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Financing Local Food Factories

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> "They used to grow food in Kansas
> Now they want to grow it on the moon . . ."
>
> —Bob Dylan[1]

> "Without funding, the vertical-farm concept will simply disappear into the government warehouse featured in *Raiders of the Lost Ark* . . . ."
>
> —Dickson Despommier[2]

INTRODUCTION

This Article seeks to provide an argument for how large-scale, or "massive," alternative urban agricultures can be successfully financed. The goal here is not exhaustiveness; indeed, a thorough review of all potential funding sources could be several times as long and still not cover the basics. Instead, this Article seeks to change how local food is conceived in terms of financing. This unusual approach could yield several important benefits. First among them being that large-scale local food production in urban areas could become more common.

Part I of this Article explores the reasons why massive alternative urban agricultures are necessary today: the difficulties associated with feeding a

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1. BOB DYLAN, *Union Sundown*, *on* INFIDELS (Sony Music Entertainment 1983).
2. DICKSON DESPOMMIER, THE VERTICAL FARM 257 (Thomas Dunne Books 2010).

rapidly growing, and rapidly urbanizing, population. Part II explores one particular massive alternative urban agriculture—the vertical farm.[3] By focusing on the vertical farm, the importance of financing, as a critical component in growing local food, is brought into focus. In Part III, the Article first explores the example of financing for what is proposed to be the nation's largest vertical farm, AeroFarms, in Newark, New Jersey, which illustrates how creative financing can facilitate massive alternative urban agricultures. Part IV then considers how several types of existing—and potential—financing could be deployed in a manner modeled on economic development agreements typically used for factories and other manufacturing uses to advance the cause of local food. By viewing local food as a finance problem, and in particular a finance problem similar to that of urban manufacturing, the prospects for significantly scaling up the production of local food, and perhaps even disrupting agricultural production as it has been practiced for millennia, begins to take shape. It provides a way forward for an agriculture that would ultimately be more economical, more sustainable, and ironically, more urban than any in the past.

I. THE MAW OF URBANIZED POPULATIONS

The need to rethink agriculture arises from both tremendous population growth and rapid urbanization of that population. A brief review of population and urbanization statistics makes this evident.

In 1960, world population exceeded three billion for the first time.[4] In the next forty years, population doubled, reaching nearly six billion in 2000.[5] World population is expected to reach nine billion soon after 2040.[6] Strikingly, 90% of the 2.5 billion persons projected to be added by 2050 will live in Asia and Africa.[7] After 2050, world population growth is expected to taper off with lower global population growth rates expected in the latter part of the twenty-first century.[8] In the United States, population is also expected

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3. See *Cities of the Future May Eat Plants Grown in the Air*, BLOOMBERG BUS. (Nov. 20, 2014, 10:27pm), http://www.bloomberg.com/news/videos/2014-11-21/cities-of-the-future-may-eat-plants-grown-in-air [http://perma.cc/9EBT-TZTT], for a video tour to help visualize a vertical farm.

4. *International Data Base: World Population: 1950-2050*, U.S. CENSUS BUREAU, https://www.census.gov/population/international/data/idb/worldpopgraph.php [http://perma.cc/AEA3-VUUZ].

5. *Id*.

6. *Id*.

7. U.N. DEP'T OF ECON. & SOC. AFFAIRS, WORLD URBANIZATION PROSPECTS: THE 2014 REVISION 7 (2014) [hereinafter WORLD URBANIZATION PROSPECTS], http://esa.un.org/unpd/wup/Highlights/WUP2014-Highlights.pdf [http://perma.cc/2YZP-BFYZ].

8. *See International Data Base: World Population Growth Rates: 1950-2050*, U.S. CENSUS BUREAU,

to grow, with population projected to grow from 319 million in 2014 to 417 million by 2060.[9] The U.S. population is estimated to reach 400 million just after the mid-century mark of 2050.[10]

As population has increased, it has also become increasingly urban. In 2007, the global population was predominantly urban for the first time ever.[11] That urbanization landmark capped six decades of rapid urbanization that largely mirrored world population growth.[12] In 1950, 70% of the world population lived in rural settlements, and just 30% lived in urban settlements.[13] By 2014, 54% of the world's population was urban.[14] By 2050, global population is expected to be 34% rural and 66% urban.[15] In other words, in just one hundred years, the world's population will go from two-thirds rural to two-thirds urban. A remarkable transformation without precedent in human history. At the same time, rural population has grown slowly since 1950, is near its peak, and is expected to start declining by 2050, especially as Africa and Asia—where 90% of worldwide rural populations live—begin to urbanize.[16] In the U.S., urbanization largely happened during the twentieth century: in 1910, just 46% of the U.S. population lived in urban areas; by 2010, more than 81% did so.[17]

However, as the world's population urbanizes, almost half of the world's urbanites live in settlements of less than 500,000, while just one in eight live in the twenty-eight mega cities with more than ten million residents—such as New York City or Tokyo.[18] This means that most urbanization is not happening in centers of administrative or governmental power, but in

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https://www.census.gov/population/international/data/idb/worldgrgraph.php [http://perma.cc/TC4C-LJ8D].

9. SANDRA L. COLBY & JENNIFER M. ORTMAN, U.S. CENSUS BUREAU, PROJECTIONS OF THE SIZE AND COMPOSITION OF THE U.S. POPULATION: 2014 TO 2060, at 1 (2015), http://www.census.gov/content/dam/Census/library/publications/2015/demo/p25-1143.pdf [http://perma.cc/CH3U-5F4F].

10. *Id*.

11. *See* WORLD URBANIZATION PROSPECTS, *supra* note 7, at 7.

12. *See id*.

13. *Id*.

14. *Id*.

15. *Id*.

16. *Id*. at 1.

17. *See Table 1. Urban and Rural Population: 1900 to 1990*, U.S. CENSUS BUREAU (Oct. 1995), http://www.census.gov/population/censusdata/urpop0090.txt [http://perma.cc/3LRV-NSVA]; *see, e.g.*, THEODORE ROOSEVELT, REPORT OF THE COUNTRY LIFE COMM'N, S. DOC. NO. 705, at 9 (2d Sess. 1909) (noting that the country had become more urban than rural, which he viewed warily, stating: "I warn my countrymen that the great recent progress made in city life is not a full measure of our civilization; for our civilization rests at bottom on the wholesomeness, the attractiveness, and the completeness, as well as the prosperity, of life in the country.").

18. WORLD URBANIZATION PROSPECTS, *supra* note 7, at 1.

second- and third-tier cities that often lack resources to influence urbanization.

This population growth, and its commensurate urbanization, results in an equally commensurate growth in the need to feed a growing population and to deliver food to an urban location. One estimate found that, if existing farming techniques were used, just meeting the demand of the three billion new people expected to be added to the planet between 2010 and 2050 would require new agricultural acreage equal to the size of Brazil.[19] Further, this new agricultural acreage would exacerbate already strained resources from existing agricultural operations.[20] Several examples serve to illustrate how existing farming techniques will not be able to meet the growing population demand and, in addition, are poorly suited to the new geography of predominantly urban life.

First, existing farming techniques strain water resources. Agriculture, including irrigation, livestock watering and cleaning, and aquaculture, utilizes 70% of available fresh water globally.[21] Although water use for agriculture varies substantially by location—Europe uses just 21% of its water withdrawals for agriculture while Africa uses 82% for agriculture—the overall trend in water use is outpacing population growth and fed by agricultural demands.[22] For instance, global water withdrawal was less than 600 km^3/year in 1900 but was 4000 km^3/year in 2010, a rise 1.7 times greater than population growth.[23] In the U.S., 40% of water withdrawal was used for agriculture in 2005, a number that also varies dramatically by region.[24]

Second, farm runoff is the most damaging form of pollution in the world.[25] The U.S. Environmental Protection Agency (EPA) notes that agricultural runoff is "the leading source of water quality impacts on surveyed rivers and streams, the third largest source for lakes, the second largest source of impairments to wetlands, and a major contributor to contamination of

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19. *See* DESPOMMIER, *supra* note 2, at 95–96.

20. *Id.*

21. *See* DESPOMMIER, *supra* note 2, at 95; *see also* FAO, *Did You Know…? Facts and Figures About: Water Withdrawal and Pressure on Water Resources*, AQUASTAT (2016) [hereinafter *Water Withdrawal*], http://www.fao.org/nr/water/aquastat/didyouknow/index2.stm [http://perma.cc/C478-RNQF].

22. *See Water Withdrawal*, *supra* note 21.

23. *See id.*

24. *See* Agricultural Water Withdrawal as % of Total Water Withdrawal, AQUASTAT, http://www.fao.org/nr/water/aquastat/data/glossary/search.html (select "Term" drop-down list; then select "Agricultural water withdrawal as % of total water withdrawal;" after search, click "view data for this variable . . .") [http://perma.cc/XL3Y-9LVE].

25. *See* DESPOMMIER, *supra* note 2, at 95.

surveyed estuaries and ground water."[26] These problems can be local, such as phosphorus loads in local streams and rivers,[27] but also national in scope, such as the large oceanic dead zones that form where large rivers flow into oceans carrying with them a whole river basin's worth of pesticides and fertilizers.[28]

Third, because food is not grown near where it is consumed, greenhouse gas (GHG) emissions resulting from the transport of food—whether to slaughter, to market, or as feed—are far in excess of what they would be if food was grown near where it was consumed.[29] This is especially true for highly perishable produce and frozen products that require air transport and refrigeration during travel.[30]

Fourth, climate change brings with it a need for resilience in agricultural production. Existing farming techniques suffer at the behest of extreme storm events that are on the rise.[31] In addition, climate change favors crops

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26. *Nonpoint Source: Agriculture*, EPA, http://www.epa.gov/polluted-runoff-nonpoint-source-pollution/nonpoint-source-agriculture [http://perma.cc/HJ8X-PTBZ] (last updated Oct. 31, 2015).

27. *See* CADMUS GRP., TOTAL MAXIMUM DAILY LOAD (TMDL) FOR PHOSPHORUS IN CHAUTAUQUA LAKE 4, 17 (2012), http://www.dec.ny.gov/docs/water_pdf/tmdlchautlk12.pdf [https://perma.cc/MKH3-B4M3]. For example, local agricultural runoff often creates problems with phosphorus loads in rivers, which can cause downstream cities to exceed their Total Maximum Daily Load (TMDL) requirements under the Clean Water Act. See *Implementing Clean Water Act Section 303(d): Impaired Waters and Total Maximum Daily Loads (TMDLs)*, EPA, http://water.epa.gov/lawsregs/lawsguidance/cwa/tmdl/ [http://perma.cc/965Q-F9ZE] (last updated Dec. 3, 2015), for a discussion of TMDLs. As a result, agricultural runoff can have more than just an environmental effect; it can also potentially lead to costly treatment requirements for urban areas. *See, e.g.*, *City Proposing to Move Forward with Innovative Dixie Drain Project Pending Approvals*, BOISE PUB. WORKS DEP'T (July 3, 2014), http://publicworks.cityofboise.org/news-releases/2014/07/city-proposing-to-move-forward-with-innovative-dixie-drain-project-pending-approvals/ [http://perma.cc/3HHA-EYL8].

28. *See* DESPOMMIER, *supra* note 2, at 33–34. *See generally Hypoxia 101*, EPA, http://www.epa.gov/ms-htf/hypoxia-101 [http://perma.cc/YX6V-HPE6] (last updated Jan. 8, 2016).

29. *See* Christopher L. Weber & H. Scott Matthews, *Food-Miles and the Relative Climate Impacts of Food Choices in the United States*, 42 ENVTL. SCI. TECH. 3508, 3510 (2008) (providing a graph for the total greenhouse gas emissions associated with household food consumption in the U.S.).

30. *See* DESPOMMIER, *supra* note 2, at 167–68, 244; Nathan Pelletier et al., *Energy Intensity of Agriculture and Food Systems*, 36 ANN. REV. ENVTL. RES. 223, 226 (2011); Andrew Zumkehr & J. Elliott Campbell, *The Potential for Local Croplands to Meet U.S. Food Demand*, 13 FRONTIERS IN ECOLOGY 244, 244 (2015).

31. *Agriculture and Food Supply: Climate Impacts on Agriculture and Food Supply*, EPA, http://www.epa.gov/climatechange/impacts-adaptation/agriculture.html [http://perma.cc/M4CE-YT8J] ("Changes in the frequency and severity of droughts and floods could pose challenges for farmers and ranchers. Meanwhile, warmer water temperatures are likely to cause the habitat ranges of many fish and shellfish species to shift, which could disrupt ecosystems. Overall, climate change could make it more difficult to grow crops, raise animals, and catch fish in the same ways and same places as we have done in the

that are resilient and adaptable to greater change.[32] Existing farming techniques have bred such adaptability out of large-scale crops, like corn or soybeans, which require more interventions in terms of production, fertilizers, and herbicides to keep these highly-modified crops tenable in uncertain times.[33]

Fifth, traditional farming economics are especially difficult now. Most agricultural production presently occurs on mega-farms, even though the number of small farms continues to grow. For instance, the 2012 Census of Agriculture found that 75% of U.S. farms sold less than $50,000 in agricultural products while 57% had sales less than $10,000.[34] For most "farmers," farming produces less than 25% of household income and 61% worked off-farm to make ends meet.[35] On the other hand, some 55% of farmland in the country is held by just 4% of farms that are over 2000 acres, a fact that illustrates that much of the farmland, and much of the food produced in the country, is the product of a few, very large agribusinesses.[36] The reason for small farmers' difficulties is not surprising: farming in soil requires the cooperation of weather patterns that are often anything but cooperative and are increasingly dependent on artificial conditions—such as irrigation—that face increasing challenges with climate change.[37]

For this reason, it is likely that existing farming techniques in soil are not a long-term sustainable solution to meeting this century's growing, and urban, food needs in the long term.[38]

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past. The effects of climate change also need to be considered along with other evolving factors that affect agricultural production, such as changes in farming practices and technology.").

32. DESPOMMIER, *supra* note 2, at 108.

33. *See* Scott Malcolm et al., *Adaptation Can Help U.S. Crop Producers Confront Climate Change*, ECON. RES. SERV., USDA (Feb. 21, 2013), http://www.ers.usda.gov/amber-waves/2013-february/adaptation-can-help-us-crop-producers-confront-climate-change.aspx#.VfRqaRFVhBc [http://perma.cc/46JT-3LUQ] ("Adaptive behaviors such as adjusting crop choices and production practices may help mitigate the negative effects of climate change and enable some producers to capitalize on new opportunities. Future developments in technology and policy are also likely to contribute to adaptive capacity.").

34. *2012 Census Highlights: Farm Demographics - U.S. Farmers by Gender, Age, Race, Ethnicity, and More*, USDA CENSUS OF AGRIC. (May 2014), http://www.agcensus.usda.gov/Publications/2012/Online_Resources/Highlights/Farm_Demographics/ [http://perma.cc/2USG-LFB8].

35. *Id.*

36. *See Farms and Farmland: Numbers, Acreage, Ownership, and Use*, USDA CENSUS OF AGRIC. (Sept. 2014), http://www.agcensus.usda.gov/Publications/2012/Online_Resources/Highlights/Farms_and_Farmland/Highlights_Farms_and_Farmland.pdf [http://perma.cc/CW54-BVPQ].

37. *See* DESPOMMIER, *supra* note 2, at 70 (noting that "nature is never wholly predictable, that it often poses threats to our very existence, and, above all, that it can never be fully understood.").

38. *Id.* at 137.

II. LOCAL FOOD, FAST BUT SLOW

Given the scale of urban populations that the twenty-first century must feed, one of the most ecologically valuable contributions that could be made would be an alternative to existing agriculture that was large in scale and close to urban environments. The last few decades have seen a tremendous rise in interest in local food—a promising sign for the future of food production. Unfortunately, despite the rise of local food, its growth is not fast enough to significantly impact the environmental challenges today's agricultural practices pose, much less feed the staggering growth in population that is coming.

The rise of local food is remarkable given where it was just several decades ago. Several surveys indicate that "local food" is something people want, even if that term is hard to define. A 2013 study of grocery shoppers found that two-thirds of consumers are interested in purchasing local produce.[39] The U.S. Grocery Shopper Trends Survey, conducted by a supermarket industry association, found that over eighty percent of surveyed shoppers reported purchasing local foods "occasionally," while nine percent reported purchasing local foods "whenever possible."[40] "Freshness" was the most frequent response for why shoppers purchased local food, while "supporting the local economy" was the second-most frequent reason given.[41]

According to a census of agriculture data, in 2012, 7.8% of U.S. farms marketed foods locally, which the U.S Department of Agriculture (USDA) defines as conducting either direct-to-consumer or intermediated sales of food for human consumption.[42] Direct-to-consumer (DTC) sales have increased to $1.2 billion in 2007 from $551 million in 1997.[43] Seventy percent of these farms used only DTC marketing channels, which include farmers' markets and community supported agriculture arrangements, while thirty percent used a combination of DTC and intermediated channels or only

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39. *See* RICH PIROG ET AL., MSU CTR. FOR REG'L FOOD SYS., THE LOCAL FOOD MOVEMENT: SETTING THE STAGE FOR GOOD FOOD 8 (May 14, 2014), http://nyscaa.wildapricot.org/Resources/BestPracticesBlog/Local%20Food%20Movement.pdf [http://perma.cc/D9KW-BXN4]; *see also* JAMES RUSHING & JENS RUEHLE, A.T. KEARNEY, BUYING INTO THE LOCAL FOOD MOVEMENT 3 (2013), https://www.atkearney.com/documents/10192/709903/Buying+into+the+Local+Food+Movement.pdf/68091049-b5c2-4d2a-a770-ee5b703da8fd [http://perma.cc/YQ9S-DCDJ].

40. SARAH A. LOW ET AL., USDA, AP-068, TRENDS IN U.S. LOCAL AND REGIONAL FOOD SYSTEMS: A REPORT TO CONGRESS 30 (Jan. 2015), http://www.ers.usda.gov/media/1763057/ap068.pdf [http://perma.cc/X4KL-UGH2].

41. *Id*.

42. *Id*. at 2.

43. *Id*. at 11; PIROG, *supra* note 39, at 8.

intermediated channels.[44] Although the number of farms with DTC sales increased by 17%—and sales increased by 32% between 2002 and 2007—between 2007 and 2012, the number of farms with direct-to-consumer sales increased 5.5%, with no change in direct-to-consumer sales, which indicates that there may be a plateauing of the local food industry.[45]

The ubiquity of farmers' markets, which the USDA defines as "a multi-stall market at which farmer-producers sell agricultural products directly to the general public at a central or fixed location, particularly fresh fruit and vegetables (but also meat products, dairy products, and/or grains),"[46] may be the most overt sign of local food's new prominence. In 2014, there were 8268 U.S. farmers' markets, up 180% since 2006.[47] Another fast-growing form of local food is community-supported agriculture (CSA), which the USDA defines as an arrangement where "members or 'share-holders' of the farm or garden pledge in advance to cover the anticipated costs of the farm operation and farmer's salary," and, in return, "they receive shares in the farm's bounty throughout the growing season, as well as satisfaction gained from reconnecting to the land and participating directly in food production."[48] CSAs have grown from just two in the mid-1980s to over 3600 by 2009.[49] In addition to these direct-to-consumer programs, the 2011–2012 school year saw 38,629 schools participating in farm-to-school programs.[50]

The cultural reach of local food is perhaps best evidenced by its evolution out of these longstanding niche markets and its entry into big box chain stores. For instance, in 2013, Wal-Mart, the largest food retailer in the world, planned to increase its share of purchasing local produce in the U.S. to nine percent by the end of 2015.[51]

There is no doubt that local food is a success story when considering the rate of its growth; however, when considered in light of total U.S. food production, the trend's growth is dwarfed by the overriding dominance of the non-local food markets. This could be dispiriting, but it should not be.

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44. LOW, *supra* note 40, at iii.

45. *Id*.

46. *What is a Farmer's Market?*, USDA FOOD & NUTRITION SERV., http://www.fns.usda.gov/ebt/what-farmers-market [http://perma.cc/75EC-ZQWW] (last updated May 27, 2015); *see also USDA Farmers Market*, USDA AGRIC. MKTG. SERV., http://www.ams.usda.gov/about-ams/programs-offices/usda-farmers-market [http://perma.cc/R4G9-6N9S].

47. LOW, *supra* note 40, at 1.

48. *Defining Community Supported Agriculture*, USDA NAT'L AGRIC. LIBR., http://pubs.nal.usda.gov/sites/pubs.nal.usda.gov/files/csadef.html [http://perma.cc/M85P-VEGD].

49. PIROG, *supra* note 39, at 8.

50. *Id*.

51. *Id*.

Rather, what local food needs is to reconsider the technologies it uses just as non-local food is doing. When the major agribusinesses consider the growth of world population and its urbanization, they see an opportunity for genetically-modified crops and others products—pesticides, herbicides, fertilizers, and the like—that will bring them increased business. Local food needs an alternative narrative, but not just one that shrinks from the responsibility of feeding the rising population. Local food's answer cannot be a bit twee, or subsist in a fashion worthy of *Portlandia*-esque parodies.

It is especially important for local food to make this leap now precisely because local food still can, and must, emerge as a greater force for feeding urban populations. It is a possible dream: a recent study found that, even while using typical agricultural techniques, the ability for local food to service urban populations remains surprisingly high.[52] In the late nineteenth century, nearly all of the U.S. population could be fed from food grown just fifty to one hundred miles from a city.[53] While that had declined over time, the study found that by 2000, American cities could still feed 80% to 93% of their population from food grown within a fifty to one hundred mile foodshed radius.[54] Larger cities, such as New York and Los Angeles, remain outliers, as they could only support around 10% of their population within a fifty mile foodshed radius and 30% to 50% within a one hundred mile foodshed radius.[55] This indicates that, for most cities—even our major cities—the ability to be fed locally remains very much a reality.

What is needed now is a new approach to what it means to grow local food.

III. MASSIVE ALTERNATIVE URBAN AGRICULTURES

The answer to growing local food lies in what this Article will call *massive alternative urban agricultures*. These new technologies are deemed "massive," in that they intend to increase yields over existing local food production by a significant scale. These are "alternative" agricultures because, in most cases, they are seeking to redefine the very act of growing food over how it has been done for millennia in some marked way. They are "urban" because they all are intended to be located in or near cities. And they are "agricultures" because, despite all of their massiveness, alternativeness, and urbanness, these new techniques ultimately do what agriculture is intended to do: grow food to eat. Moreover, they intend to do

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52. *See* Andrew Zumkehr & J. Elliott Campbell, *The Potential for Local Croplands to Meet US Food Demand*, 13 FRONTIERS IN ECOLOGY & THE ENV'T 244, 246 (2015).

53. *Id*.

54. *Id*.

55. *Id*.

so in the way that local food has come to expect: organically, without pesticides or herbicides, and in a way that is delivered to a customer that retains the freshness of a locally grown food product.

These new techniques could come in a variety of packages.[56] This Article will focus on perhaps one of the most promising, and nascent, of these massive alternative urban agricultures: the vertical farm.[57] Focusing on the vertical farm serves several purposes. First, the vertical farm, if it could be scaled, would provide enormous environmental benefits independent of the food it would produce.[58] Second, the difficulty in implementing vertical farms is likely similar to other potential massive alternative urban agricultures: its implementation is hamstrung by operational charges precisely because of the higher costs associated with an urban environment.[59] However, as will be explored in Part IV, the types of changes that hamper the development of vertical farms on a large scale are bread-and-butter issues commonly addressed through urban redevelopment financing schemes. As simple as it sounds, applying those urban financing techniques to massive alternative urban agricultures could turn nascent food production technologies into common parts of urban life. This Part first reviews the potential environmental advantages of vertical farms as an example of the kinds of benefits that could be derived from local food's turn to massive alternative urban agricultures.

The vertical farm's most notable current proponent has been Columbia emeritus professor Dickson Despommier.[60] However, the technology on which the vertical farm relies—hydroponics—dates from the early twentieth century. In 1937, a researcher at the University of California, Davis,

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56. For example, another potential massive alternative urban agriculture is aquaponics, which is "a combination of fish and plant production using aquaculture and hydroponics systems." *See Aquaponics*, USDA NAT'L AGRIC. LIBR., https://afsic.nal.usda.gov/aquaculture-and-soilless-farming/aquaponics [http://perma.cc/92MY-6XVB] (last updated Feb. 11, 2016).

57. The vertical farm was widely popularized by Dickson Despommier's book, *The Vertical Farm*. As a result, this Article relies upon that publication to provide the basic arguments for vertical farming. It should be noted that there are skeptics of the vertical farming idea. *See, e.g.*, Stan Cox, *The Vertical Farming Scam*, COUNTERPUNCH (Dec. 11, 2012), http://www.counterpunch.org/2012/12/11/the-vertical-farming-scam/ [http://perma.cc/GAY4-UQZ5]. Those ideas are not debated here because the purpose of this Article is to focus primarily on making the argument for massive alternative urban agricultures of any stripe and to discuss how to fund them.

58. *See infra* notes 66–76 and accompanying text.

59. *See, e.g.*, Daniel Terlizzi et al., *Introduction to Aquaculture*, PENN ST. EXTENSION (2016), http://extension.psu.edu/business/ag-alternatives/livestock/additional-livestock-options/aquaculture [http://perma.cc/9M82-MZME] ("The type of aquaculture operation that you begin will be influenced by your financial and labor resources as well as available markets.").

60. *See generally* DESPOMMIER, *supra* note 2.

developed hydroponics to germinate seeds and sprout roots before being transplanted into soil.[61] The technique had early relevance; in World War II, hydroponic facilities were established on several islands to feed soldiers in the Pacific Theater, ultimately producing as much as eight thousand tons of fresh vegetables for Allied troops.[62] Despommier describes the science of hydroponics as follows:

> Setting up a hydroponic facility is largely constrained by the kind of crop one wants to produce. The configuration is determined by the root system of the plant. The liquid portion of the operation is pumped slowly through a specially constructed pipe . . . . Once the piping is set up, nutrients are dissolved into the water phase and circulated through the piping, all the while being electronically monitored for concentrations of each element and organic nitrogen. The result is uniform plant growth under optimal conditions.[63]

Vertical farms can also utilize aeroponics, a technique invented in 1982 that Despommier describes as follows: "Small nozzles located under the plants spray a nutrient-laden mist onto the roots, supplying them with everything they need. It is so conservative with respect to water use that it consumes about 70[%] less water than hydroponics . . . ."[64] In the vertical farm, arrays of plants are stacked on top of each other with either the hydroponic or aeroponic systems deployed to service the roots of the plants.[65] The amount of stacking possible is, potentially, only constrained by the height of the ceiling or, alternatively, the number of floors in the vertical farm that could each hold multiple stacks of crops. In this way, many sketches of virtual farms have fantasized them as veritable skyscrapers of vegetables. In truth, such skyscrapers are likely all but impossible to fund given the tremendous cost of buildings that are tens of stories tall. Rather, vertical farms are more likely to exist in former industrial spaces where land is cheap and high ceilings permit multiple stackings of crops without the need to build extra floors. As for the final ingredient necessary for vertical farms, it is the all-important light needed for plant growth. It could come from the sun, but it may also come from artificial light.

Among the advantages of the vertical farm are the following:

- Year-round crop production, which permits vertical farms to reap multiple crops per year;[66]

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61. *Id*. at 163.
62. *Id*. at 90–91.
63. *Id*. at 165.
64. *Id*.
65. *Id*. at 129, 165–66.
66. *Id*. at 146–48.

- No weather-related crop failures, which makes agricultural production impervious to weather patterns regardless of whether those arise from existing conditions like flooding, drought, hail or early freezes, or the increasingly extreme conditions soon to arise from climate change;[67]
- No agricultural runoff, a significant environmental benefit since agricultural nonpoint source pollution dramatically affects water quality in rivers, lakes, wetlands, and groundwater;[68]
- Allowance for ecosystem restoration, since reduction in agriculture's footprint on rural landscapes would permit use of that same land for conservation purposes;[69]
- No use of pesticides, herbicides, or fertilizers, since building design would assist with pest reduction, while contamination by heavy metals would be non-existent;[70]
- Use of seventy to ninety-five percent less water, as hydroponic or aeroponic growing techniques dramatically reduce water needed for farming in soil;[71]
- Greatly reduced food miles traveled, which, as noted previously, would be especially true for highly perishable produce and frozen products that require air transport and refrigeration during travel;[72] and
- May also include more control of food safety and security,[73] new employment opportunities,[74] purification of greywater to drinking water,[75] and the production of animal feed from postharvest plant material.[76]

Despite all of the valuable contributions that vertical farms could offer, their evolution and deployment is hampered primarily by cost. For vertical farms to be deployed on a large scale in a way that could yield optimal benefits, they would need to become "cheap to build, modular, durable, easily maintained, and safe to operate."[77] Moreover, they would also need to address the fact that land values in urban areas are high, as one reason

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67. *Id*. at 148–50.

68. *Id*. at 151–54; *Polluted Runoff: Nonpoint Source Pollution*, EPA, http://water.epa.gov/polwaste/nps/agriculture.cfm [http://perma.cc/2J2Q-9J9E] (last updated Dec. 10, 2015).

69. DESPOMMIER, *supra* note 2, at 154–60.

70. *Id*. at 161–62.

71. *Id*. at 162–67.

72. *Id*. at 167–68.

73. *Id*. at 169–71.

74. *Id*. at 171–73.

75. *Id*. at 173–75.

76. *Id*. at 175.

77. *Id*. at 24.

farms are not in the urban core is price.[78] Overcoming that location barrier arising from the cost of urban land values remains an important hurdle.

Right now, with few vertical farms in the world,[79] the concept remains mostly a vision rather than a reality. However, this does not mean that vertical farms are a lark; what it does mean is that they need a funding mechanism that can assist them in growing from the idea stage to mass implementation to disruptive force that changes the nature of agricultural production. As Despommier noted in *The Vertical Farm*, "I think the real issue regarding the invention of vertical farming is, who will pay for the first ones?"[80] The answer to funding this highly inventive approach to farming may lie in the most mundane of places: the types of financing typically deployed in local economic development agreements. Despommier himself considered precisely this approach in an off-handed manner:

> City, state, and federal governments are prone to encouraging the development of new areas of commerce by, for example, underwriting the building of a new sports arena or entertainment center, creating an industrial park by offering long-term favorable tax incentives, or donating city properties for mixed-income housing developments. These 'sweetheart' deals make it nearly impossible to turn one down if the right partners are involved.[81]

Despite noting the possibility of using traditional economic development agreements as a strategy, Despommier did not pursue it in *The Vertical Farm*. Instead, he ultimately proposed a model more akin to the federal research institutes—like the National Institutes of Health—that provide money to other universities, states, and agencies to conduct research.

This Article contends that Despommier, and others, should not be so quick to write-off the role of local economic development strategies in overcoming the types of financing problems that face massive alternative urban agricultures, such as the vertical farm. Moreover, the employment of these strategies to local food may not be as crazy as it seems at first. Increasingly, there is recognition—if not always the political will—that investing in infrastructure that reduces long-term costs for governments is worthy of upfront financing.[82] Local food might well be considered a type of

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78. *Id*. at 130 (noting that early vertical farms might need to occur on the outskirts where it is more economical).

79. *See* Dickson Despommier, *Farming up the City: The Rise of Urban Vertical Farms*, 31 TRENDS IN BIOTECH. 388, 389 (2013) (counting six vertical farms then extant in 2013).

80. *Id*. at 253–54.

81. *Id*. at 254.

82. *See GPL Strategies*, HARV. KENNEDY SCH. GOV'T PERFORMANCE LAB, http://govlab.hks.harvard.edu/gpl-strategies [http://perma.cc/7NKN-NUCQ] (discussing several approaches such as pay-for-success; results-driven contracting; and performance improvement funding, such as social impact bonds).

infrastructure that could reap significant public health benefits for urban cities as well as environmental benefits in rural areas. Indeed, a recent deal to finance the largest vertical farm in the United States in Newark, New Jersey,[83] illustrates that it is precisely this kind of financing that is most likely to take vertical farming, and other massive alternative urban agricultures, off the drawing boards and into our cities. The promise of local food may ultimately rest in thinking of it, for financing purposes, as if it were a factory.

IV. FINANCING LOCAL FOOD FACTORIES

There are certainly many funding sources for local food;[84] most, however, focus on the types of local food production that cannot scale production quickly, such as farmers' markets and regional food hubs. The scarcity of vertical farms makes evident how cost has kept at bay one of the better ideas for growing local food. A July 2013 review of existing vertical farms listed just six around the world—with two located in Chicago and one each in Canada, Singapore, Japan, and South Korea.[85]

The 2015 deal to finance a vertical farm in Newark, New Jersey, may indicate that times are changing. It may also indicate a growing willingness to consider the financing of massive alternative urban agricultures using the kinds of financing that local governments have used to finance factories and to lure businesses for decades.

AeroFarms, which also does business as Just Greens, LLC, entered into a $39 million public-private partnership to build a 69,000 square foot indoor vertical farm and global headquarters in a converted steel factory located in the environmentally and economically distressed area of Newark known as the Ironbound District.[86] When it opens in late 2015, AeroFarms expects up

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83. *See infra* notes 86–116 and accompanying text (referencing the AeroFarms discussion).

84. *See* AHNA KRUZIC, LEOPOLD CTR. FOR SUSTAINABLE AGRIC., FUNDING OPPORTUNITIES IN LOCAL FOODS (2014), http://www.leopold.iastate.edu/sites/default/files/pubs-and-papers/2014-10-funding-opportunities-local-foods.pdf [http://perma.cc/CW6X-AAFN]; *see also Local Food Promotion Program*, USDA AGRIC. MKTG. SERV., http://www.ams.usda.gov/services/grants/lfpp [http://perma.cc/AW7R-XEPE]; *Grants, Loans & Support*, USDA, http://www.usda.gov/wps/portal/usda/usdahome?navid=KYF_GRANTS [http://perma.cc/YD8F-FWZ6] (last updated Dec. 4, 2015).

85. *See* Despommier, *supra* note 79, at 389.

86. *See* C.J. Hughes, *In Newark, a Vertical Indoor Farm Helps Anchor an Area's Revival*, N.Y. TIMES (Apr. 7, 2015) [hereinafter *Vertical Farm Anchors Area's Revival*], http://www.nytimes.com/2015/04/08/realestate/commercial/in-newark-a-vertical-indoor-farm-helps-anchor-an-areas-revival.html; Lilo H. Stainton, *Giant Indoor Garden to Grow Jobs, Vegetables in Newark's Ironbound*, NJ SPOTLIGHT (Mar. 13, 2015), http://www.njspotlight.com/stories/15/03/12/giant-indoor-garden-to-grow-jobs-vegetables-in-newark-s-ironbound/ [http://perma.cc/K88T-FDGF].

to thirty harvests a year, yielding a staggering two million pounds of greens, including kale, arugula and romaine lettuce,[87] illustrative of the power of the vertical farm.

Of greater significance for the future of vertical farms, AeroFarms financed the project the way local economic development teams often think of recruiting a factory.

First, there were the tax breaks and the funding assistance. The project received significant public benefits valued at $9 million, which included a $500,000 allocation of Community Development Block Grant funding from the City of Newark.[88] AeroFarms also received $2.2 million from New Jersey's Economic Redevelopment and Growth program and $6.5 million in Grow New Jersey tax credits from the New Jersey Economic Development Authority.[89] In addition, the project received a New Markets Tax Credit allocation from Goldman Sachs, United Fund Advisors, and Dudley Ventures.[90] The project also received over $30 million of financing from Goldman Sachs and Prudential Financial.[91] This type of funding—bundling together a variety of federal, state, and local incentives—is typical for

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87. *See Vertical Farm Anchors Area's Revival*, *supra* note 86.

88. *See* Stainton, *supra* note 86; *see also* CITY OF NEWARK, N.J., RES. 13-2044 (Feb. 11, 2014), https://newark.legistar.com/LegislationDetail.aspx?ID=1652128&GUID=1C2F87BE-6A61-4F0B-AF6F-473BB2C5B89C [http://perma.cc/P3VX-F6AB] (noting $500,000 in CDBG funds "to provide physical rehabilitation to 212 Rome Street, Newark, New Jersey").

89. *See* Stainton, *supra* note 86; *see also* New Jersey Economic Development Authority Agenda (Dec. 9, 2014), http://www.njeda.com/web/pdf/EDA/agenda_12092014.pdf [http://perma.cc/6UQU-83GK] (noting action item "to approve the application of Just Greens, LLC dba Aerofarms for a Grow New Jersey Assistance Program Grant to encourage the applicant to make a capital investment and locate in Newark, NJ. Project location of Newark, Essex County qualifies as a Urban Transit HUB Municipality under N.J.S.A. 34:1B-242 et seq. and the program's rules, N.J.A.C. 19:31-18. The project is eligible, pursuant to the statute, for bonus increases to the tax credit award for Deep Poverty Pocket and Capital Investment in Excess of Minimum. The estimated annual award is $655,500 for a 10-year term.").

90. *See Groundbreaking for AeroFarms New Corporate Headquarters & World's Largest Indoor Vertical Farm in Newark, NJ*, GOLDMAN SACHS (July 9, 2015) [hereinafter *Aerofarms*], http://www.goldmansachs.com/what-we-do/investing-and-lending/impact-investing/case-studies/aerofarms-press-release-7-9-15.pdf [http://perma.cc/R3KG-GEGR]. New Markets Tax Credits are allocated to specific projects, as well as regional and national Community Development Financial Institutions, and provide a form of financing to projects in low-income census tracts, as defined by statute. *See generally New Markets Tax Credit Program*, U.S. DEP'T. OF THE TREASURY COMMUNITY DEV. FIN. INSTITUTIONAL FUND, https://www.cdfifund.gov/programs-training/Programs/new-markets-tax-credit/Pages/default.aspx [http://perma.cc/T6SX-AWSY].

91. *See AeroFarms*, *supra* note 90.

economic development efforts to lure manufacturing;[92] it may be singular in its use to fund production of local food. It points a path forward, especially in that the deal did not end there. Instead, the deal contains many of the other components typical of multi-party negotiations that often involve public agencies, private corporations, labor, and neighborhood group interests.

Second, AeroFarms also partnered with a community group, the Ironbound Community Corporation, to create a recruiting and job training program targeting local residents for both skilled and non-skilled roles.[93] Local food advocates may not think to align themselves with such a group or to seek out a labor partner, but in the world of financing major projects, it comes with the territory of bringing together diverse interests.

Third, the area where the AeroFarms vertical farm is proposed, the Ironbound District, has been noted by the EPA to have once been the site of many manufacturing operations that have closed, "leaving behind contaminated sites and deteriorating infrastructure."[94] The EPA continues saying, "[t]he area is economically distressed with the poverty rate as high as 55[%] . . . [and] contains more than 100 brownfields."[95] Still, AeroFarms is confident the vertical farm can grow food safely here precisely because growing food in a vertical farm has nothing to do with the soil—all of the growth will occur aeroponically above ground—and the water supply will come from pipes rather than wells.[96] By proposing to grow millions of pounds of leafy greens in an area of brownfields, AeroFarms provides a clear example of how the technology for producing local food can change agriculture. There is no way that conventional local food production, based in soil, could ever be located anywhere near this site. However, such brownfield sites provide a valuable resource; by moving the food production out of the ground, vertical farms permit food to be grown locally on urban land that happens to have an important, seldom found trait: it is cheap.

These three parts of the AeroFarms deal are indicative of how a technology of local food—vertical farms—can pair with tools of local economic development to produce novel results. Economic development has long had a bad reputation for "smokestack chasing," a derogative term that elicits efforts to "steal" a business from another location with the offer

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92. *See* Stephen Malpezzi, *Local Economic Development and Its Finance: An Introduction*, *in* FINANCING ECONOMIC DEVELOPMENT IN THE 21ST CENTURY 7–22 (Sammis B. White et al. eds., 2012).

93. *See Aerofarms*, *supra* note 90.

94. *See Brownfields Area-Wide Planning Pilot Project Fact Sheet: Ironbound Community Corporation, Newark, NJ*, EPA (Oct. 2010), http://www.epa.gov/sites/production/files/2015-09/documents/awp_newark_nj.pdf.

95. *Id.*

96. *See Vertical Farm Anchors Area's Revival*, *supra* note 86.

of incentives.[97] Economic development agreements often involve federal and state money, but typically, it is local governments and other local agencies, such as redevelopment agencies, that provide much of the funding.[98] The subsidies granted yearly are staggering: a 2012 *New York Times* analysis found that local governments typically give over $80 billion a year in subsidies to corporations.[99]

Several recent deals, all closed in 2014 or 2015, are indicative of the largesse that cities are using to win the siting of major corporations. Cincinnati, Ohio, offered General Electric incentives that could be worth more than $51 million in job-creation tax credits if the company creates 1400 jobs.[100] Chattanooga, Tennessee, had a successful bid for a Volkswagen facility that was aided by a $166 million grant from the State of Tennessee for costs associated with development and infrastructure of the new facility, as well as a $12 million grant from the State for employee training.[101] The rural Chester County, South Carolina, lured Giti Tire, the tenth-largest tire company in the world, with a $38 million grant from the State of South Carolina, as well as job-development tax credits.[102] In perhaps the biggest economic development deal in recent memory, Reno, Nevada, became the site of Tesla's new battery factory with the assistance of $1.1 billion in sales tax and real and personal property tax abatements from the State of Nevada, $195 million in transferable tax credits, and the State's decision to permit Tesla to sell directly to Nevada residents—something coveted by Tesla, which has long sought to sell directly to consumers.[103]

While these large deals all involve manufacturing, agriculture is the second-largest sector of the economy to receive these local subsidies.[104] Considered in that light, the AeroFarms deal is not so unusual: agricultural projects receiving subsidies are nothing new. What is new, though, is that the type of subsidies the AeroFarms deal received are far more typical of the deals received by urban manufacturing facilities. Perhaps that should be the case for massive alternative urban agricultures. Perhaps they should be

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97. EDWARD J. BLAKELY & NANCEY GREEN LEIGH, PLANNING LOCAL ECONOMIC DEVELOPMENT: THEORY AND PRACTICE 57–59 (4th ed. 2010) (describing "smoke stack chasing" and its commensurate policies).

98. *See generally* Louise Story, *As Companies Seek Tax Deals, Governments Pay High Price*, N.Y. TIMES (Dec. 1, 2012), http://www.nytimes.com/2012/12/02/us/how-local-taxpayers-bankroll-corporations.html?pagewanted=all&_r=0.

99. *Id*.

100. *2015 Gold & Silver Shovel Awards: Investment Projects of the Year*, AREA DEV. (2015), http://www.areadevelopment.com/Gold-Shovel-Econdev-Awards/Q2-2015/projects-SolarCity-GE-Volkswagen-GitiTire-Tesla-44405157.shtml [http://perma.cc/VRC3-WY95].

101. *Id*.

102. *Id*.

103. *Id*.

104. *See* Story, *supra* note 98.

funded similar to other traditional urban uses—like manufacturing. Perhaps, as well, the urbanization of these alternative agricultures should also affect the way agriculture is subsidized. And perhaps these new alternative agricultures could redefine other funding sources.

At its core, "economic development" is nothing more than a collection of legal and policy tools that can be deployed for any purpose. If tools like tax abatements and tax increment financing can be used to lure factories to town, why should they not equally be used to lure producers of locally grown fresh-leafy vegetables? The only reason is because there has not been an incentive to use those tools to benefit the industries associated with massive alternative urban agricultures.

That trend is now changing. There are several ways that economic development tools can be used to assist the growth of massive alternative urban agricultures, with a particular focus on the vertical farm as an example.

Perhaps the most common form of subsidy involves taxes, which could arise from the federal, state, or local governments. On the federal level, the AeroFarms deal involved New Markets Tax Credits, a type of transferable tax credit offered for placing development in low income communities.[105] State credits often involve tax incentives for placing investments in low income areas and providing jobs, in addition to the pure incentives of tax abatements on otherwise applicable real or personal property.[106] Local governments may also grant tax breaks; for instance, Baltimore has instituted a tax credit precisely to benefit urban farms.[107]

Other sources of federal money that is distributed by local governments could be applicable. For instance, the AeroFarms deal involved Community Development Block Grant funding, which is given to local governments from the federal government to then facilitate projects.[108]

Another form of subsidy involves assistance with the development process. This subsidy includes land assembly as well as assistance with the entitlement process. Some cities, like Denver, Colorado, have pre-zoned massive alternative urban agricultures, such as aquaponics—the raising of farmed fish or other seafood in tanks and using the waste byproducts to fertilize farming operations, which are often hydroponic—likely with the

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105. *See New Markets Tax Credit Program*, *supra* note 90.

106. *See supra* notes 81, 89–92 and accompanying text.

107. *See* Yvonne Wenger, *Baltimore City Council Approves Tax Credits for Urban Farmers*, BALT. SUN (May 4, 2015), http://www.baltimoresun.com/news/maryland/baltimore-city/bs-md-ci-urban-ag-20150504-story.html [http://perma.cc/5EDC-QBLJ].

108. *See Community Development Block Grant Program – CDBG*, U.S. DEP'T. OF HOUSING & URB. DEV., http://portal.hud.gov/hudportal/HUD?src=/program_offices/comm_planning/communitydevelopment/programs [http://perma.cc/6PH3-GP5V].

goal of eliminating the uncertainty that can arise in the entitlement process.[109] Doing so effectively means aligning the comprehensive plan, zoning code, and building codes to ensure that urban agricultures have less administrative burdens in moving into an urban area while also ensuring that local communities are protected from the industrial-style externalities that arise with any large agricultural production facility. This type of assistance could also prove especially valuable for cities because they could target certain areas in need of redevelopment for this special type of pre-zoning, which would have the effect of directing development to those parts of the city that need it most.

Local governments also routinely use the redevelopment, or urban renewal process, to assist projects in ways that could be beneficial to massive alternative urban agricultures. This assistance has historically included two important tools that can be used in redevelopment areas: the ability to condemn land through eminent domain and the ability to bond against projected, future tax revenues, which is called tax increment financing (TIF).[110] Parcel assembly can be a major issue in urban areas and is often one of the most sought out public contributions to redevelopment of an area; to the extent that massive alternative urban agricultures would need assistance here, cities could seemingly provide this same service that it employs on the behalf of other industries.[111] Arguably of greater assistance to massive alternative urban agricultures would be access to TIF, which has proven a valuable source of upfront funding to any number of development projects since it was first developed in California in the 1950s.[112] Tax increment financing permits a local government to bond upfront on the basis of projected tax revenues that the redevelopment of a blighted or deteriorated area would generate.[113] With that upfront capital, local governments often provide necessary infrastructure to facilitate projects.[114] Here again, this

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109. *See* DENVER, COLO., DENVER ZONING CODE § 11.12.6(B)(1) (as amended through July 10, 2015), https://www.denvergov.org/content/dam/denvergov/Portals/646/documents/Zoning/DZC/DZC_071015_web-optimized.pdf [http://perma.cc/J5J5-AWUP].

110. *See generally* Richard Briffault, *The Most Popular Tool: Tax Increment Financing and the Political Economy of Local Government*, 77 U. CHI. L. REV. 65, 65, 68 (2010).

111. *See* INT'L ECON. DEV. COUNCIL, REAL ESTATE DEVELOPMENT AND REUSE 45–49 (2011) [hereinafter REAL ESTATE DEVELOPMENT AND REUSE] (discussing factors in real estate site planning and assembly in economic development decision-making).

112. *See* Briffault, *supra* note 110, at 68–69; REAL ESTATE DEVELOPMENT AND REUSE, *supra* note 111, at 170.

113. *See* REAL ESTATE DEVELOPMENT AND REUSE, *supra* note 111, at 169.

114. *See, e.g.*, MARTIN D. ABRAVANEL ET AL., *What Makes for a Smart Community or Economic Development Subsidy? A Program Evaluation Perspective*, *in* SMART SUBSIDY FOR COMMUNITY DEVELOPMENT 104, 112 (Fed. Reserve Bank of Boston & The Aspen Inst. 2011), http://www.bostonfed.org/commdev/smart-subsidy/104-abravanel-pindus-theodos.pdf [http://perma.cc/8N3N-DSHJ].

developers' tool could be used for massive alternative urban agricultures. Since these funds are typically available only in areas where there is need for economic development, deployment of TIF to assist these massive alternative urban agricultures would likely help to place them within often economically and environmentally challenged areas.[115] These are many of the same areas that often have "food deserts," or the need for better access to fresh produce and other healthy foods.[116] It could be that conditions associated with the use of TIF for a massive alternative urban agriculture could require that the service also have a community-facing component to the operation. That could be educational, a store that sells to locals in that area for reduced prices, or some other approach that has a benefit to the community.

Assistance with redeveloping brownfields is also a common tool governments provide.[117] As the AeroFarms deal makes clear, vertical farms—and other types of alternative agricultures that can occur above ground—provide exciting ways to potentially revitalize environmentally contaminated brownfield sites. For these reasons, massive alternative urban agricultures like vertical farms—which do not utilize soil—could prove remarkable re-uses of spaces that otherwise have difficulty being repurposed. The potential reuse would depend, of course, on the nature of the contamination and whether it might still have the ability to affect the food grown under alternative measures, such as vertical farming, but there could be a substantial coalescence between brownfield redevelopment and vertical farms.

Land assessment policies are another means of assisting vertical farms and alternative agricultures. Most land is assessed for corporate purposes under the policy of "highest and best use."[118] Many states have long offered tax exemptions for traditional agricultural uses where farmers agree to keep land in agricultural production and the local government then assesses the property at agricultural values rather than highest and best use, which is often

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115. *See* Briffault, *supra* note 110, at 65. Deployment of redevelopment and TIF historically has required findings of "blight" or "deterioration," though the concepts have been abused over time. *See, e.g.*, Colin Gordon, *Blighting the Way: Urban Renewal, Economic Development, and the Elusive Definition of Blight*, 31 FORDHAM URB. L.J. 305 (2003).

116. *See Creating Access to Healthy, Affordable Food*, USDA AGRIC. MKTG. SERV., http://apps.ams.usda.gov/fooddeserts/ [http://perma.cc/SJK7-TAQK].

117. *See, e.g.*, INT'L CITY COUNTY MGMT. ASS'N, BROWNFIELDS REDEVELOPMENT: A GUIDEBOOK FOR LOCAL GOVERNMENTS AND COMMUNITIES iii, 3 (2d ed. 2011), http://www.usmayors.org/brownfields/library/Brownfields_Redevelopment.pdf [http://perma.cc/2Z9J-3BSR].

118. *See, e.g.*, Emil E. Malizia, *Property Tax Appraisals and the Reuse of Inner-City Properties* 4 (Lincoln Inst. of Land Policy, Working Paper WP97EM1, 1997), https://www.lincolninst.edu/subcenters/property-valuation-and-taxation-library/dl/malizia.pdf [http://perma.cc/WJ7D-JCK5].

non-agricultural use in urban areas.[119] Permitting these agricultural valuations in land assessment within urban areas could be especially important in ensuring that urban agricultural production does not receive unequal treatment as compared with traditional rural agriculture.

If massive alternative urban agricultures were taken seriously, other economic development supports offered to rural farmers should also be revised to level the playing field of subsidies offered to conventional soil-based farming. For instance, the Natural Resources Conservation Service (NRCS), a sub-agency of the USDA, is the primary agency through which conservation on agricultural lands is funded.[120] Through a variety of conservation and agricultural easements and conservation contracts, the NRCS allocates millions of dollars each year to pay soil-based farmers to engage in farming practices that lessen the environmental impact on the land.[121] Since vertical farms would have a similar effect of lessening the environmental harms of farming, it is plausible that they, too, should receive some subsidies similar to those of soil-based farmers. Because the urban agriculture is not associated with a particular piece of land on which soil-based agriculture would otherwise occur, the nature of the conservation funding accorded to urban agricultures would need to have some "but for" component: but for this urban agriculture, a certain amount of soil-based farming would otherwise need to occur. The specifics of such an approach are beyond the scope of this Article, but merit further investigation—especially in light of the significant environmental benefits that are provided by urban agricultures like vertical farming.

Vertical farms might also be ripe for new applications of existing financing mechanisms in the private sector, such as real estate investment trusts (REITs) and other forms of securitization. Other aspects of soil-based farming have already experienced success in utilizing these structures.[122] For instance, many wineries have found a REIT structure valuable.[123] In that

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119. *See Agricultural Assessment Program - Overview*, N.Y. DEP'T OF TAX'N & FIN., http://www.tax.ny.gov/research/property/assess/valuation/ag_overview.htm [http://perma.cc/G66M-2LU3] (last updated Mar. 16, 2012) ("The Agricultural Districts Law allows reduced property tax bills for land in agricultural production by limiting the property tax assessment of such land to its prescribed agricultural assessment value.").

120. *See Agricultural Conservation Easement Program*, USDA NAT'L RES. CONSERVATION SERV., http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/easements/acep/ [http://perma.cc/6YVQ-SYCT].

121. *Id*.

122. *See* Anna Robaton, *Farming REITs*, NAREIT (Jan. 21, 2015), https://www.reit.com/news/reit-magazine/january-february-2015/farming-reits [http://perma.cc/XK6C-7VKA].

123. *See, e.g.*, *About VinREIT*, GLOBAL WINE PARTNERS, http://globalwinebank.com/winecapital-vinreit.html [http://perma.cc/2Y8E-VHJC]

model, the wineries sell their land to the REIT, then lease back the land from the REIT.[124] Next, the REIT assists the wineries with upfront costs associated with purchase and replacement of machinery, something that many wineries find difficult to otherwise finance.[125] The REIT then securitizes the interests in the wineries and the annual rents derived therefrom to investors that act as shareholders in the REIT's interests, rather than any one individual winery.[126] The structure could prove equally valuable for vertical farms, which have high upfront costs—especially early on before the technology becomes cheaper—but which are likely to have steady income streams derived from the sale of crops. Indeed, vertical farms would seem especially appropriate for this kind of investment because their crops are not susceptible to the vagaries of weather that make traditional agriculture a bad bet for this kind of approach, and thus, they should have a more certain income stream. Those income streams may vary depending upon the crop, but investors could make their choice to invest based upon specific crops and their expected returns.

Another alternative financing mechanism could be the social impact bond.[127] In these financial instruments, a private investor provides upfront capital for a city to make social investments for which there is increasingly little capital available but where implementation of the investment is almost certain to have long-term social, and economic, investments for the city.[128] The city pays back the bond over time through the savings that the city otherwise would have spent on dealing with the long-term problems that would otherwise have occurred but for the upfront investment.[129] A classic case for a social impact bond is pre-school, which has shown to have dramatic long-term results for cities' bottom lines, such as lower incarceration rates, but for which upfront funding can be hard to find.[130] Similarly, vertical farms and other massive alternative urban agricultures would seem to be ripe for this kind of financing. Healthier diets are known to lead to better long-term health outcomes; however, it can be difficult to get healthy food into poor neighborhoods and it can be even more difficult

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("VinREIT is a real estate investment trust (REIT) created specifically to provide real estate sale-leaseback financing to the wine industry.").

124. *Id*.

125. *Id*.

126. *See generally id*.

127. *See Social Impact Bonds*, GOLDMAN SACHS (Oct. 2014), http://www.goldmansachs.com/our-thinking/pages/social-impact-bonds.html [http://perma.cc/95M4-QHKQ].

128. *Id*.

129. *Id*.

130. *See, e.g.*, Stephen Goldsmith, *Utah Applies Social Impact Bonds to Early Childhood Education*, GOVERNING (Feb. 18, 2015), http://www.governing.com/blogs/bfc/gov-social-impact-bonds-early-childhood-education-utah.html [http://perma.cc/V74P-WLBJ].

to change the habits of middle class and wealthy residents who prefer less healthy diets.[131] Providing upfront financing to urban agricultures that could radically influence diets in a city is almost certain to provide long-term public health benefits that the city could bank on today.

Cities might also consider owning the buildings for the first of the vertical farms or other massive alternative urban agricultures. In such a case, the cities could contemplate a rent structure that would permit the vertical farm to pay a lower rent at the time when the vertical farm was just beginning but where the vertical farm would pay more as it became a greater success. One such approach typically employed in retail development—and also in the leasing of some public facilities to private entities—is to charge a total rent that is composed of a base rent plus a percentage rent that varies based on the sales.[132] This simple structure has a long history of encouraging growth of new businesses while also rewarding the landlord, or another funder, as the business becomes prosperous.[133] Surely there are other rent structures that could be deployed. The goal of mentioning this structure here is simply to indicate that there are a number of ways that even existing rent structures commonly used could be utilized to unlock the potential of vertical farms.

Cities also have varied concerns beyond simply ensuring the success of business. Among those are the vitality of their neighborhoods and ensuring jobs for their citizens—especially those most vulnerable and least-skilled. While AeroFarms is located on the site of an old steel refinery, and in an area with over one hundred brownfield sites, it is also next door to a newer community center that pre-dated the AeroFarms investment. In addition, its developer plans to make AeroFarms the centerpiece of a "Makers Village."[134] While the developer does not define that concept, the general notion of using a vertical farm, or some other type of massive alternative urban agriculture, as part of a community-defining amenity for a

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131. *See* Karen Finney, U.C. Davis, *Middle Class, Not Poor, Eat More Fast Food*, FUTURITY (Nov. 1, 2011), http://www.futurity.org/middle-class-not-poor-eat-more-fast-food/ [http://perma.cc/HHK6-MUGH] (discussing Kim DaeHwan & Paul Leigh, *Are Meals at Full-Service and Fast-Food Restaurants "Normal" or "Inferior"?*, 14 POPULATION HEALTH MGMT. 307 (2011)). *See generally Economic Costs*, HARVARD T.H. CHAN SCH. OF PUB. HEALTH, http://www.hsph.harvard.edu/obesity-prevention-source/obesity-consequences/economic/ [http://perma.cc/F8UW-PDBE] (citing one study finding that "per capita medical spending for obese individuals was an additional $1,429 (42% higher) compared to individuals of normal weight" and a second study finding that "per capita medical spending was $2,741 higher for obese individuals than for individuals who were not obese—a 150 percent increase").

132. 10 Cal. Real Est. § 34:72 (4th ed. 2010).

133. *See* Jonathon G. Nash & David C. Camp, *A Few Thoughts on Percentage Rent*, COLO. REAL EST. J., Dec. 3, 2014, at 22.

134. *See Makers Village*, RBH GROUP, http://www.rbhgrp.com/makers-village.html [http://perma.cc/Y5LF-UQHV].

neighborhood could be especially attractive to a city. This could be so even if the primary purpose of the vertical farm was not necessarily to feed the neighborhood per se; rather, a large vertical farm with a goal of servicing a fifty-mile radius, for instance, could still have a neighborhood-facing component to the project that could invite the neighborhood in for lessons on sustainability, educational programs on the future of agriculture, or even prove a testing ground for novel public health trials like "all you can eat" leafy green vegetables for the neighborhood subsidized by the city.

Such neighborhood-facing components of vertical farms could also play an important role in helping to "naturalize" the technologies of massive alternative urban agricultures, which make them accessible to people and eliminate the fear of their novelty. This is important because, right now, those who are attuned to local food can sometimes be beholden to a nostalgia-laden, back-to-the-land ethic.[135] Ironically, it is twenty-first century technological advances in urban farming that could eliminate the need for many of the environmentally-harmful, rural, agricultural technologies of the twentieth century. Convincing people to put their faith in vegetables grown in a bed of water—or under sprayers—that are stacked thirty feet off the ground may take time to catch on. Granting access to the technology, and making it familiar, would go a long way toward making this next step in food cultivation feel less foreign.

Private developers could even imagine sponsoring such a vertical farm for a private development. Both public and private development often use an amenity that either breaks even, or possibly loses value, for purposes of bringing higher values to adjacent properties.[136] It could be that vertical farms and other massive alternative urban agricultures, coupled with a community-facing component to their projects, could provide just such a boost to adjacent property values even if they themselves produce only a modest return.

The workforce component of these projects could also be of value to cities. Just as the AeroFarms project pairs with a local community development corporation to assist in worker training from a local

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135. *See, e.g.*, Sarah Searle, *Stop Romanticizing Farms*, MODERN FARMER (June 30, 2014), http://modernfarmer.com/2014/06/stop-romanticizing-farms/ [http://perma.cc/56T8-J37H] ("In a sense, we're incentivizing farmers to use their limited resources to perpetuate a romantic stereotype that consumers enjoy, rather than to spend money on functioning, sustainable (but perhaps not magazine-beautiful) models of local farming.").

136. *See, e.g.*, *The Bilbao Effect: If You Build It, Will They Come?*, ECONOMIST (Special Report) (Dec. 2013), http://www.economist.com/news/special-report/21591708-if-you-build-it-will-they-come-bilbao-effect [https://perma.cc/6446-HHEX] ("Visitors' spending in Bilbao raised over €100m ($110m) in taxes for the regional government in the first three years after the museum opened, enough to recoup the construction costs and leave something left over.").

impoverished community,[137] so too could cities that invest in massive alternative urban agricultures similarly demand such worker training in response to public investment, as well as minimum job commitments or the terms of those jobs, such as whether the jobs offer full-time employment or benefits.

Another way that costs could be kept low would be through efforts to commodify the vertical farm technology itself, or if patented, it could be leased to cities or non-profits at a low cost for deployment to feed low-income communities. Commodification and modularization of the structures would assist in making them quickly and easily deployable.

Finally, the last several decades have seen the rise of compensation systems that pay those who act in environmentally responsible ways. For instance, in California's emerging cap-and-trade system, those entities that act as "carbon sinks," like private forests that own old growth forests, can sell GHG emissions credits to emitters.[138] If vertical farms and other massive alternative urban agricultures are able to reap the results they promise, they should also be rewarded accordingly. One approach could be GHG emissions credits, or "offsets," on cap-and-trade markets, which would potentially pay vertical farms for the GHG emissions they did not incur compared to regular farming methods. The ability to actually calculate these credits is still a work in progress; however, keeping this open as a potential funding source is important.

Similarly, there may be a way to pay the vertical farms for the environmental harm they are avoiding by not farming in soil. There are at least two parts to this: the presumptive land not used for cultivation and the runoff of phosphorus and other nutrients that occur in herbicides and pesticides not used. There is no existing market for this kind of compensation, but seemingly a trading system could be started. For instance, the sulphur dioxide (SO2) credit market, which requires power plants that burn coal to pay for the right to pollute SO2, has had the effect of reducing the amount of SO2 emissions and also incorporating into the cost of coal its SO2 content.[139] If massive alternative urban agricultures evolved further, they should be considered for such a scheme that would reward them for not

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137. *See supra* text accompanying note 93.

138. *See* CAL. AIR RES. BD., CAL. ENVTL. PROT. AGENCY, COMPLIANCE OFFSET PROTOCOL U.S. FORESTS PROJECTS 13–14 (2015), http://www.arb.ca.gov/cc/capandtrade/protocols/usforest/forestprotocol2015.pdf [http://perma.cc/8TJX-UM5X]; *Compliance Offset Program*, CAL. ENVTL. PROT. AGENCY, http://www.arb.ca.gov/cc/capandtrade/offsets/offsets.htm [http://perma.cc/Q9BH-PBKJ] (last updated Feb. 10, 2016).

139. *See Progress Report: Emissions Reductions*, EPA, http://www3.epa.gov/airmarkets/progress/reports/emissions_reductions_so2.html [http://perma.cc/FJC3-T6SD].

causing the types of environmental degradations that are among the hardest for this country to treat.

CONCLUSION

It may be that the future of local food is less Wendell Berry and more Silicon Valley; in other words, large-scale adoption of local food will require massive alternative urban agricultures that a land ethic-based approach to farming will never fulfill. Local food has often been adverse to technologies in food, as it has typically meant genetically modified foods and other means of taking "naturalness" out of Nature. A new approach is needed, one that embraces technologies like vertical farms, that can provide organic, non-GMO foods grown without pesticides or herbicides on a large scale available to all. Moreover, given population change, the future of local food will need to occur at a scale that current approaches to local food are unlikely to generate.

As this Article has shown, the major impediment holding back the large-scale technologies of local food is not the availability of technology but the financing.[140] The inventions necessary are not so much related to agriculture, but how we fund new approaches to agriculture. We should not expect that the funding for such new forms of agriculture will come from those sources that currently support existing agricultures, such as federal subsidy programs to farmers. But they can come from other, unlikely sources, especially once it is recognized that financing massive alternative urban agricultures share many traits of financing urban manufacturing. All of the reasons that apply to the imperative to subsidize urban manufacturing—jobs, community benefits, redevelopment of abandoned areas, etc.—also apply to subsidizing massive alternative urban agricultures.

Initially, some may criticize subsidization of massive alternative urban agricultures as if they were factories. Some may question the return on investment, which would likely be lower than some other industries. Some may question supporting a business that, at this time, is not self-sufficient. Those are all legitimate concerns because there is real risk in providing economic development assistance to new businesses. But at the same time, the risk is the point: local governments routinely invest in nascent industries with the hope that those industries will bloom, and with their growth, new businesses will come to the city.[141] Indeed, economic development subsidies are most suspect when they invest in businesses that have no risk because

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140. *See generally supra* notes 80–83 and accompanying text.

141. *See, e.g.*, Susanne Craig, *Despite Risks, Cuomo Bets on Solar Power to Lift Buffalo*, N.Y. TIMES, Oct. 25, 2015, at A15 (detailing risks taken by State of New York in massive subsidy of solar facility with goal of begetting a "virtuous cycle [that] will follow, and public money [that] will attract private investment").

the subsidy serves no market or community purpose: a business that would succeed without the subsidy categorically does not need it.

The goal of public and private investment in risk-laden endeavors is either the prospect of short-term high returns, as is typical with private investments, or long-term public benefits, as is typical of public investments. Massive alternative urban agricultures potentially provide both types of benefits. For private investors, the first few vertical farms will undoubtedly be extraordinarily expensive compared to soil-based farming; however, private investors will inevitably hope that commoditization of the technology will drive costs down, yields up, and return future profits. For public investors, massive alternative urban agricultures are an economic risk, but one they cannot afford not to take with population change. Further, cities gain significant public health benefits from healthier eating. The effects on how a city is perceived when it invests in massive alternative urban agriculture provides a reputational advantage that can lead to other industries seeking out that location.

In essence, these investments in local food have much in common with the theory of "disruptive innovation" that is popular in technological circles. It may be that massive alternative urban agricultures can take inspiration from the so-called "disruption" theory of Clayton Christensen, who noted that disruptive technologies, which often appear to be poor or eccentric versions of products that are now dominated by another market participant, can ultimately replace—not just compete with—existing technologies by being simpler, cheaper, more reliable, and convenient.[142] Whether local food can meet these mandates of disruption theory, the use of technologies like vertical farming have the real possibility to redefine local food and food overall. The future of food can be healthy and abundant, even urban. What it needs now is a finance that believes equally in the dream.

Imagine what $80 billion a year in subsidies—or just a fraction thereof—could do to turn massive alternative urban agricultures into the mainstream of food production.

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142. *See* CLAYTON M. CHRISTENSEN & MICHAEL E. RAYNOR, THE INNOVATOR'S SOLUTION: CREATING AND SUSTAINING SUCCESSFUL GROWTH 34–35 (2003).