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## **AN ECONOMIC ANALYSIS OF URBAN AGRICULTURE**

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*Abstract:* - As consumers increasingly look to eat locally produced food, for reasons such as to support the local economy, to protect the environment, and to understand better where food is coming from; urban agriculture is becoming a growing trend but with little research done about its cost effectiveness. This study examines the economics of urban agriculture, in particular looking at the business models urban greenhouses adapt to be profitable. By analyzing literature and business models of existing, successful urban greenhouses, we determine trends within the sustaining businesses. We find that urban greenhouses typically either target niche markets, adapt a social business model, or utilize abandoned or low cost land to make a profit. While there is still work to be done to develop a robust financial analysis of these businesses, these trends of successful greenhouses will inform prospective urban greenhouse owners of possible routes to success.

*Key-Words:* - local food, locavore, urban agriculture, urban farming, social business, social capital, urban greenhouse

### **1 Introduction**

As technology improved over the course of the 19th and 20th centuries and transportation became quicker and more cost effective, the returns to mechanized labor increased relative to the returns to manual labor, leading to the rise of large, industrialized, rural farms and the decline of small, local farms [1]. With transportation gaining efficiency and lower taxes and cheaper land in rural areas, it was more cost effective for these industrialized farms to operate in rural areas. The movement of farms out to rural areas transitioned the power over the food system from regional municipalities to the growing food corporations, which resulted in the absence of farming from cities, despite city planners advocating for the inclusion of agriculture in urban areas [2]. Decades later, consumers are increasingly looking to eat local, for reasons such as to support the local economy, to protect the environment, to understand better where food is coming from, and to increase food security [3]. Due to high costs associated with moving agriculture back into urban areas, farmers must find creative ways to derive profit, such as targeting niche products or markets, adapting a social business model, or finding low cost land on which to grow if they want to produce in urban areas closer to the end consumer.

### **2 Historical Background**

Improving forms of transportation at the end of the 19th century decreased the cost of moving products from place to place. With regards to the agricultural industry, this allowed the use of fertilizers and the distribution of surplus goods to distant markets to be cost effective. At the beginning of the 1900s, new technologies greatly improved productivity, creating a discrepancy between the productivity of mechanized labor and the productivity of manual labor. Farms that invested in new technologies and specialization during the agricultural revolution of the 1900s outcompeted the farms that did not invest. Since it was only cost effective for large farms to invest in new mechanized technologies, this meant that large farms outcompeted the smaller farms, which decreased the number and increased the size of farms [1]. According to the Census of Agriculture, from the end of the 19th century to the middle of the 20th century, the number of large farms and percentage of farmland in large farms steadily increased; whereas, despite a growing population, the percentage of farmland in small and medium farms decreased [4]. This trend of increasing size and decreasing number of farms continued through the middle of the 20<sup>th</sup> century, more or less leveling off during the 1980s [5]. Essentially, small farms were out-competed.

As the number of small and medium farms decreased, city planners advocated for retaining

some sort of urban agriculture, due to its benefits to the community. With an increasingly dispersed and industrialized food system, control of the food system moved out of the regional level and into the hands of the large supermarket chains and food processors. While the early 1900s saw agriculture more or less excluded from city zoning, gardens and green spaces were still incorporated in cities. Any larger scale agriculture in cities was confined to times of crisis as a temporary measure, for example during World War I and World War II. During the 1930s, suburban space was set aside for agriculture, in an effort to bring farming closer to the cities; however, as the area around these farms developed, such spaces became an anomaly. Modern city planners advocate for and embrace the inclusion of agriculture in cities, but the power to influence the system still rests with the large food corporations [2].

### 2.1 Recent Trends

Recently there has been a popular trend towards eating local, deemed being a locavore, evidenced by a growing social movement [6]. While the benefits of buying food locally are debated due to the economics of comparative advantages; consumer groups support urban agriculture for a number of reasons, such as to support local farmers, to buy fresh food, to know from where their food is coming, and to respect the environment [3]. Specifically, one study found that 66% of those surveyed welcomed more local food options because it supports local economies [7]. Many consumers also site environmental impacts as a reason to buy local, evidenced one studying finding that environmental factors were an important reason to buy locally grown food for 61% of those surveyed [7] [8]. Another popular reason is to reduce food insecurity, which, according to the USDA, is defined as a household-level economic and social condition of limited or uncertain access to adequate food [9]. Buying locally grown food can reduce food insecurity in that having local farms provides consumers who might not have previously had access to fresh produce the opportunity to purchase it, some urban farms make a point of targeting food insecurity, and having local farms allows a city to rely less heavily on external markets to feed a their population. Despite debate of realized benefits, consumers eat local food to feel good about it [7].

## 3 Economic Issues

Regardless of the strength of their consumer base, the number of urban farms is still low due to the high costs that urban farmers face compared to rural farmers. Not only is the land more expensive, but also the limited plot size and probable contamination of the land with lead and toxins essentially necessitates the use of a greenhouse with high investment costs. Cost challenges that many urban greenhouse farmers face include securing funding, finding economies of scale, and facing high capital and operating costs. The energy necessary to heat a greenhouse through the winter makes utility costs high, the most productive greenhouse technologies are expensive, and land is of much higher value in cities than in rural areas [8]. Not to mention, the initial infrastructure cost involved in building a greenhouse is much higher than the costs that farmers growing in a field face. The costs of urban greenhouses vary greatly depending on size and type, but the construction of, for example, a hydroponic greenhouse entails costs for site preparation, construction, heating and cooling equipment, thermostats and controls, an irrigation system, a nutrient tank, and a growing system [10]. These high costs keep the number of urban farms small.

## 4 Profit Methods

Due to the these high costs, urban greenhouses must derive profit in creative ways, such as targeting niche products or markets, adapting a social business model, or finding less expensive plots of land within the city.

### 4.1 Targeting Niche Products and Markets

In the first method, targeting niche products and markets allows urban farmers to charge a premium that covers the added costs of operating in the city. Targeting a niche product could entail producing special strains of vegetables, like how Brooklyn Grange, a successful, New York City based greenhouse grows microgreens and heirloom tomatoes. The low supply of these special strains can drive a higher price to help cover the high costs of the greenhouse. To increase profitability, farmers can also find a high-end market [11]. Targeting a niche market could entail selling produce to high-end restaurants and supermarkets, such as Whole Foods, whose customers are already expecting to pay a premium price, or it could entail marketing produce specifically to locavores. In fact, one study

found that, for example, consumers were willing to pay a \$US 1.06 price premium on one pound of locally grown, organic tomatoes. In the same study, the researchers also found that urban consumers were more likely to buy locally grown produce, compared with rural consumers [12]. The high costs associated with living in a large city means that cities have a high concentration of people who can afford to eat local in this way, and the demographics of large cities translate to a high concentration of people who also see value in eating local. Together, these create a market of locavores willing and able to pay a premium for locally grown produce. By targeting niche products and markets, urban greenhouse farmers can take advantage of existing high-end markets to cover their relatively high costs.

#### 4.2 Adapting a Social Business Model

In the second method, adapting a social business model can open urban farmers up to alternate sources of funding and can lead to reduced labor costs through volunteerism, as individuals may be willing to volunteer on a farm that supports a social issue [8]. Some examples of causes that urban greenhouse social businesses focus on include education, research, the environment, and food security. In the case of an urban greenhouse that focuses on education, such as HarlemGrown in New York, adding an educational component to the greenhouse, namely the opportunity for students to learn about agriculture and the food system in a hands on nature, can allow the greenhouse to become eligible for funding from schools, governmental programs, or donors particularly interested in education. Other urban greenhouses can, for example, pitch themselves to city dwellers as an environmentally friendly alternative to commercial farms, using less fuel for transportation and fewer chemicals. This could again render the greenhouse eligible to new sources of funding. AeroFarms in Newark, NJ has adapted a combination of the previous two models, both using environmentally friendly techniques and partnering with Philip's Academy Charter School [13]. Greenhouses can additionally focus their business models on alleviating food insecurity by providing fresh produce to urban food deserts [14]. Unlike the previous cases, greenhouses that choose to focus on alleviating food insecurity would not be able to additionally use the method of targeting high end markets, unless they make an effort to use the high-end markets to subsidize the cost of providing their produce to food deserts. An example of an urban farm targeting food insecurity is World Hunger Relief Inc. in Waco, TX, which brings

produce grown in its greenhouse to food deserts in the City of Waco at a market or discount cost. What these three options share is a business model that incorporates multiple bottom lines, which allows them access to new funding and volunteer labor to reduce costs.

#### 4.3 Cutting Costs

The third method entails cutting costs rather than trying to increase revenue or funding. Specifically, urban greenhouses can seek inexpensive plots of land, such as those which have been abandoned or otherwise deemed undesirable [8]. Since greenhouses need not grow produce directly in the existing soil, possible contamination is much less important of an issue than it would be for traditional growing. As the cost of land is a main differentiator between urban agriculture and traditional growing, being able to reduce the cost of land can greatly impact the financial circumstance of urban greenhouses, resulting in a business model that is much closer to that of traditional growers.

### 5 Conclusion

Altogether, the methods of targeting niche markets or products, adapting a social business model, and finding inexpensive plots of land constitute some of the broad categories of solutions which allow sustaining urban greenhouses to derive profit in a costly industry. By utilizing one or some combination of these techniques, individuals looking to start their own urban greenhouses can add value to their business and derive profit.

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