain conditions, increase in consumption of vegetables grown in Trenton’s community gardens saved approximately $500,000 per year in cancer treatment costs (Baikley, Kaufman, 2000, 71). This supports the need for expanding urban agriculture results to value health improvement. Finally, lack of successful management and business skills impedes urban agriculture. Typically, urban agriculture projects tend to operate too independently and fail to work together to promote the value of urban agriculture on a larger scale (Kaufman, Baikley, 2000, 73). This lack of cooperation suggests the need for building participatory systems among various urban agriculture proponents to increase connectivity and cooperation to give way to a more coherent urban agriculture movement.
In summary, urban agriculture aims to provide geographic and economic access to healthy foods through urban food production and distribution. It offers a range of typologies and features by which it can adapt to serve a given site’s constraints and opportunities. This adaptability component advances the design thinking tactic of testing prototypes. Urban agriculture also advances the development of holistic goals by providing environmental and social benefits. However, despite the wide range of environmental and social benefits urban agriculture can potentially deliver, it faces various obstacles in practical implementation. The obstacles and limitations faced by urban agriculture imply the need for building participatory systems and for making visible the environmental and social benefits offered by urban agriculture. The most pressing obstacles are lack of institutional and government policy support, uncertainty about economic returns, lack of food production and distribution skills, limited access to land and lack of coordination among various urban agriculture initiatives.

**Agricultural Urbanism**

The originators of agricultural urbanism terminology, Janine de la Salle and Mark Holland define it in their book *Agricultural Urbanism* as a “planning, policy and design framework for developing a wide range of sustainable food and agriculture systems” (2010, 30). While urban agriculture focuses on the stages of food production and distribution alone, agricultural urbanism is more holistic and engages food production, processing, distribution, access and waste management. Another key distinction between urban agriculture and agricultural urbanism is that urban agriculture typically operates in urban areas whereas agricultural urbanism operates on the urban and regional scales (De la Salle, Holland, 2010, 31).
Agricultural urbanism asks design thinking’s innovative question of how to “re-invite food back into the city to re-forge connections to the rural hinterland” (De la Salle, Holland, 2010, 29). It attempts to forge these connections to create a vertically integrated local food system that captures the value of local food as an economic driver. Vertical integration means that all stages of the local food system, from production to waste management, are coordinated by a singular business entity (Jurevicius, 2013, 1). Through the development of vertical integration, agricultural urbanism advances development of participatory systems. Moreover, agricultural urbanism proponents highlight that vertical integration of local food systems can contribute to the local economy and thereby ensure future food security (De la Salle, Holland, 2010, 34). By contributing to the local economy, agricultural urbanism has potential to overcome urban agriculture’s drawback of economic viability.

Agricultural urbanism also applies the tactic of designing for the future. For example, in the scenario that environmental or economic factors disrupt the global food market, agricultural urbanism provides future resilience and food security (De la Salle, Holland, 2010, 40).

Agricultural urbanism also improves environmental sustainability by creating “closed loops” between urban and rural infrastructure. Currently, the urban rural disconnect has created “open loops” where “large material flows” such as biomass and biosolids are being inefficiently managed. For example, biomass or corn is grown in rural areas, shipped to urban areas (which contributes to GHG emissions). Likewise, biosolids or food wastes from urban areas are landfilled or incinerated (to further emit GHG emissions). Agricultural urbanism aims to bridge this disconnect through creating closed-loop cycling of material flows between urban and agricultural lands, thereby opening up opportunities for “integrated resource management” where
“energy, water and organic resources can be exchanged, transformed, and used in ways that benefit both the food growing and the surrounding area” (De la Salle, Holland, 2010, 103). In a closed-loop urban rural cycle, food grown in rural areas would travel less for urban consumption and urban food waste could supply compost for rural food production.

Therefore, through the creation of a vertically integrated food system that provides economic resilience and the creation of closed loop food systems that provide environmental benefits, agricultural urbanism advances the design thinking tactic of developing holistic goals. Despite these benefits, agricultural urbanism faces obstacles in practical implementation due to the lack of participatory systems between public, private, non-profit, and academic groups (De la Salle, Holland, 2010). The key barrier to agricultural urbanism’s long-term sustainability is that these partnership systems are complex and constantly in flux. Therefore, in order to ensure long-term sustainability, agricultural urbanism targets the cooperation of government policy at the federal and state level (De la Salle, Holland, 2010).

In summary, agricultural urbanism asks the innovative question of how to re-invite food back to the cities and build urban-rural connections. It also expands the design thinking tactic of developing holistic goals that provide economic and environmental benefits. It provides economic benefits by promoting vertically integrated local food systems that are economically viable and which also promote the design thinking tactic of building participatory systems. It provides environmental benefits through the creation of closed-loop connections between urban and rural infrastructure for more efficient and “integrated resource management” (De la Salle, Holland, 2010, 103). The closed-loop food system mitigates the problem of food
waste and minimizes the need for external fertilizer inputs, thereby addressing environmental issues in industrial food production.

**Continuous Productive Urban Landscapes (CPULs)**

Continuous Productive Urban Landscapes (Acronym: CPULs, Pronounced: See-Pulse) is an urban design theory proposed in 2005 by architects and educators Katrin Bohn and Andre Viljoen. According to the authors, CPULs result from overlaying the spatial concept of “continuous landscapes” with the sustainable concept of “productive urban landscapes” (Viljoen et al., 11). The goal of the CPULs is to be productive in economic, socio-cultural and environmental terms. The primary generator of “productivity” in CPULs is implementation of food system related activities such as food production, processing, distribution, access and waste management in both urban and rural landscapes.

A basic step-by-step implementation of CPULs can be understood as follows (Bohn, Viljoen, Howe, 2005, 13).

- Identifying existing green infrastructure such as parks, gardens, lawns, urban farms
- Identifying additional spaces for programming green infrastructure such as roof tops, parking lots, building front and backyard spaces
- Creating continuous landscapes by:

![Figure 17: Diagram showing CPULs implementation](image)

physically, visually and programmatically connecting these spaces

• Creating continuously productive urban landscapes by: programming these spaces with food related activities (Figure 17).

![Figure 17: An Edible Middlesborough.](image)


Like agricultural urbanism, CPULs aim to develop urban-rural connections and engage all the stages of the food system. They expand beyond the urban core and stretch across peri-urban, sub-urban and rural landscapes. Programmatically, they provide a range of functions such as parks, urban forests, green lungs, movement axis et cetera. By doing so, they enable activities typically associated with the rural such as
agricultural productivity to occur in the urban and activities of leisure and escape associated with the rural to take place in the urban. However, CPULs are distinct as they offer “city traversing open spaces and walking landscapes” (Viljoen et al, 2005, 11) that are activated with food system related activities (Figure 18).

CPULs advance the design thinking strategies of developing holistic goals. They provide environmental, economic as well as social or educational benefits. Parallel to agricultural urbanism, CPULs attempt to develop “closed-loop” food circuits and reduce the embodied energy in food. The growing of food in urban and peri-urban areas offers potential to “establish a healthy and sustainable balance of production and consumption [...] It is an effective, practical, but at the same time self-beneficial way of reducing the embodied energy in contemporary western food production” (Viljoen et al., 2005, 12). The creation of a closed-loop system provides environmental benefits at every stage of the food system:

• Local and organic food production: No pesticide and fertilizer is used in production, therefore no there is no associated water, soil and air contamination.

• Local distribution: Local food distribution results in significant reduction of food miles and GHG emissions. This also helps gain energy independence in the context of peak oil and reduce embodied energy in food.

• Local access: CPULs produce abundance of fresh fruits and vegetables and help in realizing fresh food accessibility for urban residents, both geographically and financially (Figure 19).

• Waste: Since food is produced and consumed in and around the city, food wastes are cycled back into urban and rural food production as compost, thereby reducing the need for external inputs (chemical fertilizer and pesticides) and cutting down on environmental costs associated with landfills.
The unique feature of CPULs that makes it distinct from previous approaches is the emphasis on utilizing food as an educational tool that integrates various aspects of food sustainability into daily life (Viljoen et al., 2005, 58). According to the authors, the introduction of food system related activities into daily experiences has potential to bring people closer to the very processes of the food system that sustain us. Implying that such integration has not only environmental but also educational benefits to offer.

The educational benefits have value because a large percentage of the urban population is so far removed from food related processes (Berry, 2005, 20) and is unaware of food-related issues. However, urban-rural connections provide educational opportunities to bridge this disconnect. An example of food education is how people can make informed food choices by considering their food’s
environmental impact. For example, some foods such as processed and meat foods have higher embodied energy (Horrigan et al., 2002, 445). For example, 1 kg of beef requires 7 kg of grain and 7000 tons of water to grow the feed-grain. This implies that cattle have an enormous environmental footprint and are most energy inefficient in converting grain calories into meat (Horrigan et al., 2002, 445). Such food education has value in informing eaters about the environmental impact of their food choice. Another example of educational value is in making informed food choices with respect to human health. For example, high intake of saturated fats in processed and meat foods is linked to chronic degenerative diseases (Frazao, 1999, 5). The CPULs authors also support the argument that unhealthy diets are to be blamed for chronic diseases as they “generally contain excessive amounts of fat and sugar and insufficient vitamin and mineral-rich fresh fruit and vegetables or carbohydrate-rich staples such as bread and potatoes” (Viljoen et al., 2005, 59). The CPULs authors argue that poor-dietary patterns are due to the lack of education, and the lack of economic and geographic access to stores providing a range of healthy produce. In response, the CPULs authors propose that integrating the food system into daily life experiences is likely to improve dietary pattern by providing access to fresh fruits and vegetables and by providing education about “where, how and when crops are grown” (Viljoen et al., 2005, 60).

Another important component of CPULs is a focus on implementing urban agriculture into key institutions. For example, CPULs authors hold the view that incorporating food growing activities into schools for educational purposes has potential to supplement traditional subjects like sciences, geography and newer cross-curriculum subjects like environmental sciences. The benefit of food integration into academic institutions has potential to enhance “quality of life of students and citizens
by providing a change of environment and a heightened sensual experience, which is not reliant upon the trappings of consumerism” (Viljoen et al., 2005, 58). From the design thinking framework, such integration could help overcome food system obstacles and build participatory systems across different food system stakeholders.

In addition to environmental and educational benefits, CPULs offer avenues for generating income through food related business opportunities. The CPULs authors propose that the main CPULs food production will occur on small to large crop fields as per the unique CPULs fragment, which will be worked on by “local occupants who rent the land and work on it commercially within an individually defined local framework” (Viljoen et al., 2005, 12). This implies that CPULs can potentially offer commercially viable business and job opportunities for local urban residents.

However CPULs face obstacles in implementation due to lack of sufficient models documenting the widespread benefits of urban agriculture. Although there is plenty of research and practical models demonstrating the life-cycle impact due to embodied and operational energy in buildings (Viljoen, 1997, 1), “few studies have examined the nature or recognition and integration of agriculture into regulative frameworks for urban land-use” (Viljoen et al., 2005, 61). Consequently, there is lack of documented models supporting the citywide application of urban agriculture and CPULs that highlight benefits. Another major obstacle is that cost-benefit analysis of land-use proposals tend to prioritize immediate economic benefit (Kaufman, Baikley, 2000, 54). Because of this, landowners tend to prioritize land-uses such as housing, commerce and industry over agricultural use (Viljoen et al., 2005, 62). In order to utilize land and infrastructure for urban food integration, cost-benefit analysis need to expand to include environmental and socio-cultural benefits offered by CPULs.
In summary, CPULs ask the innovative question of developing continuous urban rural traversing landscapes that are activated with agricultural productivity through agriculture prototypes. It focuses on developing holistic goals that offer environmental, social and economic benefits. Through providing environmental benefits, CPULs advance the strategy of designing for the future. By implementing urban agriculture into key institutions, CPULs help realize the design thinking tactic of building participatory systems. As a result, the CPULs approach fulfills all the steps in the design thinking framework.

**Table 4. Design Thinking Analysis of Current Design Approaches**

<table>
<thead>
<tr>
<th>Steps in Design-Thinking</th>
<th>UA</th>
<th>AU</th>
<th>CPULs</th>
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<tbody>
<tr>
<td>Asking innovative questions</td>
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<td>✓</td>
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<tr>
<td>Building participatory systems</td>
<td>✓</td>
<td>✓</td>
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<tr>
<td>Diversifying design considerations</td>
<td>✓</td>
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<tr>
<td>Designing for the future</td>
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<tr>
<td>Building prototypes</td>
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**Common Patterns and Obstacles in Implementation**

From the analyzed past and current approaches that engage the food system, Garden Cities and CPULs best excel at engaging the various design thinking strategies and in developing holistic food systems. This is because the Garden Cities concept has a well-developed social component of building participatory systems between farmers and other professionals for local food system engagement.
Moreover, the Garden Cities design includes communal food preparation and dining areas, through which food can be used as a tool for building social integration, thereby further advancing participatory systems. The Garden Cities concept is also well developed from the environmental sustainability perspective because it elaborates on how urban waste and water can be recycled to provide fertilizer and irrigation for local food production. The CPULs strategy advances the step of building participatory systems by engaging key institutions with the food system. It also provides environmental, economic and social benefits and advances holistic food systems. Through providing environmental benefits, CPULs help in the advancing the design thinking tactic of designing for the future. Both Garden Cities and CPULs excel at engaging the design thinking strategies and developing holistic food systems.

However, these design approaches have limitations and face obstacles in practical implementation (Kaufman, Baikley, 2000, 54):

- Obstacles due to lack of visibility of successful models
- Obstacles due to goals that prioritize economic returns and do not consider environmental and social benefits
- Obstacles due to lack of food system related skills
- Lack of highlighting local food system benefits
- Lack of government policy support
- Lack of collaboration across non-profit and for-profit local food system groups, institutional leaders and other key stakeholders
CHAPTER 5: UNIVERSITY FOOD SYSTEMS

The previous chapter analyzed past and current design approaches that engage the food system. It also identified limitations and obstacles that current design approaches face in practical implementation. This chapter explores the benefits of developing sustainable university food systems that advance holistic goals. It goes on to discuss the unique position of universities in overcoming obstacles faced by current design approaches in practical implementation. Following this is a case study analysis of university food systems: SEED Wayne at Wayne State University, Detroit, Michigan and UMass Initiative at University of Massachusetts, Amherst, Massachusetts. These case studies are analyzed in terms of how they engage the design thinking tactics and implement components of current design approaches, thereby improving local food access, community engagement, supporting local economic development, in order to address contemporary food system issues.

Benefits in Developing Holistic University Food Systems

Universities have a unique role in developing holistic food systems for several reasons. They are uniquely positioned for helping students develop healthy dietary behaviors through “experiential learning” (Bartlett, 2011, 101), through theoretical and applied inter-disciplinary research (Feenstra, 2002, 99) and through increasing “institution-wide commitment to environmentally sustainable practices” (Horwitz, 2011, 142). Moreover, by creating healthy food environments, institutions have potential to “influence and promote healthy dietary behaviors and to help ensure appropriate nutrient intake” (Dietz, 2009, 1). In this way, universities can educate students and staff about the broader environmental and social impact of food choices.
Given this influence, universities have the responsibility and opportunity for “building the next generation of workers, citizens, and leaders, and [universities] need to take to heart the dictum that healthy minds require healthy bodies, and ensure that healthy food choices are available on their campuses” (Pothukuchi, 1999, 194).

Universities are also an active catalyst of inter-disciplinary research and application by “integrating theoretical work with the applied and the pragmatic” (Feenstra, 2002, 99). This makes universities the ideal experimental ground for developing holistic food systems which require collaborations across various disciplines such as nutrition, sociology, philosophy, economics, community development, planning et cetera and which bring students and professors across the campus together to offer interdisciplinary research and education (Pothukuchi, 2011, 194).

Along with supporting inter-disciplinary research, university food systems can contribute to local economic development. Given a university’s institutional scale of purchasing and marketing capacity, universities have potential to connect local growers with eaters and make a significant contribution to their local economy. For example, university initiatives such as on-campus food production, campus farmers markets and local food procurement have potential to be utilized as strategies for local economic development. Pothukuchi confirms that, “capturing even a fraction of these dollars and targeting them toward local and regional producers through a campus farmers market could make a significant difference” (2011, 194).

Finally, universities can bring both public and academic attention to the food system through a variety of medias such as conferences, research papers, university courses et cetera, thereby adding visibility to holistic food systems initiatives. This visibility component is extremely important in institutionalizing current food system
initiatives and in ensuring their long-term implementation. Additionally, universities have the commitment to the production of knowledge and many are also committed to engaging partnerships with their community. Therefore, by building university-community engagement, universities can potentially engage their larger community in developing holistic food systems.

In order to better understand the role of universities in developing holistic food systems, two university food systems are analyzed: Wayne State University and University of Massachusetts as they are active in advancing holistic food systems and their initiatives are well documented in journal articles, websites and documentaries.

**Wayne State University, Detroit, MI**

SEED Wayne is a model for collaboratively building sustainable food systems on the university campus and in Detroit neighborhoods, through activities in teaching, research, community engagement, and campus operations (Pothukuchi, 1). Kami Pothukuchi who is an associate professor in the planning department at Wayne State University founded it. The program has strong educational components as it actively engages “students and others to examine the broader implications of their food choices. It calls for a critical assessment of the problems posed by the industrial food system to the health of local communities, economies, environments, and cultures, even as it makes cheap food abundant” (Pothukuchi, 1). A primary goal of SEED Wayne is to improve local food accessibility, actively engage the community and utilize food as a tool for local economic development. The program’s activities include on campus food production in gardens, rooftops, parking lot, food distribution through cafeteria collaboration, campus weekly farmers market and food waste
Figure 20: Mapping SEED Wayne analysis. By author, 2015
management through cafeteria composting. In the surrounding community, SEED Wayne helps with year round food production in a greenhouse and other urban farm sites. It assists neighborhood corner stores to carry fresh fruits and vegetables. The program is also involved with the Detroit Food Policy council to foster food security, justice and sustainability by developing research, planning tools, policies and programs (Pothukuchi, 1).

SEED Wayne improves local food accessibility through the Wayne State Wednesday’s Farmers Market. Established in 2008, the market runs from the beginning of June till the end of October, offering a range of farm-fresh produce, herbs, flowers, honey and other freshly prepared foods from the city and the region (Pothukuchi, 2013, 1). From the design thinking framework, the farmers market serves as a model for building prototypes for testing alternative marketing of locally grown food. Another SEED Wayne component that improves local food accessibility is the Detroit FRESH project. The project helps connect local growers to neighborhood corner stores. Through Detroit FRESH: The Healthy Cornerstone Project, SEED Wayne canvases to the local community about the community’s willingness to shop at the local grocery store and their shopping preferences. The program communicates these findings with the neighborhood stores, provides linkages to produce distributors, assists in marketing and communicates the store’s capacity of carrying fresh foods back to the neighbors (Pothukuchi, 2013). In this way, SEED Wayne helps in building local consumer-supplier partnerships and in enriching the local economy. In an interview, Pothukuchi narrates her thoughts on Detroit FRESH and its work with three pilot projects in which she has worked with three corner stores:
These are mostly liquor stores to get them to carry more fruits and vegetables. We did a lot of canvassing in the neighborhood and talked to them to see if they’d be willing to shop for fruits and vegetables at the stores and then asked them what they would like to see and then connected the store with the distributor (Pothukuchi, 2013).

From the design thinking framework, the Detroit FRESH project also helps in building participatory systems between food distributors and retailers. The building of participatory systems provides opportunities for community engagement. This is applicable also to the Wayne State Wednesday farmers market, which is a “flagship activity for SEED Wayne” and a platform for university-community engagement. Pothukuchi shares that:

Farmers markets are so important for the community. They help connect eaters with the sources of their food... Farmers markets are also great for a neighborhood because they enliven a neighborhood and create all kinds of buzz. They are like an event, a social event, people come by just to do people watching, they’ll grab a snack and they’ll sit here for an hour at an end (Pothukuchi, 2013).

Being the flagship activity, the market creates visibility for SEED Wayne within the community. It also overcomes obstacles due to lack of food system related skills by providing a variety of participatory opportunities such as interaction with local growers, chef demonstrations et cetera. This further helps in building participatory systems. Another component of community engagement is SEED Wayne’s university lectures and student led workshops on various food sustainability issues. For example, lectures held in Pothukuchi’s class, Cities and Food are open to the public and are a medium for holding university-community based collaborative discussions where community and nationally based food experts are invited to speak on sustainable food system topics, thereby furthering the development of participatory systems.
Apart from improving local food access, local community engagement, SEED Wayne utilizes food as a tool for local economic development. For example, the farmers market connects local and regional food growers to university students and community members who make up a large consumer population. By hosting the farmers market, the university campus becomes a connecting platform between growers and eaters. Moreover, strategies like supporting food stamps, such as SNAP, ensures that growers and eaters derive full benefits for their dollar value. In Pothukuchi’s words, “they (farmers markets) help generate what’s called a multiplier effect, so that for every dollar that is spent in the market, 2 dollars actually get generated because of the spin off that is created and it helps keep money in the local economy, much better than a grocery store would” (Pothukuchi, 2013). Not only does the campus farmers market target food dollars towards local growers and boost the local economy, but it also helps in creating “green jobs” for the local community.

According to the 2010 economic assessment, Wayne State University’s Farmers Markets put nearly $30,000 in the hands of local producers, $10,000 in food stamps and $6,000 in the University’s Double Up Food Bucks Program through Fair Food network (Pothukuchi, 2011, 196).

Along with local economic development, the farmers market provides environmental benefits through local food sourcing. As mentioned earlier, locally sourced foods travel much less to reach the eaters, thereby reducing food miles and mitigating associated issues such as GHG emissions. Same applies for SEED Wayne’s farmers market and the Farm to Cafeteria program that connects local growers with on and off campus cafeterias. In addition to local food sourcing, SEED Wayne also runs a cafeteria and residence halls composting project with the idea of building a closed-loop food system and demonstrating a model where food wastes are
composted using a variety of methods and are coming back into the soil. The compost is then used in fertilizing campus vegetable and herb gardens (Warrior Demonstration Garden and St. Andrews Allotment Garden), which are worked on by student groups along with staff who lease the plots seasonally to grow vegetables and herbs for their own use or for distributing produce to food assistance sites (Pothukuchi, --). This parallels with the agricultural urbanism approach of utilizing food as an economic driver to build vertically integrated local food systems that are not only provide economic resilience but are close looped and provide environmental benefits.

In summary, SEED Wayne improves local food accessibility, facilitates community engagement and utilizes food as a tool for local economic development. From the design thinking framework, SEED Wayne tests the alternative marketing of local food through the farmers market prototype. It connects local food distributors to retailers such as neighborhood corner stores through the Detroit FRESH: Healthy Cornerstore Project, thereby building participatory systems. SEED Wayne’s initiatives parallel agricultural urbanism through the creation of vertically integrated closed loop food systems that are economically and environmentally beneficial.

University of Massachusetts, Amherst, MA

The University of Massachusetts’s UMass Permaculture initiative focuses on improving local food accessibility, community engagement and local economic development. The initiative was founded in 2010 by an interdisciplinary student-led Permaculture Committee, described as “a group of passionate students that engage and educate the campus community about permaculture and sustainability” (UMass Permaculture, 1). The co-originator of the term permaculture defines it as
Figure 21: Mapping UMass Initiative analysis. By author, 2015
“consciously designed landscapes which mimic the patterns and relationships found in nature, while yielding an abundance of food, fiber and energy for provision of local needs” (Holmgren, 2012, 3). In accordance with the definition, the UMass Permaculture Initiative designed a “unique and cutting edge sustainability program that transformed grass lawns on the campus into diverse, edible, low-maintenance, and easily replicable gardens” (Geber, 2012, 1). This idea of converting under-utilized spaces into agriculturally productive landscapes is similar to the design thinking strategy of testing prototypes and the design of CPULs. On the university campus, the initiative has transformed quarter acre of a grass lawn near the Franklin Dining Commons into the Franklin Permaculture Garden, which now supplies food to UMass dining services. Since 2010, the initiative has expanded into four on campus permaculture gardens and two permaculture gardens at local elementary schools in the surrounding community (UMass Permaculture, 1). Through the permaculture gardens, the initiative increases local food accessibility and like CPULs, it also provides social and educational benefits of engaging the local community. For example, 2500 students, staff across various disciplines and local community members have become involved in the building of the permaculture gardens. From the design thinking framework, community engagement has helped build participatory systems between the university and the surrounding community.

Another component of the UMass Permaculture Initiative is how it is “changing the way students interact with their food and surroundings” (UMass Permaculture, 1). This connects back to CPULs which integrate food sustainability into daily life with the intent of bringing about awareness towards environmental impact of food. The UMass Permaculture Initiative serves as a vehicle for integrating food sustainability as part of student campus life, with students reporting that they
come to volunteer at the garden between classes and the space has become a venue for “empowering hands-on learning opportunities, beautiful gathering and an educational space for volunteers, classes, groups, and community events”. Like the CPULs strategy of building closed loop food systems, the UMass Permaculture Initiative recycles UMass cardboard and woodchips to create 1.5 million pounds of compost (UMass Permaculture Initiative, 1). This idea parallels the design thinking tactic of designing for the future, which in this case means reducing the need for external inputs and building closed loop food systems. This idea is similar to the CPULs strategy of reducing embodied energy in food. Another component that reduces food embodied energy is that since 2010, the UMass Residential Dining has made it a “priority to source fresh, nutritious, local produce” (Horwitz, 2014, 1). The dining service collaborates with a local farmer running “Czajkowski Farms”, a reliable and consistent partner, who in turn expands his network to include other local farmers and acts as a local aggregation and distribution center for UMass Residential Dining. From the design thinking framework, this further facilitates community engagement and the building of participatory systems across different local food system stakeholders. Another component of community engagement that the UMass initiative provides is the university’s Revisioning Sustainability Conference, that invites “change-makers” nationally and internationally to re-envision food sustainability.

Along with improving local food accessibility and community engagement, the UMass Initiative contributes to the local economy. The UMass dining has signed on to the Real Food Challenge to commit to reaching 20% real food (which is locally procured) in their overall food spending by 2020. As of 2013, UMass spent $1.8 million on Real Food which puts the university at an estimated 8% Real Food (Lavallee, 2014, 1). This indirectly supports local economic development as
partnerships between local growers and the university help keep the dollars circulating in the local economy.

In summary, the UMass Permaculture Initiative asks the innovative question of converting under utilized grass lawns into agriculturally productive permaculture gardens, both on campus and in the surrounding community. Through the design and building of these gardens, the initiative builds participatory systems through community engagement. These gardens supply produce to the UMass Dining Services, thereby reducing the embodied energy in food. University cardboard and other wastes are recycled as compost to fertilize these gardens, thereby further minimizing embodied energy. The initiative helps real world food system issues by mitigating chemical run off that pollutes water, depletes soil nutrients. These concepts parallel the CPULs ideas of reducing embodied energy in food through the development of closed loop food systems and through integrating experiences of food sustainability into daily student life.
CHAPTER 6: CONCLUSIONS

This investigation began by considering the role of design in developing and implementing holistic food systems. The discussion on industrial food system issues in Chapter 2 revealed that the current food system prioritizes maximizing economic efficiency and does not factor in environmental and social costs that are directly and indirectly associated with the industrial food system. The complex and dynamic nature of these environmental and social issues supported the case that food system issues are wicked and need an innovative design approach for engaging them.

In order to investigate the role of design in developing and implementing holistic food systems, a design thinking framework was developed in Chapter 3. The various design thinking steps identified were: asking innovative questions, developing holistic goals, building participatory systems, designing for the future and testing prototypes.

This framework served as a matrix for analyzing past and current design approaches that engage the food system. The analysis revealed that Ebenezer Howard’s Garden Cities and Bohn and Viljoen’s CPULs were most effective in engaging the various strategies in the design thinking framework and in developing holistic food system goals. Howard’s Garden Cities utilized the strategy of asking the insightful question of uniting the city with the country, developing participatory systems between farmers and professionals and considering future upcycling by reusing urban waste and water as fertilizer in local food production. CPULs likewise utilized the design thinking strategy of asking the innovative question of designing continuous urban rural traversing landscapes that are activated by agricultural productivity. CPULs also utilized the strategy of designing for the future by creating closed loop food systems that convert urban waste into fertilizer. They developed
holistic goals for providing environmental, social and economic benefits and emphasized food education in key institutions. The involvement of key institutions with local food systems incorporated the design thinking strategy of building participatory systems. Following this was an identification of obstacles faced by current design approaches in implementing current design approaches.

In order to better understand the role of design in practical implementation of holistic food systems, two university food systems were analyzed in Chapter 5: Wayne State University, Detroit, Michigan and UMass Initiative at University of Massachusetts, Amherst, Massachusetts. The analysis of Wayne State University revealed that, like Agricultural Urbanism, SEED Wayne utilized food as a tool for local economic and community engagement by for example, holding weekly farmers markets and connecting surrounding corner stores with local growers. The analysis of University of Massachusetts revealed that, like CPULs, the UMass initiative converted vacant spaces into food production by, for example, converting under-utilized grass lawns into permaculture gardens for food production. The UMass initiative utilized the design thinking strategy of building participatory systems by involving students across the university and community members in the building of the permaculture gardens. UMass Dining further advanced participatory systems by procuring food from local growers. These case studies demonstrate how holistic food systems proposed by designers can be incorporated into contemporary reality, using the various design thinking tactics to begin to address food system issues.

Limitations

While this study investigates many facets of design thinking as an approach to addressing contemporary food system issues and the case studies present integrated
models of holistic food systems, this study is limited in two ways. First, it investigates only three current design approaches to creating holistic food systems. There are numerous permutations of these approaches as well as additional methods that were not investigated. In addition, only two university food systems are analyzed. There are many other universities and colleges that vary in scale and approach to local food systems as well as other non-higher education situations that present holistic models for local food system development.

**Future directions**

Based on the limitations listed above, future directions could involve the analysis of more design approaches that engage the food system. Moreover, the study could expand beyond university institutions and analyze other key institutions such as elementary schools and hospitals to better understand their roles in overcoming barriers and shifting the paradigm towards holistic food system goals and implementation.
REFERENCES


Rotman School of Management Website, University of Toronto. “Definitions of Integrative Thinking”.


