Policy and collective action in place

Maryann Feldmana and Nichola Loweb

aDepartment of Public Policy, University of North Carolina–Chapel Hill, 209 Abernethy Hall, Chapel Hill, North Carolina 27514, USA, maryann.feldman@unc.edu
bDepartment of City and Regional Planning, University of North Carolina–Chapel Hill, 209 Abernethy Hall, Chapel Hill, North Carolina 27514, USA, nlowe@unc.edu

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The role of policy is often misunderstood, either revered as a panacea or despised as a barrier to change. This is especially true in the process of regional transformation. This article develops a case of economic development policy as an adaptive and improvisational process: effective policy is endogenous and the result of negotiations and power relationships. Transforming a regional economy involves myriad policy actions so subtle and so numerous that they can easily be overlooked. The article conceptualises effective policy as the continuous culmination of programmatic adjustments in response to changing conditions, and opportunistic pivots to adjust to new circumstances. Creating innovative, entrepreneurial ecosystems challenge our existing economic models and suggest that complexity requires new conceptualisations of policy and planning.

Keywords: regional economic transformations, economic development policy, innovation and entrepreneurship, ecosystems

JEL Classifications: economic development, industrial change

Introduction

The transformation of regional economies is the result of complex forces that play out over time. The traditional resource endowment factors that drove regional advantage have lost primacy in knowledge-intensive economies, replaced by the capacity to innovate and engage in creating economic and social value. Local economies are constantly evolving, developing new social and economic arrangements that are based on historical contingencies and influenced by the local conversational space. Many efforts aimed to transform regional economies have produced little more than public disappointment and government debt. Yet other places, which at first glance seem unlikely candidates, have been able to successfully redefine their local economies. The lack of ability to consistently make good choices is perhaps because the underlying frameworks that guide regional economic development policy are inadequate. In the face of great uncertainty, perhaps the most appropriate policy for regional economic development may fundamentally be about a search for just and meaningful action.

In economic development, there are two new dominant concepts behind our search for new models. The first is ‘complexity’, which builds on advances in physics and biology and extends the idea of an economic landscape as a complex...
adaptive system (Martin and Sunley, 2007). The second and related stream in the literature is the concept of ‘ecosystems’, which stresses the interactions between actors (Alvedalen and Boschma, 2017; Stam and Spigel, 2018). The literature has produced long lists of factors that draw on the usual suspects long associated with economic development. Government policy is always mentioned in these lists, yet described in such a limited manner that the impression is that good policy promotes economic transformations, while bad policy inhibits the functioning of markets and the realisation of potential. Yet really embracing new economic development models requires thinking about processes rather than outcomes (Arthur, 2014; Colander and Kupers, 2014). There is a need to move away from the idea that economies converge towards a clear equilibrium and to conceptualise economies as endogenous and socially constructed through creative actions and collective decisions involving adjustment, adaptation and incremental change. Government policy becomes a vehicle for collective action and a lens to understand the process of economic transformation.

This article offers a narrative-based illustration, drawing on our investigation of the long-term economic transformation of the Research Triangle region in North Carolina. Today’s Research Triangle is known worldwide as a site for dynamic, technology-intensive development. But its development path was not determined or predicted in advance. Guided by a strong political desire to reorient the state economy away from declining and low-paying industries such as textiles, furniture and tobacco processing (McCorkle, 2012), actors within the region, including policymakers, undertook a series of institutional experiments in response to unanticipated challenges and emergent opportunities. Transformation of the regional economy was driven by endogenous developments, rather than by a reaction to external shocks or exogenous forces. In this regard, the Research Triangle’s historical development does not involve moving from one punctuated equilibrium to another. Rather, we argue that it is representative of a more common process of continuous and iterative policy adaptation—one involving improvisation and tinkering on the part of local actors. Policy played a strong role in this process, inspiring creative and collective action, while also maintaining a sense of public purpose and meaning throughout the region’s history. We argue that policy initiatives can be conceptualised as milestones of incremental and coordinated actions to guide the local economy, and by examining them, we can discern how these policy initiatives are conceived and implemented and how economic change is realised over time.

Policy and collective action in place

Human agency and creative action are notably missing in our theoretical understandings of the transformations of regional economies (Bristow and Healy, 2014). Regional economies are often conceptualised as relatively easy to model, with pre-existing amenities and resources operating through path dependencies or evolutionary forces (see Lowe and Feldman, 2015, for a review of the literature). The idea of path dependency in regional economic development typically assumes historical lock-in and does not accommodate the creation of new trajectories, nor does it account for inflection points that reposition regions on new and structurally different trajectories (Isaksen, 2015). Yet pragmatically, an economic development practitioner’s concern is how to transform places from lower to higher value-added economic activities—that is to say, how one can break the current trajectory and reposition a place to achieve a higher level of economic development. Economic growth can be conceptualised as a move along an existing trajectory. In contrast, economic development involves collective and coordinated action to move to a new and more advanced trajectory (Feldman et al., 2016).

This has led evolutionary economic geographers to argue that large-scale economic
adjustment is not only rare but also when it occurs, it is often the result of an equally noteworthy economic or political shock (Martin, 2010). Admittedly, these shocks do not have to be exogenous in form, nor are they always negative (Martin and Gardiner, 2018). Still, the general premise is that regions are constrained through path dependence, with historically rooted structures, resources and practices in place that must be forcibly challenged or upended in order to move a regional economy to a new equilibrium state. This perspective offers an improvement to standard neoliberal theory, which assumes regional economic change results from rational decision-making or economic optimisation.

Still, evolutionary theory has its limits, failing to recognise regional economic transformation as an ongoing and incremental process—one that includes room for human agency and collective action. While certainly affected by exogenous forces—including global competition, large-scale technological change or emergent consumer trends—the ability of regions to successfully restructure is often shaped from within and the result of complex negotiations and compromises. This is different from ‘agency’ in the neoclassical sense, which is conceptualised as a rational decision-making process where individuals choose among alternatives with full information. Rather, we present agency as a socially and locally interactive process of engaging with complexity (Stark, 2011).

Engaging with complexity requires abandoning the idea that policymakers can calculate predictable and optimal outcomes (Rubin, 1988). Complex evolving systems are beyond the control of government or anyone to predict (Colander and Kupers, 2014, 30). Making choices in the face of complex and evolving environments requires adaptation and improvisation. Policy emerges from complex social and political forces that involve experimenting and searching for meaning and working towards some desired outcome. Rather than deterministic and predictable, the most appropriate policy is adaptive, by necessity responding to unpredictable events.

Rather than seeing efficient economic actors engaging in single transactions, regional economies are constructed by individuals and organisations with diverse motives that extend beyond the market. Furthermore, many of these individuals and organisations themselves are not static but evolve through social interactions. Actors in a regional economy engage in repeat transactions over time, where trust and common purpose are established or squandered. Regional economies involve relationships that, rather than deterministic and preconceived, play out through improvisation and adaptation on a certain geographic stage, building and redefining the dimensions of that stage as dictated by demands from the local community. The system is endogenous and jointly determined, defining a place by the interactions of its component actors.

When groups of individuals come together, they are trying to collectively achieve meaning, though at larger scales of human interaction. Attempts to impose models of rational behaviour, with well-measured outcomes, on the more complicated forms of human organisations reduce rich interactions into unsatisfying unidimensional caricatures. For example, places are urged to find their competitive advantage in some specific industry or activity, but that has proven difficult to achieve and only leaves places vulnerable to adverse events beyond their control. In the absence of effective models or heuristics to guide economic development policy, perhaps the best thing that the citizen or elected officials in a place can do is strive to achieve meaning through their actions. Rather than searching for efficiency, an alternative is for places to define and redefine policy towards new objectives of quality of life and prosperity.

Government policy appears on every list of attributes for a successful local ecosystem but is limited to descriptions such as “supportive policies should be in place covering economic development, tax and investment vehicles”
(Feld, 2012, 186–187). Yet the details of these supportive policies are manifest and their study has proven elusive. Policy determines the specific operational details of the transformation process. Viewed through the lens of complexity theory, the process of regional transformation is a story of an adaptive search for relevant solutions enacted through policy and realised through the emergence of new institutions and self-organised governance. From these assumptions, a very different set of institutional consequences emerge that have direct implications for the role of policy. Rather than the outcome of hierarchy, the transformation of place is defined by participation in networks, relationships and social experiences, the result of a process that involves political leadership, vision and coordinated action among constituent groups. Yet the precise process by which this occurs needs greater articulation and definition.

In the next section, we describe our work in North Carolina, which studies the development of the region over a 60-year time period. What is unique about this example is the role of government and public policy. We believe that this example, and the many other interesting examples of successful regional transformation in unlikely and unexpected places, offer insights into how effective public policy may catalyse an ecosystem. Indeed, we argue that the difference between evolutionary responses to change that result in successful restructuring, versus places that become extinct, is due to the role of policy. That is, the entire ecosystem must respond in a coherent manner, yet how this process happens at the regional level remains unexplored.

**Notes from the field**

For the past eight years, we have been engaged in studying the Research Triangle Park (RTP). Frequently at the top of lists of innovative and entrepreneurial ‘hot spots’, the Research Triangle region is widely acknowledged as a successful example of regional transformation. At the centre of the region is the RTP, an industrial park that resulted from a public/private partnership. Many authors have written on the Park (Hardin, 2008; Link, 1995, 2002). Our interest lies in understanding the development of the regional industrial economy and the temporal and spatial development of an entrepreneurial ecosystem in the areas adjacent to the Park.

Our study of the regional economic transformation of the Research Triangle region was at first frustrating, then surprising and ultimately delightful. It was frustrating to realise that our long-held belief about economic development and economic growth did not hold (Feldman and Storper, 2016). By examining the empirical data and interviewing entrepreneurs, policymakers, politicians, organisational leaders and employees, we were constantly surprised to learn details, backstories and information that at first glance seemed like gossip, but proved relevant in informing our understanding of the motivation for specific actions. Finally, we were delighted to realise that change is possible and good things do happen.

Details of our research methodology can be found elsewhere (Feldman and Lowe, 2018). The key elements are that we have built a firm-level database that follows new firm formation and entrepreneurs from the founding of the RTP, as a catalytic event to the present time. We have followed the development of these entrepreneurial firms, recording details of their participation over time with entrepreneurial support organisations and financing entities (both public and private). We have tracked the careers of entrepreneurs in the region, including their former employment and education. We have amassed a large number of documents, reports and news articles. Our motivation was a belief that the processes of regional economic transformation could only be understood by taking a deep dive into one specific region and focusing on a longer time horizon.

Our investigation demonstrates that the development of an ecosystem, rather than a straight path, involves myriad twists and turns and unanticipated events. Rather than driven
by market forces, it has become clear that personal relationships, social networks and power relationships affected the observed outcomes. Rather than the result of a plan with a known path forward, there were many unanticipated events. The early history of the region was successful because the ultimate objectives were grand and reflected a vision aimed to achieve a high level of social welfare, while also advancing individual and private firm interest. When obstacles arose, government responses were creative and appropriate to advancing their goals. Equally important, when opportunities arose, government was there to marshal resources and motivate a response.

**Appreciative theorising on the early genesis of the Research Triangle region**

We chose the 1950s to begin our analysis of the Research Triangle region. In 1950, North Carolina was one of the most industrialised of the southern states in the USA, with unemployment below the national average. Due to employment concentration in lower-wage industries, state per capita income was 71% of the US average.

In 1955, shortly after being promoted due to the death of his predecessor, Governor Luther Hodges formed a committee of business leaders and university officials to investigate the state’s economic future. There was a recognition that demands for the labour-intensive, lower skill production that dominated the North Carolina economy was vulnerable to global competition and technological innovation. This was coupled with a recognition of the possibility of leveraging the three most prominent local universities (Duke, North Carolina State University and the University of North Carolina at Chapel Hill). Hodges ambitiously titled his 1957 State of the State Address, *The North Carolina Dream*, and laid out a long-term vision with a billion-dollar budget request for investments in education and infrastructure. The plan, along with Hodges’ refusal to engage in the resistance tactics of other Southern governors to the Supreme Court’s Brown v. Board of Education federal plans for desegregation, established North Carolina as a progressive Southern state (McCorkle, 2012). Most importantly, in sum, financial investments along with a large context and vision for the future reinforced the economic development aspirations of the RTP. Many places have attempted unsuccessfully to leverage a research park for economic development without other related, larger contextual elements. These actions set expectations, providing social and media signals.

The question that must be asked is as follows: How Hodges came up with this ambitious plan? There are three explanations that seem plausible. The first is that there was a collective political commitment to the idea of high wage employment. Link (1995), in *A Generosity of Spirit*, notes that discussions about the concept of a regional industrial park date back to the 1920s. Rather than motivated by profits, advocates were motivated by extra-market motives such as the desire to offer employment opportunities to students educated at the state universities, basically family members who headed outside the state after receiving their diploma. Link (1995) documents a bottom-up process of advocacy that is consistent with the scholarship on social movements that suggests that a long nascent period is required for an idea to gain traction and legitimacy, with myriad reinforcing actions required for significant social change (Strang and Soule, 1998). These policy decisions may be seen as the result of cumulative public opinion—an idea whose time had come. The idea of investments to build capacity was at odds with the prevailing Southern economic development strategy of competing on the basis of low wages and docile labour (Cobb, 1993; Lowe, 2014). North Carolina and Texas were the only states from the old Confederacy that refused to follow Mississippi’s initiation in the late 1930s of special state financial incentives for relocating businesses. When North Carolina recruited outside industry, it did so primarily on...
the basis of workforce skill and quality amenities. Moreover, Hodges signed the first state minimum wage law in the South, which had been debated for 10 years. Hodges insisted on the minimum wage as necessary, as paving on the state’s road into the future: “Employers can afford it, employees deserve it, and the state’s economic progress demands it” (Ivey, 1968, 87). Hodges’ connections with the business community legitimised this claim.

Second, Hodges was influenced by his personal experiences and networks. A biography of Luther Hodges (Ivey, 1968) entitled Practical Idealist argues that Hodges’ economic vision was influenced by his time working in Germany on the European Recovery Programme (ERP), also known as the Marshall Plan. This was a transformational experience for Hodges, which combined practical business experience with the need to accommodate multiple political interests while working to achieve important objectives. In Germany, Hodges believed that the future of democracy was at stake; in North Carolina, he was passionately advocating a vision for a prosperous future. When Hodges appointed a committee to study the feasibility of the RTP, his ERP colleague, Robert Hanes, headed the committee. Hanes was also the president of Wachovia, a local bank. Certainly, it is not difficult to imagine that Hodges and Hanes had developed a shared knowledge from their Marshall Plan experience and shared a common vision. McCorkle (2012) argues that the key advocates of the RTP were from the old economic interests that came together to form what Key (1949) called a ‘progressive plutocracy’.

Finally, RTP may be understood as, ultimately, a quite successful hybrid form of a public–private partnership, with a good deal of beginning and continuing private sector leadership (McCorkle, 2012, 519). This was exemplified by the Triad banker and key RTP figure Robert Hanes’ sponsorship and tutelage of Governor Hodges (McCorkle, 2012, 506–510). The lines between state government and the industrial elite become quite porous and blurred. While this partnership might have resulted in self-serving and predatory behaviour, guiding principles prevailed.

The idea of the RTP gained tangible form through the action of Romeo Guest, a private construction contractor who is notable for recognising the opportunity for the RTP. Guest attended MIT during the immediate post-World War II period and noted that the activity occurring in Cambridge was missing among the North Carolina universities (Cummings, 2015, 5). Guest’s family business was building textile plants, and this construction was in decline. He was the principal behind Pinelands Company, Inc., which, by July 1957, had acquired options to purchase nearly 800 acres at an average price of $161 per acre in what would eventually become RTP. Operating secretly and without fanfare, Guest and his associates had acquired options for 3430 acres of an identified 4000 acres by September when the press began to publicise the park idea (Link and Scott, 2003). The original idea was to create the Park as a for-profit enterprise, believing that high rates of private return were possible.

It became clear that the Pinelands project was too large for a private entity. Rather than let the endeavour fail, Hodges made the decision to create a non-profit quasi-governmental entity, Research Triangle Foundation, “benefiting the state of North Carolina as a whole and the three universities in particular” (Ivey, 1968, 179–180). This is one of the first uses by the state government of a 501c(3) corporation, which operates independently, is less subject to changing politics and can exist in perpetuity. In 1958, Pinelands Company, Inc. was reorganised as the RTP, which became a for-profit subsidiary of the Research Triangle Foundation. To build support for this idea, a prominent UNC Sociology professor, George Simpson, was assigned to work as a staff member to Hanes’ committee in the Governor’s office. The resulting plan became known as the Simpson Plan (1957), increasing the universities’ stake in the
Plan. To raise money for the Foundation, Archie Davis, another well-known local banker, canvassed the state to raise money. Key (1949) further notes, 'An aggressive aristocracy of manufacturing and banking...has had a tremendous stake in state policy and has not been remiss in protecting and advancing what it visualises as its interests.' Power relationships and politics were more important than market forces. In 1959, it was announced that $1.425 million had been raised by the Research Triangle Foundation, with $500,000 set aside to establish the Research Triangle Institute (RTI) (New York Times, 1959). The RTI, which was modelled after the Stanford Research Institute in Palo Alto, was the Park’s first tenant and served as a focal point for companies interested in the Park.

George Simpson, who became the first full-time director at RTP, made the vision of the Simpson Committee clear in a speech to the UNC faculty in February 1959:

What we are attempting here is really the stimulation of a general movement, the development of a new state of mind, among the people of the state. Our problem in North Carolina and in the South, is not essentially technical; we have available to us the same scientific information as is available elsewhere...Our problem is essentially cultural—it is the failure of our people to grasp the use of science in industrial development, the failure to put to work what is available, the failure to begin these chain reactions of research and invention and developing which are the hallmark of mid-twentieth century life. (Link, 1995, 281)

Of course, culture is typically considered as a factor that inhibits economic development, yet new attitudes and values develop and thus culture does change. The early efforts were dedicated to articulating a vision for a prosperous future.

Once the RTP was launched, there was a need to attract tenants. While advertisements were taken out in major newspapers, and trade delegations travelled around to attract tenants, the realisation of the vision relied on a series of personal and rather idiosyncratic events. During the 1960 campaign, North Carolina Democratic gubernatorial nominee Terry Sanford shocked the South by giving an endorsement speech for the Massachusetts Catholic John F. Kennedy at the Los Angeles convention over his fellow Southerner, Lyndon Johnson. When Kennedy won the Presidency, then outgoing governor Luther Hodges was appointed as Kennedy’s secretary of commerce in 1961. The tag-team efforts of Governor Terry Sanford and Commerce Secretary Hodges were instrumental in helping RTP land the National Institute of Environmental Health Sciences laboratory as one of the first tenants (see Cummings, 2015, 14).

IBM moved to RTP in 1965, providing a corporate stamp of approval that jump-started the fledgling park (Sternberg, 1996). There is a large and complicated literature that examines firm location decisions, with the conclusion that economic factors, such as wages, tax rates and other costs, fail to adequately explain noted moves. The relocation of IBM to RTP offers an interesting insight, which others have written about and our interviews confirm. The story is that Frederick Brooks, the architect of the IBM 360, was a North Carolina native and wanted to return home and pursue an academic career. Brooks was born in North Carolina and attended Duke University as an undergraduate. He received a PhD in 1956 in Applied Mathematics from Harvard University, where he was supervised by Howard Aiken, one of the preeminent early computer scientists. Brooks joined IBM in New York, where he worked on the architecture of early IBM computers, eventually becoming the manager for the development of the System/360 family of computers and the OS/360 software package. The project was the first computer available for scientific and commercial use. Brooks is noted to have coined the term “computer architecture” and to have separated hardware and software. Brooks wanted...
to return to the South and to an academic career; in 1964, he started the computer science department at the University of North Carolina. Brooks, who is self-deprecating and humble, notes, “The people at the park did the persuading. All I did was get [then-CEO Thomas Watson Jr.] to be serious enough to send someone down to look at it” (Dagger, 2005). Link (1995) notes that the IBM had been courted by the RTP team for seven years until the arrival of Fred Brooks seemed to be the precipitating event. When IBM established an R&D facility in RTP, they provided sponsored research funding for Brooks and the UNC Computer Science faculty, creating a fluid and mutually beneficial relationship. In the absence of these very lucky occurrences, the efforts of Governor Hodges and industrial elite figures like Hanes may well have come to naught. This point could especially underline the authors’ emphasis on uncertainty and complexity in economic development efforts.

An active entrepreneurial policy phase began in 1980 when the newly elected Governor Jim Hunt assembled a blue-ribbon panel to consider the next phase of economic development. One option was to target low-wage jobs in manufacturing and tourism. Governor Hunt promoted the vision that North Carolina could become a leader in technology industries. The policy blueprint was a 1980 report by the Board of Science and Technology, which proposed capitalising on the region’s emerging technology strengths and with a goal to support entrepreneurship and small business development. Proposed initiatives outlined in the report included: the North Carolina Microelectronics Center, the North Carolina Biotechnology Center (hereafter Biotech Center), the North Carolina School of Science and Mathematics, and the system of small business centres at the community colleges, and small business and technology development centres affiliated with the universities. This was another grand plan and vision for state economic development, but one that also entailed uncertainty and thus required policy experimentation.

In other work, we have discussed this in relation to the early formation of the Biotech Center (Feldman and Lowe, 2011). North Carolina was unique in establishing quasipublic technology-based economic development agencies with a specific industry focus. It launched the Microelectronics Centers of North Carolina in 1980, followed shortly by the Biotech Center. Originally, under the direction of the Board of Science and Technology, a legislative study group recommended it also become a quasi-independent publically funded agency.

The continued policy influence of the Biotech Center and its ability to represent various needs and interests has ensured its benefits are broadly dispersed (Lowe, 2014; Lowe and Feldman, 2015). Critically, the 1984 Biotech Center’s Articles of Incorporation specified having 23 board members, with diverse representation detailed to a specific sector and appointment authority, broadly shared. For example, the board reserved nine seats for three representatives from animal husbandry, plant agriculture (at least one from forestry) and the marine trades. Additionally, two representatives were to be appointed from the state’s pharmaceutical industry or medical establishments, with the dean of the medical school of Wake Forest University also listed. The board also included five university leaders who represented the UNC system, UNC-Chapel Hill, North Carolina State, East Carolina University and Duke University. While the sheer size of the Biotech Center board reflected its original need to build consensus, it also served to increase transparency and guaranteed a diversity of opinions to enhance decision-making. The Biotech Center board eventually increased to 36 members, including representatives from other interested constituencies.

Elected officials who participated in the original 1980–1981 legislative study commission had recommended the Center adopt this governance structure. Some of these individuals would go on to become board members of the
Center and, in that role, also strongly encouraged an internal deliberative process for strategy development through committee or task force review. Much like the legislative study commission, the goal was to bring various outside perspectives to the table for consideration when developing strategies and priorities. This organisational design facilitated the quick identification of potential conflicts and encouraged adaptive solutions, one example involving the creation of the nation’s first field experimentation ordinance to help resolve an unanticipated conflict between agricultural biotechnology corporations and local farmers (Feldman and Lowe, 2015). Early on, the Center institutionalised deliberative and reflective processes that resulted in effective problem-solving and resilience. It had also established goodwill with the public, the legislature and regional universities. When encountering financial challenges, especially during times of political uncertainty, Biotech Center leaders were able to call on numerous allies representing broad segments of society to defend the Center’s continued existence and ongoing state support.

In its early years of existence, when funding was limited and the need to demonstrate cooperation with universities was strong, the Biotech Center began offering small amounts of money and encouraging recipients to then apply for larger research grants from other, better-funded organisations. One early activity was organising interdisciplinary groups to respond to specific requests for proposals from Federal agencies. At the time, the state received less than half the national average of federal R&D obligations per worker (National Science Board, 2014, tables 8–41). The Biotech Center stressed its ability to respond to funding announcements and to convene diverse groups of researchers (NCBC, 1985, 16–17). The activities were proposed by groups or individuals outside of the center, and seed money was provided. The requirement was that the interdisciplinary research groups contain faculty from the three Triangle Universities. Much of the early focus was on biomaterials and bioelectronics, to transcend the barriers between physical and biological sciences. At its peak in 2004, this programme provided up to $250,000 per project to support large-scale, multidisciplinary, multi-investigator projects.

In an effort to increase interaction between universities and industry, a visiting industrial scientist and engineer programme was started in 1985 to provide one-week support for industrial scientists to visit university labs. At this time, the industrial firms in the region were Burroughs Welcome and Glaxo, neither of which were active in biotech research at the time.

A competitive grants programme was initiated in 1985. The grant programme gave priority to young investigators at universities and in industry, encouraged established academics to investigate topics new to them and individuals doing R&D towards establishing a new company. Paul Modrich, winner of the 2015 Noble Prize in Chemistry, was a recipient in the first round of competitive research grants. The grant was for $9,600 (about $21,250 in current dollars). Grants were allocated to equipment and supplies.

Early on, the Center also recognised the need to increase the size of the academic community with biotechnology research expertise. In 1985, an Eminent Scholars programme was initiated after the Center conducted a detailed inventory of academic departments and affiliated faculty. While these programmes are now common (Feldman et al., 2018), at the time, North Carolina was an early adopter. The programme provided funding to recruit faculty to any institution in the State. These funds were used effectively: for example, in 1987, the Biotech Center helped recruit seven researchers to start the University of North Carolina at Chapel Hill’s molecular biology and biotechnology research program. Among them was Oliver Smithies DPhil, who won the Nobel Prize in Physiology or Medicine for 2007. In total, 56 researchers were recruited to State
institutions—individuals that were also responsible for launching 14 new companies and filing 92 technology patents (Biotech Center webpage). An economic impact study estimated a $53.48 known return on every dollar invested in the programme, excluding the substantial non-monetary benefits.

Even with all its progressive programmes, the Center was not immune to public criticism. In 1985, State Senator Barnes questioned public support for the Biotech Center on the grounds that it was too focused on academic research and not engaging sufficiently in economic development (C071 N55). A new division was formed in response to more directly support economic development through active business engagement. The Center’s first published annual report in 1987 also emphasised that “the purpose of all NCBC programs is economic development” (NCBC, 1987, 9). Many of the Center’s subsequent programmes specifically targeted entrepreneurial firms (Lowe and Feldman, 2015); however, there are some additional NCBC programmes worth noting that lay the foundations for long-term economic development.

Biotech Center promoted “clear, comprehensive, long-term communication” (NCBC, 1987, 27). The objective was to anticipate and respond to the needs of citizens, government, educational institutions and industries with regard to information, education and training and to develop materials for a range of audiences. Recognising that biotechnology did not exist when high-school teachers receive their training, prompted a five-day workshop on recombinant DNA held at Cold Spring Harbor Laboratories. The intention was to bring excitement to their students about opportunities in biotechnology.

Recognising the need for information about the new technology, the Biotech Center established a new division for biotechnology information, which featured a library and access to four biotechnology databases, covering academic literature, patenting activity and venture capital activity. To provide information for the general public, there was a lending library of cassettes, providing background on the industry, and employment opportunities with offerings for all ages and educational levels. Staff within this division also provided research for clients on the cost recovery basis. The activity was well received and became a model followed by other members of the National Council of Biotechnology Centers, which the Biotech Center helped to form in 1990. A national database of biotechnology firms was created, to compare with local firms because there was a dearth of information on the emergent industry, and the director of the Biotechnology Information Division, Mark Dibner, spun out the national database as a for-profit company, BioAbility, in 1994. Still located in the region, the firm operates as a consulting firm providing strategic business information. Dibner remains an active participant in the local industry. Academics have used these records for empirical work (Lerner, 1995). The Biotech Center has continued maintaining a database of firms in the state.

Economic development initiatives moved to the forefront of the Center’s activities in 1988, with the establishment of the Economic and Corporate Development Division, later renamed the Economic Development Division, and finally the Business and Technology Division. Initially, the division was set up to emphasise technology transfer helping start-up companies and recruiting R&D firms to North Carolina (NCBC, 1988, 8). The Triangle universities were relatively behind their peer institutions in terms of investment in technology transfer. In keeping with the concept of university collaboration, the Triangle University Licensing Consortium (TULCO) was promoted. The rationale was efficiency: combining resources with a single entity handling all invention disclosures would allow for greater specialisation of the licensing professionals who could focus their efforts and build credibility with faculty and industry experts.
A cooperative approach could lead to more effective marketing of inventions, efficient use of resources and development of economies of scale through specialisation of the licensing professionals. When this experimentation did not work for a variety of organisational reasons (Goble et al., 2017), the Biotech Center added a technology transfer advisory committee in 1993. Separate technology licensing operations were set up at each of the universities by 1995. The Biotech Center offered assistance in their formation.

Over time, the Biotech Center has expanded its support for entrepreneurial firms, adding new initiatives and internal divisions that we describe here and outline in Table 1. These initiatives were small pivots that adapted to the articulated needs of the community. Recognising the need for entrepreneurial firms to secure seed financing, the Biotech Center leveraged the federal Small Business Innovation Research (SBIR) programme and offered matching funds in 1992. While many states now have SBIR-matching programmes, this was one of the early efforts and is unique in its focus on biotechnology (Lanahan, 2015). With this programme, we see a significant increase in the number of North Carolina firms moving from phase one to phase two SBIR awards (Lanahan and Feldman, 2018). This programme became a model for a larger programme run out of the Governor’s Office of Science and Technology Policy that provides matching funds for any firm, regardless of industry.

In 1994, the Biotech Center initiated a Patent Funding Assistance Program. The idea was to encourage university scientists to apply for patents or to extend coverage to other patent systems. Here there is evidence that the number of patent applications increased, although the timing coincides with the establishment of the university technology licensing offices. Certainly, the two programmes worked in tandem, reinforcing faculty efforts to establish the intellectual property rights necessary for initiating a start-up venture. While local venture capital is frequently an early investment for many emerging clusters, a dedicated biotech fund was added significantly later. In 1990, the Biotech Center promoted a small firm financing programme and a series of venture capital conference. In 1991, a summer MBA associate programme was initiated to place MBA students in local companies, with a 50% match in compensation. In 1998, the Biotech Center received a state appropriation of $10 million to catalyse the creation of a North Carolina Bioscience Investment Fund (NCBIF). A letter from Charles Hamner, then president of the North Carolina Biotechnology Center, to Michael Hooker, chancellor of the University of North Carolina, asks the university to invest endowment funding in NCBIF, noting that North Carolina has traditionally proven less strong in providing, from within the state, the venture capital necessary to support such companies (Letter to Michael Hooker, 15 October 1998). As a result, an additional $16 million was raised from private sources.

In more recent years, the Center has turned to the question of job creation, and with the goal of creating quality jobs in biomanufacturing for workers displaced from North Carolina’s traditional manufacturing industries, including textiles, furniture and microelectronics. In that role, the Center has helped recruit prominent biomanufacturing firms to the state (Lowe, 2014). But it has also helped established pharmaceutical manufacturers in North Carolina deepen their research based in the state—thus helping to support an innovative productive economy, with the goal of supporting further job creation through new product and process development (Lowe, 2007; Lowe and Wolf-Powers, 2015). This expanding focus is motivated by the need to expand good paying job opportunities to more North Carolinians, pure and simple. Not simply an act of strategic brilliance, the focus on biomanufacturing is also a pragmatic response to increased political pressure to create jobs for the local labour force.
Policymaking may be conceptualised as a search space with different options available to achieve a goal or objective (March 1991). Bounded rationality suggests that policies will be copied from one context to another, as those responsible for regional economies search for appropriate strategies. However, copying policies or best practices from another place frequently fail to achieve the desired outcome (Tödtling et al., 2006): there are simply too many variables to consider. If the parameters to develop regional economies and promote entrepreneurship were well established, then the policy solutions would be rather straightforward and easily transferred and replicated. But experience tells us that this is not the case, and many economic development attempts have not yielded the expected results, despite large public and private expenditures (The Economist, 2016). Instead, every story and every example is unique, with creative interpretation of the parameters of what policies and investment are required. Economic development practitioners, entrepreneurs, policymakers and civic leaders use their own intuitive heuristics—this is the common, unifying principle. Stam (2015, 7) concludes that “regional policy is not about maximizing a certain indicator of entrepreneurship but creating a context, a system in which productive entrepreneurship can flourish.” Yet the precise process by which this occurs needs greater articulation and definition. Regional economic development policies are fundamentally about a search for meaningful policy action in the face of great uncertainty. The geographic concentration of industry

**Table 1. North Carolina Biotechnology Center initiatives.**

<table>
<thead>
<tr>
<th>Goal</th>
<th>Target organisation</th>
<th>Programmes</th>
<th>Year started</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interdisciplinary collaboration</td>
<td>Universities and firms</td>
<td>Various: bioelectronics, bioprocess engineering, marine biotech, plant molecular biology</td>
<td>1985</td>
</tr>
<tr>
<td>Research support</td>
<td>Universities and start-up firms</td>
<td>Competitive Small Grants</td>
<td>1985</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Economic Development Grants</td>
<td>1988</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Institutional Development Grants</td>
<td>1988</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Historically Minority University Biotech Program</td>
<td>1994</td>
</tr>
<tr>
<td>Talent recruitment</td>
<td>Universities and start-up firms</td>
<td>Visiting Industrial Scientists</td>
<td>1985</td>
</tr>
<tr>
<td>Public technology awareness</td>
<td>High schools/news outlets</td>
<td>Media and public relations (expert writers)</td>
<td>1985</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Education and public affairs</td>
<td>1987</td>
</tr>
<tr>
<td>Workforce development/vocational training</td>
<td>High school and community colleges</td>
<td>Education and public affairs</td>
<td>1987</td>
</tr>
<tr>
<td>Technology transfer</td>
<td>Universities</td>
<td>Educational Enhancement Grants</td>
<td>1991</td>
</tr>
<tr>
<td>Entrepreneurship/commercialisation</td>
<td>Start-up firms</td>
<td>Various initiatives</td>
<td>1988</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Match</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Commercialisation support</td>
<td>1992</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Patent Funding Assistance</td>
<td>1994</td>
</tr>
<tr>
<td>Expand state’s manufacturing capacity</td>
<td>Biopharma manufacturers</td>
<td>Recruit Corning BioPro and Biogen</td>
<td>1994/1995</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Develop customised training for Novozymes</td>
<td>1998</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Launch BioWork with community college system</td>
<td>2001</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Partner with NC State and NC Central universities to create BTEC and BRITE</td>
<td>2007</td>
</tr>
</tbody>
</table>

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inextricably links regions to the trajectory of an industry’s life cycle and the pace of technological innovation. The unpredictable development of new technology, the influence of global trade and the closing or downsizing of local firms further may limit economic development efforts by providing additional unpredicted challenges to address. Cyclic fluctuations in the macro-economy are more intensely felt at the local level, where monetary policy interventions are not available and fiscal policy responses are limited. Rather than planned with perfect foresight the capricious decisions, the best that local policymakers can do is continuously search for meaningful action.

Under conditions of uncertainty, organisations face the need to search for alternatives to solve problems that are defined simultaneously with the search for a solution. Stark (2011) argues that the challenges under conditions of uncertainty is the process of search in which you do not know what you are looking for, but will recognise it when you find it. There is a difference between occasions when we search for solutions within a set of established parameters, and those occasions where the parameters are not well known or subject to alternative definitions and perceptions. As famously characterised by Donald Rumsfeld, in his 2002 Department of Defense press briefing:

There are known knowns; there are things we know we know. We also know there are known unknowns; that is to say we know there are some things we do not know. But there are also unknown unknowns—the ones we don’t know we don’t know. And if one looks throughout the history of our country and other free countries, it is the latter category that tend to be the difficult ones.

For local economies, the ‘known knowns’, like the planned construction of a new highway, are mendable through planning. But the ‘unknown unknowns’, the large changes in the industrial structure of a local economy, are difficult to anticipate and to launch an economic development recovery strategy. In these cases, there are no means of testing to see which decision is better because there is no basis for comparison and no time to analyse. When confronted with the unexpected, the only response is to experience things as they come and to respond in a way that advances long-term collective objectives.

Upon examination, regional transformations are the result of complex forces that construct locations over time, negotiating among various political factions and competing interests—if only the processes of regional economic change were as automatic and easy as the prevailing models imply. When we move from generic social and economic capacities to the specific precursors of innovation, there is evidence of a growing role for public institutions and investments (Block and Keller, 2009; Mazzucato, 2013). This is in part because the nature of scientific research has changed, increasingly taking the form of decentralised industrial networks or open innovation. R&D and innovation are thus no longer confined to the laboratories of large corporations or government but are now collaborative activities, embedded in networks between both public and private institutions, and large and small firms. This degree of decentralisation fosters a greater dependence on government programmes to coordinate the operations of these networks and to limit moral hazards and predatory behaviour (Schrank and Whitford, 2009). At a time when market fundamentalism has come to guide American policy debates, the public sector has actually become more and more immersed in the economy through technology policies in particular (Block and Keller, 2009). The public sector is the only entity with the required long-term staying-power and sufficient command of resources to make the large-scale investments, to effectively coordinate economic systems and ensure that the resulting benefits are fairly and widely distributed. There is a role for government in regional economic development in order to provide resources—the sunshine, the
soil and the water that allows the ecosystem to flourish (Feldman et al., 2017). The role for government policy suffers in comparison to the role prescribed by other actors and organisations in the ecosystem perspective. This is perhaps because of the lack of understanding about how policy can effectively deal with great uncertainty.

Lester and Piore (2004, 4–5) distinguish between an analytic mode of problem solving and the interpretation model that is especially relevant to understanding policymaking under great uncertainty. Policy making in routine circumstances is based on the analytic mode: the parameters are well known and change is incremental. However, the ever-accelerating pace of change requires an interpretation model in making policy, especially when the situation is uncertain, as is the case with economic development, which involves innovative and emerging technologies or industrial restructuring due to factors often beyond the policymakers’ control. The interpretive model, we argue, requires a well-defined search for meaning that keeps the public interest front and centre—and is also a check to government becoming captive to special interests. Policy choices are further complicated because the current targets of economic development are innovation and entrepreneurship, which are based on processes that are not well understood, nor easily influenced.

The search of effective policy, however, needs to be based on assumptions about human behaviour and social interactions, the role of institutions and collective action, and reasonable expectations about what is meaningful for a regional economy, which are not accommodated by the existing models of economic development. With new interpretive and more realistic models of economic development policy to guide the new realities of constant change and the lack of a stable equilibrium may be possible. Simmie and Martin (2010, 30) argue persuasively that ‘what matters for the long-run success of a regional economy is the ability of the region’s industrial, technological, labor force and institutional structures to adapt to the changing competitive, technological and market pressures and opportunities that confront its firms and workforce’. Building such frameworks will take time and is certainly beyond the scope of this single article, but will aid both theory and practice.

Reflective conclusions

Our purpose is to introduce new conceptual frameworks to the discussion of economic geography and regional development. While the history of any region is particular and idiosyncratic, we offer an example that contrasts with the traditional market forces that are given primacy in the traditional economic development model. Rather than realised through individual action, meaning in places is frequently constructed through collective action that is negotiated among various constituencies: adaptive, rather than planned and orchestrated. Policy change in response to a dynamic environment is difficult, if not impossible, to fully specify and predict. Rather than seeing efficient economic actors engaging in single transactions, regional economies are constructed by individuals and organisations with diverse motives that often extend beyond the market and that themselves evolve through social interactions. Actors in a regional economy engage in repeat transactions over time, where trust and common purpose are established or squandered. Regional economies involve relationships that, rather than deterministic and preconceived, play out through improvisation and adaptation on a geographic stage, building and redefining the dimensions of that stage as dictated by the demands from the local community. The system is endogenous and jointly determined, defining a place by the interactions of its component actors. Drawing on philosophy, we argue that attempts at changing regional economies, by building new industries and engaging in place making activities, are about the larger, fundamental search

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for meaningful action. Rather than being able to maximise any one element, policymakers instead satisfice to make the best decisions with limited information.

Regions face choices—the policy initiatives that define their future. Policy may be conceptualised as a search space with unlimited options to fit the external environment. The actions that are taken may be shorter or longer term, they may serve special interests or individual interests, or they may reflect the greater public good. Often the policy prescriptions are formulaic, involving large capital projects. But the genesis of industrial clusters is an endogenous process with resources developed over time through deliberate, repeated and incremental policy actions.

Certainly, this does not imply that infrastructure is not important and that capital investments are unnecessary. Rather than the heaviness of large, splashy one-time initiatives—the pouring of concrete, or the grand announcement of a new programme—the most effective policy may be the small-scale, incremental and more mundane adjustments that advance the objective of improving living standards and residents’ quality of life. Often these policies are unnoticed because they are small in scale, using minimal resources and implemented by divisions of government entities.

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