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The Environmentalization of Urban Entrepreneurialism: From Technopolis to Start-Up City

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Abstract

This paper investigates two trends in contemporary forms of urban entrepreneurialism: (1) an increasing focus on cultivating entrepreneurship and (2) the promotion of entrepreneurial ecosystems that leverage culture and sustainability to attract and support entrepreneurs. We argue that these trends signify a shift from the entrepreneurial city to new strategies that shape cities for entrepreneurs. Underpinning this development is a broad normalization and valorization of entrepreneurship as the dominant pathway for urban economic growth. Additionally, we show how sustainability and greening are enrolled in these economic development strategies, promising to bolster the environmental image of the city. We highlight these two changes by focusing on the intellectual foundations of the technopolis concept in Austin, Texas, and the development of a cleantech entrepreneurial ecosystem that has increasingly been leveraged in Austin's entrepreneurial growth efforts. We offer insights into how the growing trend of "making cities for entrepreneurs" is reshaping urban entrepreneurial governance, potentially exacerbating inequalities in urban development.

Introduction

Increasingly, entrepreneurial ecosystems (EEs) are recognized as foundations for building dynamic, prosperous, and resilient urban economies (Faggian et al., 2017; Malecki, 2018). Studies on the geographies of EEs have highlighted the importance of place-based social and cultural conditions for creating the robust environments, the ecosystems, in which entrepreneurship can thrive (Acs et al., 2017; Audretsch et al., 2015; Audretsch and Belitski, 2017; Ferm, 2017; Samila and Sorenson, 2017; Spigel, 2017a). Yet only recently has critical literature on urban entrepreneurialism considered the growing recognition of EEs (Fiorentino, 2018; McNeill, 2017; Rossi and Bella, 2017). In fact, urban entrepreneurialism is increasingly organized around ways to enroll social and cultural (i.e., non-economic) processes into endeavors that innervate the environments of entrepreneurship. We investigate this new aspect of urban entrepreneurialism through a case study of Austin's (Texas) high-technology industries, particularly the cleantech sector, and show how attempts are being made to enjoin non-economic factors with a local economic development agenda that is focused on creating a more vital and dynamic ecosystem for entrepreneurship.

Two contemporary trends in entrepreneurialism, what we call its "environmentalization," are identified and highlighted in our case study. Firstly, urban entrepreneurialism is increasingly focused on ways the urban environment can be used to enliven entrepreneurship, support robust EEs, and attract potential entrepreneurs (Cohen and Muñoz, 2016; Florida et al., 2017; Florida and Mellander, 2016). Secondly, urban entrepreneurialism is increasingly greener. From marketing and branding to strategic infrastructure investments to new policy initiatives to experimental forms of economic development, a concern for urban sustainability is reshaping interurban competitiveness and the strategies and practices of urban entrepreneurial governance (Greenberg, 2015; Krueger et al., 2007; Lederman, 2015; While et al., 2004). Increasingly, too, as this paper suggests, cleantech entrepreneurship (entrepreneurialism in the green economy, green innovation, and sustainable technology) is a target of urban entrepreneurial agendas (Fitzgerald, 2010; Gibbs and O'Neill, 2017; Indergaard, 2013).

Our case study focuses on these trends in urban entrepreneurialism in Austin and its emergence as an important center for high technology. We draw on interviews and textual materials.

Between 2014 and 2016, we conducted 25 semistructured, open-ended interviews with key informants from the City of Austin (COA), the University of Texas (UT), the Austin Technology Incubator (ATI), Austin Energy (AE), the Austin Chamber of Commerce (Chamber), and some additional nonprofit groups. Informants were approached because of their role in a particular organization, their knowledge of the issues related to this study, and often, because of snowball sampling, their connection to other interviewees. We also rely on primary-source materials such as annual reports, personal documents provided by informants, and library archives from the Austin History Center and UT-Austin. We also draw on secondary news sources, especially the Austin Business Journal.

The paper is broken into two parts. The first outlines recent scholarship on urban entrepreneurialism and the geographies of entrepreneurship, especially the culture of entrepreneurship and EEs. Then we focus on the greening of urban entrepreneurialism and entrepreneurship, specifically in the cleantech sector. In the second section, the focus is our case study of Austin, where we discuss the overlap between local growth coalitions' efforts to support an ecology for entrepreneurship and ecopreneurs. We show how a model of development, the technopolis model, created in Austin in the 1980s shaped the institutional supports that helped the city develop a significant entrepreneurial ecosystem. We then show how Austin's cleantech ecosystem emerged out of this historical context of high-tech industrial growth and Austin's culture of environmentalism. We conclude with a discussion of the implications of this case for the broader literature on urban entrepreneurialism, which has only recently explored the role of entrepreneurship, EEs, and the green economy in urban governance.

From the entrepreneurial city to cities for entrepreneurs

Decades of urban political economic scholarship on urban entrepreneurialism have shown how cities have increasingly enrolled in public-private partnerships, engaged in real estate speculation, and focused on marketing and branding of place (such as in business improvement districts or tax increment financing zones) (Lauermann, 2018). The following trends can also be identified: strong growth-first policies and strategies, a policy discourse that naturalizes market forces and logics, privatization of the public sphere and services, extrospection toward enhancing competitiveness, narrow supply-side interventions, more professional forms of boosterism and

marketing, and, often, exclusion of marginalized communities (Hackworth, 2007; MacLeod, 2011; Peck et al., 2009, 2013; Roberts and Schein, 1993; Rossi, 2017).

These are still important and widely practiced components of urban entrepreneurialism, but recently there has been considerably more focus on ways of cultivating entrepreneurs and entrepreneurship as part of local economic development strategies (Audretsch et al., 2015; Florida and Hathaway, 2018). What makes these recent developments in urban entrepreneurialism notable, even novel, is that specific place-based interventions aim to encourage and valorize entrepreneurial activities, to support cultures of entrepreneurship, by shaping or reshaping local environments and their cultural, social, and material aspects; collectively these are called "entrepreneurial ecosystems" (EEs). Aspects of EEs can include accessible markets, human capital and workforce capacities, funding and finance, institutional support systems and mentorship programs, governmental and regulatory frameworks, education and training, institutions of higher education, and cultural supports (Stam, 2015).

EEs are akin to clusters, innovation systems, and industrial districts, but their focus is more explicitly on the role of entrepreneurs in co-producing markets and industries in a region and often targeting high-growth areas of entrepreneurship (Brown et al., 2017; Feld, 2012; Pitelis, 2012). Moreover, regional policy correspondingly focuses on more intangible place-based material, social, and cultural attributes, "the framework conditions" that comprise EEs and serve as inputs to assist new start-ups and entrepreneurial success (Audretsch and Belitski, 2017; Spigel, 2017b). Scholars of entrepreneurship note too how social and cultural resources are key to legitimizing and encouraging risk-taking entrepreneurship (Audretsch et al., 2019; Doody et al., 2016). Additionally, there is a focus on how particular aspects of cities, like their role as knowledge hubs, can foster entrepreneurship and the development of EEs (Acs et al., 2017; Audretsch et al., 2015). Finally, developing intimate and stalwart connections between institutions of higher education and a private-sector is a key area of regional EEs' policies and initiatives. However, unlike past regional policy, newer policies increasingly emphasize the significance of intermediary organizations such as incubators, technology transfer offices, and research centers (Malecki, 2018). These institutions support the development of local

entrepreneurial cultures by building a sense of community and an ethos of mentorship that increase the success of entrepreneurs.

Yet only recently has critical urban scholarship paid attention to this shift in urban entrepreneurialism (Fiorentino, 2018; McNeill, 2017; Rossi and Bella, 2017), hence the importance of this special issue. In particular, Rossi and Di Bella (2017) contend that the focus on entrepreneurship is part of a global trend they call "start-up urbanism." They argue that major technopoles of the 1980s and 1990s, like New York and Rio de Janeiro, showed how policy-driven regional economic development was shaped by the entrepreneurialist "late Keynesian state," which has since been supplanted by a more decentralized mode of urban entrepreneurial governance. Moreover, start-up urbanism is associated with the tenets of neoliberal governance and rationality, and its emphasis is on how people should conduct their lives as entrepreneurs. Rossi and Bella illustrate how urban environments are being reworked to better foster the cultural practice of entrepreneurship, where “the city is seen as an ‘ecosystem’, comprising knowledge, creativity and a variety of communities of practice, enabling the individual to become an ‘entrepreneur of himself’” (ibid., 1001). Here the development of a literature on entrepreneurial ecosystems is interpreted critically to refer to more than academic ruminations on the value of various cultural, social, or material attributes of a place for regional growth, and points toward a new logic of capital accumulation and the urbanization of capital that is connected to decentralized forms of urban governance.

Like Rossi and Bella (2017) we believe the recent shift in urban entrepreneurialism points to a characteristic of neoliberal, urbanized capitalism, and we too draw on the work of Foucault but with a focus on his thoughts on the environment and neoliberalism. Foucault (2010: 259–260) suggested that neoliberal governmentality was characterized also by “an *environmental* type of intervention instead of the internal subjugation of individuals.” Gabrys (2014) creatively applied this Foucauldian analysis to conceptualize the urban environment as a site of governance, where regulation of social and cultural life can be accomplished through the control of “the rules of the game” in addition to more direct attempts to shape individual behaviors or collective norms. Taking this meaning of *environmentalization*, we critically interrogate the creation of urban entrepreneurial ecosystems and investigate how urban entrepreneurialism, its local government

policies and initiatives, increasingly focuses on environmental interventions that support entrepreneurship to facilitate a new process of capital accumulation. Moreover, we point out how the environment, a concern about ecology, has been an increasingly important facet of urban entrepreneurialism.

Greening entrepreneurialism and cultivating ecopreneurs

The second element of the environmentalization of urban entrepreneurialism is characterized by its greening. While et al. (2004: 550) observed a relationship among urban entrepreneurial governance, urban sustainability agendas, and the remaking of "urban environments and ecologies." Designed to address a range of environmental problems, urban sustainability agendas, they noted, also open up new economic development opportunities and help cities secure a better position within the global intercity competitive hierarchy. Recently, there has been growing interest in the connection between urban and regional environmental governance (aimed at environmental sustainability) and economic development, questioning what the broader impacts of sustainability are for job growth, green industrial development, innovations, and so on (Fitzgerald, 2010; Gibbs and Lintz, 2016). Entrepreneurship and innovation are often seen as essential elements of green economic development (O'Neill and Gibbs, 2016). Moreover, urban entrepreneurialism increasingly involves cultivating and attracting entrepreneurs (as discussed above), including a subset called "ecopreneurs" (Schaper, 2016). Ecopreneurs work on innovations in the green economy, ranging from renewable energy to circular economies to eco-tourism, which holds the promise of more sustainable development, economic growth, and better ecological stewardship. In addition to being an area of significant economic potential, the presence of green industries in a city can contribute to a city's green identity and reputation.

Central to the green economy are green innovations developed and championed by ecopreneurs (Chapple et al., 2011; Gibbs and O'Neill, 2014a, 2017). Assuming that the transition toward a low-carbon, less resource-intensive future will require the adoption of significant technological innovations, ecopreneurs recast environmental problems as profitable business opportunities that can best be solved by business acumen (Santini, 2017). The area of the green economy where high technology, innovation, entrepreneurship, and a concern for ecology all overlap is called

"cleantech" (Horwitch and Mulloth, 2010). Ecopreneurs and entrepreneurial ecosystems have a central role in cleantech because it is distinguished by the pursuit of new market opportunities through innovation (Caprotti, 2012). Since 2001, following the dot-com crash, cleantech has energized faith in high-growth, high-tech entrepreneurship and regional development policies that support industrial clustering, and EEs have played an important role in cleantech expansion (Davies, 2013; Goldstein, 2018; Gray and Caprotti, 2011).

The incorporation of green industries, especially cleantech, into urban entrepreneurial strategies is also a recent development, one not captured by the existing scholarship. Scholarship on urban and regional environmental governance has captured how environmental initiatives are increasingly central to economic development (Jonas et al., 2011; While et al., 2004, 2010), but only recently has critical scholarship questioned the role of entrepreneurs and the valorization of entrepreneurship in generating sustainable cities (Gibbs and O'Neill, 2014b; O'Neill and Gibbs, 2016). This is particularly surprising given the emphasis on entrepreneurship in literature on high-growth green industries (such as renewable energy, circular economies, information and communication technology, and so forth) (Demirel et al., 2019; Tilley and Young, 2006, 2006). Taken together, entrepreneurship, sustainability initiatives, and the green economy have become ever more central to urban entrepreneurialism, especially in the case of Austin, which has wider resonance with cities engaging in similar policies and practices.

Entrepreneurialism environmentalized

Our case study of Austin's industrial development shows how urban entrepreneurialism has been environmentalized. From the late 1970s to the 1990s, the city's entrepreneurial policies moved from a focus on attracting large firms to developing a more diversified strategy of encouraging and fostering an environment for entrepreneurship. The case study then shows how the foundations of entrepreneurial ecosystems developed throughout the 1970s and 1980s and converged with Austin's social and cultural "milieu of environmentalism" to successfully develop a local industrial policy around cleantech.

Austin, by many measures, is an exceptional place for entrepreneurship. The Kauffman Foundation—a private foundation that funds research and entrepreneurship across the U.S.—has

repeatedly ranked Austin among the top 10 U.S. metros across its three major indices: start-up activity, growth entrepreneurship, and main street entrepreneurship.[i] In 2015 and 2016, Austin ranked first in start-up activity—measured as a combination of the rate of new entrepreneurs, opportunity share of new entrepreneurs, and start-up density—only surpassed in 2017 by Miami. Research from the Martin Prosperity Institute showed Austin as the 13th-ranked metro for VC investment globally in 2012, holding 1.5% of the global share of VC funding, or $626 million, and on a per capita basis, Austin ranks sixth globally, behind San Diego, Durham, Boston, San Francisco, and San Jose; in 2016, VC investment climbed to $977 million (Florida, 2017; Florida and King, 2016). Finally, the number of start-ups in Austin grew from 6,528 in 2000 to 11,127 in 2007 (before the recession), and after 2010 ballooned to 35,710 in 2016 (Echeverri-Carroll, 2017).

Austin has also developed a reputation for being green. On the one hand, Austin has a strong environmental movement and the city has developed a laudable urban sustainability agenda that serves and informs the city's economic development agenda and its urban planning and policy priorities (Swearingen, 2010; Tretter, 2016). On the other hand, Austin's growth over the last 50 years has been propelled by high-technology industrialization and more and more the city has a reputation as a center for cleantech innovation (Oden, 1997; Saha and Muro, 2017).

One thing that stands out in Austin is the elephantine role of the University of Texas at Austin (UT) in forming the city's social and cultural landscape. In particular, UT has played a decisive role in the creation of the city's high-technology landscape in at least five ways: training a highly technically skilled labor force, supporting the creation of locally based firms, raising the city's reputation, creating a more desirable cultural atmosphere, and using its powers as a land developer (Tretter, 2016). Additionally, we place particular emphasis on the unique role a separate UT research think tank, the Institute for Constructive Capitalism (IC2) directed by George Kozmetsky, has played in Austin's urban and regional development. IC2 has directly and indirectly informed the direction of Austin's growth, and several of its subsidiaries, especially the Austin Technology Incubator (ATI), have made direct and substantial contributions.

The making of the technopolis

Over the last 50 years, Austin's entrepreneurial efforts have shifted from recruitment campaigns to the creation of a healthier entrepreneurial ecosystem (EE). By the 1970s, Austin, using an effective entrepreneurial recruitment campaign, had attracted a number of branch plants from national electronics and defense firms (such as IBM, Texas Instruments, Motorola, and Advanced Micro Devices) and one national firm, Tracor, a defense contractor, had established its headquarters in the city. In the 1980s, the number of branch plants increased but more importantly, in two successful national competitions, the city managed to capture the headquarters of two large national computer-defense-related technology consortiums, the Microelectronic Computer Corporation (MCC) and SEMATECH. By the 1990s, Austin's industrial policy, once "focused on attracting major high-technology manufacturers," began to concentrate on becoming a "breeding ground for start-up companies" (Greater Austin Chamber of Commerce, 1999: 1). An increasing number of homegrown firms were founded in the city during the 1990s, primarily in computer manufacturing and software design. The most notable was Dell, founded by Michael Dell when he was a student at UT-Austin. In addition, numerous corporate spinoffs or spinouts from early start-ups have emerged, such as Tivoli (Echeverri-Carroll and Oden, 2016), even as Austin has continued to attract investment from larger companies like Oracle and Apple.

Changes in Austin's growth coalition's development strategy were intimately informed by and tied to the activities and ideas of UT-Austin business professor George Kozmetsky (Phillips, 2006, 2009). In fact, it was difficult to discern the line between his ideas and those of city or Chamber officials. Kozmetsky and his technopolis model provided an influential framework in Austin for how to achieve regional growth in a high-technology world, and he advised local and regional power brokers on the development of Austin's economic development strategy (Farley and Glickman, 1986; Gibson and Rogers, 1994; Smilor, Gibson and Avery, 1989). Moreover, Kozmetsky used his special role within the UT system to support his conviction, his vision, that universities should serve a regional growth agenda, in particular by supporting the creation of robust environments for entrepreneurship.

Kozmetsky was a businessman cum academic who came to Austin in the mid-1960s to become the Dean of the School of Business at UT. He had briefly held a faculty position at Carnegie

Tech's (now Mellon's) Graduate School of Industrial Administration, but his fame and fortune came from his work with defense contractors, most importantly as co-founder of the Los Angeles-based Teledyne, a leader in the first wave of high-technology innovation in the 1950s and 1960s. In 1966, having amassed a sizeable fortune, he formally left his role as a corporate executive (although he continued to serve on Teledyne's board) to join the faculty at UT, where he worked from 1966-1982.

One of Kozmetsky's most enduring achievements as a dean was establishing a stand-alone research center called the Institute for Constructive Capitalism, or IC2. Formed in 1977, IC2 was initially a division of UT's business school. However, in 1982, when Kozmetsky stepped down as dean, IC2 became an independently financed research unit within the UT system. Kozmetsky became its first director, and IC2 was officially renamed Innovation, Creativity, and Capital. In 1977, IC2 was mainly a pro-capitalist think tank that engaged in some for-profit consulting but was primarily generating research reports to "combat anti-business feeling ... and improve the image of the corporate executive" (McLeod, 1978: 14). Save in-kind financial benefits, IC2 did not receive any direct funds from UT, but being attached to a university enhanced the legitimacy of the institute and its reports and studies. These included such titles as *The Self-Sufficient Consumer* (1979), *The State of American Capitalism* (1981), and *Corporate Creativity* (1984). There were also several publications about Texas' economy, business, and society. However, it is notable that the institute produced no dedicated studies about Austin and its regional development until the release of IC2's *Austin Technology-Based Industry* in 1991, a joint project with the Austin Chamber of Commerce.

In the late 1980s, IC2 "began to take on the role of a catalyst organization and to focus on management for change," and much of this shift was precipitated by Kozmetsky's discovery of the technopolis (Jones, 2018: 326–328). The "technopolis" was defined by Smilor, Gibson, and Kozmetsky (1989: 50) as "[a city] that interactively links technology commercialization with the public and private sectors to spur economic development and promote technology diversification. Linking technology and economic development in a new type of city-state is an emerging worldwide phenomenon." Their intellectual project highlighted Austin's urban and regional high-tech development trajectory as a prototype that differed from the trajectories of

major global cities and areas like New York, London, Silicon Valley, and Boston's Highway 128 regions (Castells and Hall, 1994; Saxenian, 1996; Scott, 1993). They explain that four factors are especially important in the development of a technopolis: the achievement of scientific preeminence, the development and maintenance of new technologies for emerging industries, the attraction of major technology companies, and the creation of homegrown technology companies. Many of Kozmetsky's insights were gleaned from his ruminations on the conditions that drove Austin's rapid economic development, and he became convinced that Austin's experience could be replicated in other cities. Yet he used "the Austin region as [IC2's] laboratory" to implement his Austin Model, "a strategy to pull government, businesses and academic institutions together to build technology- based firms" (Butler, 2010: 109).

For Kozmetsky Austin was an archetypal technopolis and what his model described was the importance of intensive institutional arrangements—the coalition, configuration, and roles of the public sector (local and state governments), the educational sector (institutions of higher education), and the private sector (business organizations and both emerging and established firms)--that made the city's development possible (Gibson et al., 1992; Smilor et al., 1988; Smilor, Gibson and Kozmetsky, 1989). Importantly, the emphasis on the decisive role of local organizational relationships, especially the leading role played by universities, had come from IC2's reflections on UT's role in the successful luring of the national headquarters of MCC and Sematech to Austin in the 1980s (Gibson and Rogers, 1994). It also came from reflecting on how the state of Texas had supported industrialization through specific initiatives. For instance, in the mid-1980s, in the wake of a recession, the Texas Legislature established the successful Advanced Technology and Research Program (ATRP) (Smilor, Gibson, and Kozmetsky, 1989). More recently, Austin's entrepreneurial success, as Echeverri-Carrol and Oden (2016: 17) explain, "has been mainly tied to the continuous migration of talent, mostly from other cities in Texas and Silicon Valley." As they note, it's Austin's capacity and its social, cultural, and institutional infrastructure that support its ability to retain and attract talent, leading the influential Austin businessman Pike Powers (2004) to call Austin the "Human Capital."

Moreover, the Technopolis model prescribes the creation of an institutional framework to support local entrepreneurship, and in Austin this was implemented largely in response to

Kozmetsky's work. This framework laid the foundation for entrepreneurial ecosystems and the current entrepreneurial context for high-technology industries and ventures. An ATI representative said (Interview, October 2015):

> Kozmetsky ... founded the IC2 institute … a thinktank for entrepreneurial studies at the university. He decided that a way to deal with the commercial real estate crisis [in the 1980s] ... was to build a technology incubator [ATI]. It would keep the engineering talent that was bubbling up out of the university, in town, and get them to start founding tech companies.

Former Chamber President Glenn West went further and claimed:

> George Kozmetsky knew about [entrepreneurship] ... While we were out chasing companies, George was putting in place all the support infrastructure for entrepreneurship: the capital area network, a computerized data service for investors and entrepreneurs, the Austin Technology Incubator, [and] the Austin Software Council) (Quoted in Echeverri-Carrol and Oden, 2016, page 22).

Kozmetsky and his colleagues as IC2, in fact, came up with the phrase "technology venturing" to define the "collaborative entrepreneurial process for commercializing science and technology through innovative institutional arrangements" (Jones, 2018: 336; Kozmetsky et al., 1985).

Throughout the 1980s, IC2 became more involved in efforts to promote Austin's regional development, particularly by targeting institutional support for the creation of start-ups and the enhancement of entrepreneurial activities. These initiatives included the Capital Network, Austin Tech Networks, Enter Tech, and the Austin Technology Incubator (as the Glenn West quote above indicates). Housed under IC2's Center for Technology Venturing, these initiatives provided a number of important business services such as connecting venture capitalists to new firms and giving technical assistance to help entrepreneurs grow their businesses. Among these programs, the Austin Technology Incubator, an independent "alliance of public and private interests," has been most significant in supporting "Austin-based companies" and regional growth (Gibson and Rogers, 1994: 414). One study estimated that from "1989-2014 ATI ... graduated 142 companies. At least six of these companies were publicly [sic] traded or went public after ATI graduation, more than 40 have merged with or been acquired by larger firms, and another 50 are still operating as going concerns" (Jarrett and Field, 2014: 13). Another noted

that in the 1990s, “some 200 start-up technology companies were founded [in Austin] each year [in the 1990s],” and a significant number of these start-ups can be traced back to a “specialist business support system, largely private in origin,” established by IC2 in the late 1980s (Cooke, 2002: 14).

Although ATI was modeled on other technological incubators that had appeared throughout the world since the 1970s, it was unique in that it was a legally separate entity within a public higher-education system. Drawing on the university’s authority and technical expertise, ATI served and continues to serve the “dual purpose of service to the University as an education and research laboratory on entrepreneurship and technology venturing and as a regional catalyst for economic development” (Gibson and Butler, 2013: 71). Moreover, ATI was founded with financial contributions from the city, the Chamber, Travis County, and Kozmetsky’s personal charity, as well as in-kind support from UT-Austin and many local businesses, and continues to be a conduit that links the city of Austin, the University of Texas, and the Austin Chamber of Commerce (Jones, 2018, page 342).

As early as the late 1980s, Austin's Chamber had embraced the idea that building an entrepreneurial ecosystem was essential for the city's economic development, and as such it sought to cultivate, retain, and attract skilled labor who would enhance Austin’s entrepreneurial culture and found new start-ups. As a Chamber report from 1985 stressed (ACC 1985, page 7):

> Over the past few years, regional, state, and local economic development strategies have become increasingly sophisticated. Simple recruitment campaigns to lure firms from one location to another … are increasingly seen as zero-sum games that can create footloose businesses always looking for the next incentive somewhere else. New approaches have emerged as communities recognize their *need to establish an environment* [emphasis added] that retains and attracts both stable businesses and talented individuals. In this context … [there are] four priority action areas which can serve as foundation for properly guiding the future of Austin: Promoting economic diversification and entrepreneurship … Developing human capital through education and training … Anticipating physical infrastructure needs. … Improving social, cultural, and recreational resources.

Increasingly, the Chamber began to support efforts that both valorized entrepreneurship and normalized the collective efforts necessary to support entrepreneurs' success. At the time these efforts were controversial; today they are unquestioned, and the Chamber has been resolutely committed to investing in programs that grow entrepreneurship in Austin. For instance, in the Chamber's most recent strategic growth plan, Opportunity Austin, it called for creating and funding a regional program to develop networks of entrepreneurship. And in the 2010s the Chamber helped fund Capital Factory, a business accelerator located in Austin's Central Business District (Greater Austin Chamber of Commerce, 2012: 11–12). More recently, the city has also adopted an innovation district model, incorporated as the nonprofit Capital City Innovation and focused on biotechnology, with UT's Dell Medical School serving as an anchor in downtown Austin (Greater Austin Chamber of Commerce, 2017).

ATI also has played an essential role in valorizing, normalizing, and fostering entrepreneurial activity. Since its founding, ATI has relied on Austin's established entrepreneurs to encourage and support new entrepreneurs, and this mentorship approach has distinguished Austin's start-up entrepreneurial ecosystem from other important high-tech hubs, most notably Silicon Valley. Proving to be extremely potent, its mentorship programs have created an entrepreneurial community that is an essential part of the city's "innovation ecosystem," helping firms secure financing, skilled labor, and professional services (Gibson and Butler, 2013: 64). Moreover, the city, in partnership with the Chamber, tasks ATI with providing entrepreneurs with mentorship and networking opportunities. Public and private support for economic development efforts that cultivate entrepreneurs, rather than just support existing firms or capture investment, is indicative of the shift in urban entrepreneurialism toward a more diffuse process of building a generative ecosystem. Although this shift began in earnest in the late 1990s, these more recent efforts have become a central part of the growth coalition's regional development strategy.

The focus of the entrepreneurial ecosystem in Austin has been on high-tech and related industries. Austin's high-technology economy has been steadily maintained by growth in telecom services, IT hardware, IT services, and IT software, but the city has a relatively high percentage of businesses in the energy and environment sectors as well (IC^2 Institute, 2002: 50), and this has increasingly separated Austin from its intercity competitors. Moreover, this

distinction plays a prominent role in recapitulating Austin's identity as a sustainable, green city, and recasting Austin's environmentalist history as central to its future success in cleantech.

Extracting value from environmentalism and cultivating cleantech entrepreneurs

Austin's entrepreneurial ecosystem (EE) has proved vital to supporting green and cleantech entrepreneurs. Two key factors led to the emergence of this EE, underpinning a new form of urban entrepreneurialism that conjoins EEs and urban sustainability agendas. Firstly, as the previous section detailed, the historical development of high-tech industries in Austin created the skilled workforce, social networks, cultural acceptance/appreciation, and institutional support to enable growth in cleantech entrepreneurship. Cleantech in many ways builds on the experience of high-tech development, learning to apply similar approaches and business models to environmental problems. For example, cleantech often includes software and IT development, so called "smart technologies," for reducing energy and water consumption. The rising importance of cleantech pushed Austin's growth coalition to recognize it as one of the city's strategic sectors for growth, not least because it enhances Austin's green economy and sustainability image. Increasingly, ATI serves as a direct link between other high-technology sectors and cleantech, and, as we describe below, they created the Clean Energy Incubator to support cleantech following the dot-com bust. Moreover, many of the same actors that helped nurture Austin's high-tech industry also supported cleantech, including ATI, UT, the city, and the Chamber. As Jose Beceiro, former Director of the Chamber's Clean Energy initiatives, said: "Clean energy is an economic driver in Austin. The semi-conductor industry grew here starting in the 1980s. Now we're leveraging this high-tech workforce and research base, and using them to recruit the nation's top clean energy entrepreneurs" (Quoted in Jaffee and Doucette, 2013: 18).

Furthermore, Austin's cleantech entrepreneurial ecosystem builds on the existing network of relationships that have traditionally been part of the broader high-tech entrepreneurial ecosystem. However, the cleantech ecosystem has been further energized by new organizations, public-private partnerships, and initiatives. From building the cleantech community through events and organizations, such as CleanTX and South by Southwest (SXSW) Eco, to providing seed capital and mentorship to building new spaces for profitable experimentation like Pecan Street (in the Mueller neighborhood), there has been significant energy expended to grow this part of the green

economy through urban policy, partnerships, and programs. These efforts have been bolstered by strong commitments from the city and Austin Energy, the city's municipal utility, because of their alignment with the priorities of the city's sustainability agenda and the Chamber's efforts to attract and grow new industries. Importantly, the result has been an attempt to rework Austin's urban fabric and cultural milieu in such a way that they cultivate and nurture entrepreneurship and enhance the city's green identity.

ATI's long-term efforts to create an environment conducive to entrepreneurs in Austin has provided a rich infrastructure for new cleantech entrepreneurship. Since the late 1990s, cleantech has been an area of substantial industrial growth in Austin and in the early 2000s it figured centrally in ATI's mission to grow the economy by focusing on high-tech innovations and the valorization of entrepreneurship (ATI Representative Interview, November 2015). In 2001, ATI, in partnership with the National Renewable Energy Lab, established the Clean Energy Incubator (CEI). One of the first and longest-running cleantech incubators in the U.S., CEI focuses on energy efficiency, renewables, grid modernization and optimization, batteries and storage, demand response, and distributed generation. Wholly funded from a number of public sources including Austin Energy, the State Energy Conservation Office, and the DOE, ATI-CEI, as a part of a larger regional clean-energy network, is targeting and acquiring private-sector partners such as "Wells Fargo, British Petroleum, Shell, Total, Blackstone Foundation, and the McNair Foundation" (Barry, 2002; Webber, 2017: 9).

In Austin, ATI-CEI was "instrumental in … developing [Austin's] cleantech cluster" and, as of 2003, helped "generate five startups and solidify Austin's clean energy community" (Wiggins and Gibson, 2003: 61). More generally, ATI-CEI's primary work has been developing a community of cleantech entrepreneurs and new start-ups. According to one ATI representative (Interview, October 2015), having the existing infrastructure and entrepreneurial community of ATI has been central to growth in Austin's cleantech ecosystem:

> One of the first things that the CEI did … was work with companies and startups in cleantech … [and] companies develop[ing] a community around [it]. [...] We got the incubator name, but … [now] it's more about adding value to startup companies … in the form of infrastructure. We source talent for them. The

> executive team at ATI are all former management consultants and executives … they work with the companies and … get their businesses off the ground … The biggest value added is our network of advisers and mentors. We work with 300-400 people who we hook up with startups in specific areas of domain expertise to get them access to talent they can't afford in the early stages of business.

In the wake of the Great Recession in the late 2000s and early 2010s, ATI took on a much broader mandate and now provides "high value mentoring in four technology verticals: IT, clean energy, wireless, and biosciences" (Gibson and Butler, 2013: 71). Even more recently, ATI has expanded its focus to include the circular economy, water and food, and transportation sectors. While some might include these areas in a broad definition of cleantech, in Austin, cleantech remains predominantly synonymous with clean energy.

Austin's cleantech EE has also been buttressed by UT-Austin's role in the regional economy, and this role has been amplified by ATI. Increasingly, ATI has focused more directly on how it can magnify the university's role as a producer of human capital, particularly for cleantech innovation. For instance, ATI developed a "pre-seed" incubator that focuses on nurturing student entrepreneurs at UT and has worked with the business school to develop a cleantech concentration for their MBA graduate degree (ATI Representative Interview, November 2015). Additionally, ATI and UT have worked together to promote entrepreneurship and test commercializable ideas for faculty. In the context of cleantech, an ATI representative explained:

> We [are] a laboratory for entrepreneurship; we give students practical experience in entrepreneurship through our associate positions or [our] internships [and] we work with faculty... to help advance the state of knowledge on entrepreneurship and innovation. (Interview, November 2015)

In 2016, Austin's metro, mostly due to UT-Austin, had "a relatively high number of patents in clean-technology categories such as energy efficiency, advanced green materials, energy storage, energy efficiency, solar and transportation" (Cronin, 2017). ATI's partnership with UT (and other universities) has always focused on making university research discoveries commercially viable. ATI describes it this way: "Our University Partners provide ATI with ongoing high-quality deal flow. ATI works directly with the Technology Transfer Offices at each university to connect inventors and business drivers, facilitate introductions to corporate partners, turn startups

& scaleups into viable businesses, and to advance technologies to commercialization."[ii] Additional UT-ATI affiliated partnerships, e.g., CEI and Pecan Street, provide civic infrastructure that nurtures cleantech entrepreneurs through advice, mentoring, and networking opportunities. UT's ability to produce new talent that can take advantage of social networks and infrastructures built by ATI reinforces efforts to promote an entrepreneurial culture in Austin.

Moreover, efforts to develop the cleantech EE have been augmented by other cultural assets in Austin, especially its reputation for environmentalism. Since 2008, Austin's cleantech specialization, especially in energy, has become a cornerstone of its economic growth strategy. By the late 2000s, it was apparent that "Austin-based semiconductor manufacturing" was in decline, and "it was clear to business and community leaders that the region could not base its future ... so heavily on this one industry sector" (Gibson and Butler, 2015: 52). With the arrival of the financial crisis, the Chamber undertook a strategic reassessment of Austin's economic development prospects and released a report that identified key sectors for the region's growth. The assessment noted that Austin, because of "[its existing] reputation as a green city," had a comparative advantage in the green economy and it implored city leaders to "leverage the seed planted regionally in clean energy by growing local companies into dynamos built to capitalize on the coming U.S. 'green revolution'" (Greater Austin Chamber of Commerce, 2007: 49, 70). In particular, the Chamber's report highlighted the significance of Austin's "clean energy engine," a group that included ATI's Clean Energy Incubator (CEI), CleanTX, Austin Energy, Pecan Street Project, and several private-sector firms. Subsequent Chamber efforts, especially through the partnership with CleanTX, focused on cleantech entrepreneurship.

CleanTX has been a robust, regional cleantech industry association headquartered in Austin since 2001. Its central mission is "to accelerate the growth of the cleantech industry in Texas through information exchange, thought leadership, and strategic partnerships".[iii] In addition to the Chamber, UT Austin, Austin Energy, and others, ATI is a central partner in CleanTX. One ATI representative (Interview, October 2015) described ATI's relationship with CleanTX this way:

> [CleanTX] … developed out of the ATI [as a] cleantech industry association. CleanTX conven[es] the cleantech community. We … [are in] the middle of this

> group of stakeholders [ATI, CleanTX, UT, the COA, and the Chamber]. [W]e … develop companies that … develop wealth and jobs.

In particular, through its partnership with CleanTX, ATI promotes cleantech entrepreneurship by seeding new companies and providing them with entrepreneurial mentorship, and advises existing Austin-based cleantech firms (Interview with Chamber representative, November 2015).

Austin Energy, the city's municipal utility, has played an important role in the development of Austin's cleantech sector. The city of Austin owns and directs Austin Energy as a public energy utility, and through it has supported partnerships with the Chamber and ATI, and positioned the utility as a key support system for cleantech entrepreneurship and experimentation. Significantly, too, clean energy (as cleantech) entrepreneurship has become a more important part of the local government's urban sustainability agenda. With the city's ambitious target of 65 percent renewables by 2027, support for entrepreneurship and innovation in clean energy has been a central theme in Austin Energy's plans and policies (Craver, 2017). But this support has been much longer in the making. Since 2001, Austin Energy has been working with ATI-CEI and other groups, including the now-disbanded Austin Clean Energy Initiative (Barry, 2002). A key argument behind expanding clean energy in Austin has been the creation of new jobs and economic development, something that is built on Austin Energy's role in attracting and retaining business with low-cost energy and its contribution (around $105 million per year)[iv] to the city's general fund to help economic development efforts (Austin Energy, 2012; Tuttle, 2016: 61). In addition to contributions to the General Fund, Austin Energy has created a space for entrepreneurs to use the city's electric grid to develop new technologies (Greater Austin Chamber of Commerce, 2009).

Pecan Street Inc. is emblematic of Austin's broader cleantech community, its cleantech ecosystem, and displays the new spaces and features of urban entrepreneurialism. The project is strongly supported by the local government; it was established as a formal private-public partnership among the city of Austin, UT, the Chamber, ATI, the Environmental Defense Fund, and others.[v] The project's "aim [is] to make the city of Austin into America's clean energy laboratory—a place for researchers and entrepreneurs to develop, test, and implement the urban power system of the future" (Gregor, 2008). Its offices are situated in Austin's Mueller

neighborhood, where field trials for new inventions, particularly those related to cleantech, are conducted in a "living laboratory" (Levenda, 2019). Typically, this means residents of Mueller participate in a range of trials for clean-energy companies that want to test their products and services in their residences (products like electric vehicles, charging stations, solar arrays, smart-home technologies, and smart meters). An ATI representative (Interview, November 2015) described Pecan Street's role in Austin's cleantech ecosystem thus:

> Pecan Street is our local testing and validation partner … We are looking at a much larger universe of companies [to] help. As we bring them in, they are going to need product testing and validation resources that Pecan Street offers.

The testing and validation of new technologies is a vital resource for entrepreneurs working to bring their products to a broader market, and a key aspect of building Austin's cleantech industry (Tuttle, 2016: 85).

Through a range of policies, the features of Austin's urban entrepreneurialism fuse green industries with a focus on entrepreneurial ecosystems. While the overall tendency to incorporate environmental issues into urban economic development is a standard practice in many cities (Fitzgerald, 2010; Krueger et al., 2007; While et al., 2004), the characteristics of Austin's urban entrepreneurialism do not so easily fit existing characterizations. In Austin, there is a merging of environmental initiatives, especially the city's concern with promoting cleantech, particularly clean energy, and the role of quasi-public institutions that are trying to promote growth by showcasing and enhancing Austin's entrepreneurial ecosystem. The targets of entrepreneurialism have been reworked–from firms to firms and entrepreneurs–and its goals of economic growth realigned–from economic growth to urban sustainability as economic growth. In general, the case of Austin shows a recentering of the figure of the entrepreneur in economic development strategy, a focus on generating the infrastructures for supporting entrepreneurs with an ecosystem approach, and a growing emphasis on environmentalism as central to economic growth.

Discussion and Conclusion

A recent trend in urban entrepreneurialism is its environmentalization. As this paper has explored, entrepreneurialism has become more widely valorized and normalized through cultural

norms, educational programs, and governmental initiatives, and has become enmeshed with the production of social, cultural, and material infrastructures. The case study of Austin's high-tech, cleantech, entrepreneurial ecosystem illustrates this process of normalization and the evolution of entrepreneurial rationality into all manner of urban institutions and policies. Austin's technopolis strategy cemented the foundations for its high-tech, and cleantech, entrepreneurial ecosystem, and shaped the formation of a new form of urban entrepreneurial governance, which concentrates less on attracting specific companies and more on diffused ways to cultivate entrepreneurship by creating an entrepreneurial ecosystem. We argue that the diffusion and integration of entrepreneurship into urban governance has shaped how cities act as a site of governance by regulating social and cultural life through environmental inventions, i.e., "the rules of the game." Similar to the way Harvey (1989) identified how urban entrepreneurialism was united by an orthodoxy of privatization and market rationality across political parties and national boundaries, the same can now be said for entrepreneurship.

Centrally, the entrepreneurial strategy we describe focuses on so-called human capital. Accompanying this trend is the proliferation of support systems, educational programs, metrics, standards, and encouragement for people to become entrepreneurs, and for local governments to enact programs that encourage entrepreneurship through partnerships and policy experiments. We highlighted how in Austin this took shape in the cleantech entrepreneurial ecosystem, which has predominately focused on mentorship and social infrastructure, elements essential to becoming an entrepreneur, and how this has become subsumed into urban entrepreneurial governance as a strategy to stimulate economic development. New private-public partnerships, institutional arrangements, and organizations have formed; existing ones have been transformed by a conviction that everyone can become an entrepreneur; and both are united by the idea that entrepreneurial individuals thrive in well-supported ecosystems and that this is the key to urban prosperity. We described how Austin's cleantech entrepreneurial ecosystem is marked by the growing presence of start-ups, entrepreneurs, and venture capital but also new kinds of private-public partnerships found in entrepreneurship research institutes, university incubator programs, and urban test-bed projects that support an environment for more robust ecosystems for entrepreneurs.

Our account does not delve into the large body of scholarship critical of the normalization of entrepreneurialism that focuses on elements of its social inequality, which is certainly relevant in Austin (Dardot and Laval, 2014; Irani, 2015; McNeill, 2016; Spence, 2015; Szeman, 2015). In Austin, the benefits of this new entrepreneurial transformation are uneven. For example, researchers at UT found that men were employed 1.7 times more than women in high-tech, high-skill jobs spurred by Austin's entrepreneurial ecosystem between 1980 and 2015, and that overall, the ratio of men to women in the high-tech sector and high-skill positions was 2.4:1 in 2015 (Echeverri-Carroll et al., 2018). Scholarship has also linked gentrification and displacement in Austin to its recent high-technology industrialization and some greening initiatives (Busch, 2017; Long, 2016; Straubhaar, 2012; Tretter, 2016).

What stands out in Austin is the way policy has catered to entrepreneurs as city-builders and environmental problem-solvers justified not just by the pursuit of the city's sustainability goals but the necessity to stimulate economic development through technological innovations. Moreover, there is an increasing convergence between the pursuit of venture capital and the city's environmental goals. As cleantech grew in national and international attention through the 2000s, largely associated with university research on "transformative" energy technologies, it attracted significant venture capital funding (Caprotti, 2016; Goldstein, 2018; Saha and Muro, 2017) and attracted attention from local economic development agencies and chambers across the U.S. (Jaffee and Doucette, 2013). In Austin, for example, homegrown solar firms like HelioVolt attracted venture capital investment, and spinoffs firms like SolarBridge Technologies moved to Austin from Illinois because of the opportunity to recruit and gain the support of the city of Austin and the ATI-CEI (Walsh, 2012). Although cleantech remains a small portion of international VC funding and start-ups, in Austin, as we have discussed, it is very significant; today, Austin has about 3% of national VC cleantech funding, similar to New York City (Cumming et al., 2016; Muro, 2017).

In Austin one sees a trend that Peck (2017a, 2017b) described as entrepreneurial cities giving way to financialized urban governance. More than ever the attraction of venture capital seems to matter more, as does the reliance on finance for even basic programs or infrastructure projects. Beyond this, He (2017) has recently suggested that creative city strategies, and the

entrepreneurial networks that support them, might be considered spatial and temporal fixes for capital accumulation. For the past half century, entrepreneurialism has been offered as a solution in times of crisis wherein ingenuity and innovation are presented as opportunities to save us from economic downturns. In Austin, entrepreneurialism became visible during the oil downturn of the 1980s, again with cleantech after the 2001 dot-com bust, and then again after the Great Recession. In each case, the response involved the creation of new private-public partnerships and ventures, and recent efforts to attract entrepreneurs and build an environment in which entrepreneurs prosper fit this broader trend. Our paper has shown one example of this, but further research is needed to better understand how local urban responses connect to broader dynamics in the political economy.

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[i] These indices have been published at the metro and state level since 2015, but data is available back to 1996 for the largest 15 metros, a list Austin is not included on.
[ii] This is quoted from the ATI website: https://ati.utexas.edu/about/partners/ accessed July 8, 2019.
[iii] This is quoted from the CleanTX website: https://cleantx.org/ accessed June 10, 2019.
[iv] Data can be accessed at: https://data.austintexas.gov/Utilities-and-City-Services/Austin-Energy-General-Fund-Transfer/zzix-yxi4
[v] The Pecan Street Project was officially supported via a city ordinance (20090806-033) adopted by the Austin City Council. This ordinance is accessible online at: https://www.austintexas.gov/edims/document.cfm?id=129735