The Green Technopole and Green Localism:

Ecological Modernization, the Treadmill of Production, and Regional Development

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Abstract

Two emergent “green” forms of regional development are compared and contrasted in terms of a concept of sustainability that includes ecological, economic, and equity considerations. The green technopole is built around the ecological modernization of existing industries or the development of new environmentally oriented industries, and green localism is based on production for the regional economy through small firms and nonprofit organizations. Examples and types within each category (e.g., the Freiburg solar industry for technopoles and sustainable local agricultural networks for localism) are outlined. Both ecological modernization theory and treadmill of production theory have been skeptical about the viability of localist projects, albeit for different reasons. This essay explores the degree to which such skepticism continues to be justified, and the extent to which localist projects are themselves undergoing a modernization process that may require a reassessment of their potential and viability.

During the 1970s a technology-oriented wing of the environmental movement drew considerable attention for its demonstration projects based on appropriate technology, soft energy, and what would today be called sustainable technology. Social theorists soon drew attention to the obvious shortcomings of the appropriate technology "movement." In Germany Joseph Huber argued that the projects were not economically viable and, due to the lack of capitalization, sometimes used outdated machinery that was actually less "green" or efficient than the machinery in mainstream businesses. His disappointment with the promise of the appropriate technology projects led to one strand of ecological modernization theory, which focused on the possibility of existing industries to solve the ecological crisis by technological innovation (Huber 1989; Mol 1996: 35-37). In the U.S. Allan Schnaiberg (1982) argued that although the appropriate technology movement had a populist rhetoric that emphasized the democratic potential of technological innovations (such as solar energy), in practice the movement was more concerned with the distributive politics of shifting resources into soft technology rather than the redistributive politics of enhancing equity (also Schnaiberg 1983a, 1983c). He also argued that the appropriate technology movement underestimated the extent and strength of resistance from corporate or treadmill firms. In other words, two of the most influential frameworks in contemporary environmental social theory (Buttel 2000a, 2000b)—ecological modernization theory and treadmill of production theory—diverged on fundamental issues, such as the ability of capitalism to solve the environmental crisis without fundamental change (Mol 1996a, Pellow et al. 2000), but they found some common ground in their skepticism of the 1970s experiments in appropriate technology.

This paper will draw on both ecological modernization theory and treadmill of production theory to describe the dual legacy of technology-oriented environmental experiments of the 1970s at a regional level. On one side, many of the ideas behind appropriate technology have been absorbed into existing industries in a process that could be described as partial ecological modernization or a partial greening of the treadmill of production. At the regional level, the partial transformation can be found in the emergence of the "green technopole," or a regional industry cluster that has developed around environmentally oriented production. On the other side, the grassroots visions of appropriate energy technology have merged with other environmentally oriented grassroots experiments, such as sustainable agriculture and reuse/resale, and those projects have also undergone a process of transformation and development into a growing economic sector that will be termed here "green localism." Unlike the corporate orientation of the technopole, the localist organizations are generally smaller, and they involve a mixture of civil society, small business, nonprofit, and public sector organizations. This paper will explore some of the variations and subtypes among the green technopole and green localism, then it will discuss their possible relationships.

The green technopole and green localism represent two emergent forms of environmentally oriented regional economic development, one dominated by the traditional urban growth machine and treadmill of production and the other more by traditional social movement concerns of a rich concept of sustainability that, to some degree, includes equity. This paper will argue that green localism is far from a failed legacy of the 1960s and 1970s social movements and counterculture. Instead, green localism represents a vibrant and growing sector of regional economies, and it warrants

greater attention as a strategy for regional economic development and a topic for environmental social theory.

Definitions and Background

As a strategy of regional economic development, "localism" focuses attention on regional or community control of capital by redirecting both investment and consumption toward local organizations (Shuman 2000; Williamson, Imbroscio, and Alperovitz 2002). Localism is defined here as a vision of economic development that highlights poverty reduction, civil society development, public and local ownership, and networks of national and transnational grassroots enterprises (Hess and Winner 2003). The existence of a strong localist sector of the regional economy can help protect regions from runaway shops, the boom-and-bust cycles of global economic displacements, invasion by pollution-producing firms in the name of job creation, and the siphoning of local capital to distant headquarters.

The term "green" production is used here in a generic sense to encompass a diverse range of production and product changes that take into account concerns with mitigating or ameliorating environmental damage. Within that category, "environmentally oriented" technologies and production are defined as relatively incremental modifications to products and the production process that generate lower amounts of waste and/or energy consumption. In business circles the term "clean technologies" is increasingly used to identify this approach. Although the innovation may be incremental, the total effect can in some cases be very substantial if the innovation is widely diffused. One example is the case of increased energy-efficiency in

automobiles or in greenhouse-gas generating heat and electricity facilities. Although innovations such as hybrid automobiles or cogeneration do not break with energy production based on greenhouse gases, if widely diffused they have the potential to bring about significant reductions in environmental withdrawals and deposits that characterize treadmill production. However, as treadmill of production theory notes, if such technological changes occur along with increased production, any ecological gains could be erased by overall increases in withdrawals and deposits from the environment.

In contrast to environmentally-oriented production or clean technologies, the term "sustainable production" in an ecological perspective will be used here to refer to a higher level of technological innovation that 1) takes into account the entire product life cycle, from extraction through manufacturing use, and disposal; 2) is established as a loop so that disposal feeds back into raw materials extraction and little if any resource depletion occurs; and 3) results in minimal or zero waste and pollution throughout the life cycle. Models of such a form of technology exist in the work of visionaries such as Gunther Pauli (1998) and Nancy and John Todd (1993; see also Gorman and Mehalik 2002), and those models provide a measuring stick for a post-recycling social movement that is oriented toward product stewardship or extended producer responsibility. A sustainable product is defined here as a product that is created from waste, made and used without generating significant pollution or waste, and disposed as an input into a new product. Life itself provides the ultimate model of a sustainable technology, but organic food production that recycles food scraps and unharvested plant material back into compost is another example.

Although from a design perspective "sustainable" technologies and products represent a more profound transformation than the above-described clean or environmentally oriented technologies, if the incremental changes that occur in the greening of established, large industries are widely diffused, they can have potentially greater environmental impact. Thus, the design of the technology is only one ingredient in its sustainability in an ecological sense; its economic viability and ability to scale up to a level that has ecological impacts is also important. This is an argument that ecological modernization theory has raised, and it points to a potential weakness in the localist strategy, even if some of the localist technologies are more deeply sustainable in an ecological sense.

A second necessary amplification of the concept of sustainability is in the social or "red" sense of developing a society that has greater equity. Given the record of human civilizations and the current spatialization of pollution across geographically enforced class boundaries, the challenge of building a sustainable civilization in a social sense is formidable. Whether one wishes to ground a "red" or social justice dimension of the definition of sustainability on a functional argument that the dimension is necessary for social stability or on a more moral basis, this dimension of sustainability has been an important part of the development of the concept and will remain part of it here. In the planning literature the multidimensional problem is represented by the three E's of ecology, economy, and equity (Campbell 1996; cf. Moore 2003).

Civil society organizations and social movements have played an important part in the emergence and growth of green localism. Civil society organizations are defined here as voluntary associations; that is, they are based on the voluntary donations of

members who control the organization. The donations may take the form of labor (volunteer organizations), funds (membership organizations), or mixes of the two types. Although the organizations may have other sources of income (endowments, sales of goods and services, gifts and grants from nonmember donors, etc.) and paid staff, they are primarily reliant on the voluntary donations. This definition allows civil society organizations to be distinguished from firms or private sector organizations (which may be nonprofit or for profit, but are based on the production of goods and services), government organizations, and domestic units. Movement organizations represent a subtype of civil society organizations that are dedicated to resisting or bringing about change in favor of less powerful actors, either through existing channels (reform movements) or extrainstitutional channels (social movements). Elsewhere I have developed a comparative analysis of "technology-oriented and product-oriented movements" (TPMs) that examines a process by which large corporations “incorporate” or absorb alternative technologies and then “transform” them through redesign, sometimes after an initial period of attempted suppression (Hess 2002b). This model was originally developed based on my extensive fieldwork on the movement for nontoxic cancer therapies in the U.S., where the alternatives were first suppressed then slowly incorporated into the mainstream, but only in the form of complementary or adjunctive therapies (Hess 1999, 2003). During the incorporation and transformation process, "object conflicts" develop between corporate/treadmill organizations and social movement/small business organizations over the design, regulatory statutes, and use of the technologies and products in question. The process can be observed in a number of TPMs in addition to nutritional medicine, including renewable energy, solid waste,

organic food production, urban infrastructure, community media, and open source software. For example, in Denmark wind energy developed from a social movement into a major industry (Jørgensen and Karnøe 1996; Jørgensen and Strunge 2002), and in the U.S. recycling went from a community-based, social movement to a part of the waste industry (Weinberg, Pellow, and Schnaiberg 2000).

Green Technopoles

The development of environmentally oriented changes in production and products in the corporate sector emerges in part as a response to the work of social movements. As the corporate sector or treadmill firms incorporate, transform, and otherwise coopt the technological innovations produced in the TPMs, they also undergo a partial transformation that involves some movement in the direction of social movement goals through their incorporation of redesigned social movement production technologies and products. The dual perspectives of treadmill of production theory and ecological modernization theory seem helpful to understand the complexity. In other words, pace treadmill theory, social movement goals become coopted by their absorption into the treadmill of production, but pace ecological modernization theory, existing industries are transformed by their absorption of the alternative technologies. Nevertheless, again pace treadmill theory, the transformation is only partial and potentially reversible.

As both treadmill of production and ecological modernization theory note, the private sector embraces environmentally oriented production changes because it is driven by government regulations and networks of reform efforts of social movement organizations and political parties. The studies of Bayliss, Connell, and Flynn (1998a,

1998b) confirm and extend previous findings that regulatory push is the strongest reason that companies give for their environmental improvements in production and products. Although some firms and industries in the private sector continue to attempt to rollback regulatory reforms, others have recognized that environmentally oriented innovation in both products and production processes need not be conceptualized in a zero-sum relationship with the traditional pursuit of profits. At a policy level, the parallel trade-off between environmental and economic growth goals has not disappeared as much as increasingly undergone a challenge from within, as some firms and leaders of the business world have reconceptualized the ecology/profitability relationship as a potentially positive-sum relationship (DeSimone et al. 1997, Florida 1996, Hawken et al. 1999). Although the relationship is reconceptualized as positive sum, it is within a framework that recognizes the need for continued regulation, albeit in a modified form. For example, Rennings (2000: 236) argues that the externalities captured by price reductions in competing, less environmentally benign products result in lower investment in eco-innovations, and consequently regulatory policy is necessary, especially if the goal is to drive production process innovation. Likewise, Porter and van der Linde (1995: 124) suggest that regulatory policy is necessary, but it should be altered to be more innovation friendly, for example by focusing on outcomes rather than prescribing specific remediating technologies.

The dominant actors in the public and private sector have become divided between an earlier rhetoric of a trade-off between environment and economic growth goals and later rhetoric of ecological modernization that emphasizes the potential profitability of green production. Although when the dominant actors utilize terms such

as “sustainable development,” their meaning is far from sustainable in the sense in which the term is defined above, their very reference to the concept represents a shift in the politics of legitimation and the way in which industrial development policy is framed. As a result, policies such as the return to fossil fuels in the second Bush administration in the U.S. undergo a legitimation crisis both within domestic elites and across international partnerships, and consequently even attempts to return to fossil-fuel policies must be anchored in a long-term legitimation strategy that emphasizes ecological modernization as a goal, such as the Bush administration’s $1.7 billion policy proposal that emphasizes conversion to hydrogen power. Although the long-term policy of ecological modernization may be a smokescreen to weaken opposition to a short-term policy of increased treadmill production, the fact that this type of smokescreen is being used suggests how the politics of legitimation have shifted due to the division within elites over ecological modernization. Furthermore, as an elite-oriented policy, there is little concern with labor or equity issues, or with the general problem of reducing consumption.

At a local and regional level, a similar division within the elites occurs. The traditional urban growth machinery has focused on the high-tech potential of manufacturing for competition in global markets, with increasing emphasis on the development of regional innovation clusters in biotechnology, information technology, nanotechnology, or other high-tech industries. The literature on globalization has recognized the advantages of proximity and specialization among the world's "global cities" (Sasken 2000) and "technopoles" (Castells and Hall 1994), and increasingly urban areas or larger regions have developed policy goals of attracting regional industry clusters

along the lines of Silicon Valley, Boston's Route 128, Cambridgeshire, Sophia-Antipolis, and other regions. The regional innovation literature (e.g., Etzkowitz and Leydesdorf 1998, 1999) suggests that inter-firm resource sharing and the "triple helix" of university-government-private sector partnerships are crucial prerequisites for the successful development of regional industrial clusters that can compete in continental and global markets. Increasingly, the role of the university and technology transfer is being recognized as a key ingredient in both national (Nelson 1993) and regional (Leydesdorff et al. 2002) systems of innovation.

Systems of regional and national innovation are generally oriented toward a continuation of capitalist production, with little interest in environmental considerations and with equity framed only as job creation through industrial development. However, there are some signs that regional innovation clusters are emerging around environmental technology as well. The meaning of “environmental technology” can vary widely, from pollution remediation equipment for fossil-fuel energy sources to some reasonably nontoxic microbial technologies in biotechnology firms that are attempting to remediate pollution. More generally, there is some evidence for the emergence of “green technopoles” as a regional expression of ecological modernization. Green technopoles may be broken down into three types: the greening of existing regional industry clusters, the integration of regional industries through the conversion of waste into resources, and the development of new, environmentally oriented industries.

Regarding the greening of existing regional industry clusters, one example that shows some triple-helix dynamics is the Ecological Project for Integrated Environmental Technologies of Graz, Austria (ICLEI: Case Study #24). This project showed an

incipient triple helix by bringing regional small and medium enterprises such as printing shops and automobile garages together with the Department of Environmental Protection from the city governement and a research group from the Graz University of Technology. Businesses reviewed their production processes and prioritized substitutions based on time for return on investment; the most successful firms were given awards and authorization to use the ECOPROFIT label for one year. At a somewhat larger scale, major national industrial clusters are undergoing a greening process, again in part driven by regulatory push. In addition to the growth of renewable energy in the transportation industry (e.g., the shift of research and development toward hydrogen powered automobiles in the U.S. and Japan), the greening of the Dutch chemical industry provides a less well-known example that has also become an exemplar of ecological modernization theory (Mol 1996b). Mol (2003: 314) notes that by 1999 199 of the 143 chemical firms in the Netherlands were producing annual environmental reports and had an environmental management system. Companies were spending an increasing amount of their annual investment on environmental measures, and new products were developed and reviewed with environmental benefits in mind. The greening process is probably especially advanced in the Dutch chemical industry; comparative data suggest that the chemical industry has undergone greater regulatory scrutiny than most and that there is considerable variation in regulatory push across nation-states (Bayliss, Connell, and Flynn 1998a; Mol 2003: 323-324). The impressive level of state intervention in the Dutch case is also suggested in the work of Schot (1992: 43; also Schot et al. 1994), who examines various points of state intervention that go beyond end-of-pipe regulations to encourage environmentally oriented innovation: investment in new product development

where private sector funds are not forthcoming; modifying the policies of industries that will affect marketplace acceptance, such as insurance companies and manufacturers' associations; and creation of links between producing firms and departments within consuming firms that are most likely to influence acceptance, such as marketing, environmental, and quality assurance departments.

A second type of green technopole involves the development of a new environmentally oriented industry around a new or emergent technology, rather than the greening of existing industrial clusters. The German solar industry will be discussed here, but the Danish wind industry is another example. In Freiburg, Germany, activism surrounding the Whyl nuclear power plant eventually led to a solar-oriented urban policy that directed the municipal utility to develop greater solar energy use (Energie-Cities 1999). Triple-helix dynamics emerged with the founding of the university-affiliated Fraunhofer Institute for Solar Energy Systems in 1981, and two decades later there were seven institutes that had combined into a Solar Energy Research Group (REFOCUS 2000). The city government spurred development by placing solar units in municipal buildings, and in 1992 it required that future housing and municipal buildings use passive and active solar energy (Solar-City: Germany 2000). By the mid 1990s, when the International Solar Energy Society moved its headquarters to the city, there were about 200 installations in the city for about 2500 square meters, and the municipal utility was running an advice center for solar energy (International Solar Energy Society 2001; Energie-Cities 1999). However, a more fundamental change occurred in 1999 when the Federal Ministry of Economics and Technology inaugurated the 100,000 Roofs Solar Energy Power Program, and in 2000 the Renewable Energy Law allowed sell-back to the

grid for solar-generated power (International Energy Agency 2002). By 2001 there had been about 50,000 solar installations in the country, of which 20,000 occurred in 2001 (Solarbuzz 2002). Once again, the role of the state--here both national and local--was crucial for the development of the industry.

In the U.S. there less evidence of green technopoles that have developed around new industries. One incipient form is the electric vehicle nexus that has emerged in Chattanooga, Tennesse, for urban buses (Electric Vehicle Institute 2003). Although electric vehicles have a long and troubled history (Callon 1987), and the major automakers have mostly abandoned the electric automobile in favor of hybrid vehicles, there is growth in electric and other alternative bus production. Another example of an incipient green technopole around a new industry is the emergent New York State environmental technology cluster around fuel cells (D'Errico 2002). However, the California Bay Area has probably the most advanced environmental technology cluster in the U.S. San Jose State University and the Redevelopment Agency of the City of San Jose have sponsored an Environmental Business Cluster that has graduated fifty firms (Robbins 2002), and the Alameda County Waste Management Authority has established an eco-industrial park in San Leandro (Bartholomew 2002). In addition, the former Alameda Naval Station is in the process of conversion, and it houses two business incubators that include several renewable energy and energy conservation firms (Allen 1996; Davis 1997, Calstart 2003, Greenstart 2003). Stanford University's Global Climate and Energy Project is a $225 million dollar research project with support from Exxon Mobil, GE, Toyota, and other companies; the project will develop "clean energy" technologies and technologies for controlling greenhouse gases (Blumenstyk 2003). The

rapid growth of the Bay Area cluster suggests the continued vitality of the entrepreneurial environment of Silicon Valley, which has been able to withstand various rapid transformations in the information technology industry (Saxenian 1996) and now is expanding into the environmental technology industry. In this context private investment from venture capital firms is crucial for the capitalization of new firms, which develop according to entrepreneurial models established in other industries.

A third type of green technopole involves the integration of non-similar businesses through a waste-into-resources conversion processes. Kalunborg, Denmark, provides the model of the eco-industrial park, which is built around the wastes generated from a fossil-fuel burning plant. The non-renewable energy source immediately establishes this form of green technopole development as an environmentally oriented, incremental change rather than sustainable technology. Efforts to establish eco-industrial parks in the U.S. suggest that the Kalunborg model may not be very portable, due in part to stringent federal regulations on solid waste disposal and liability (Desrochers 2001). Even in regions committed to environmentally oriented regional development, such as Chattanooga, Tennessee, projects to establish eco-industrial parks have stalled (Portney 2003: 116). In addition to the regulatory problem, eco-industrial parks create vulnerabilities in supply chains. For example, if one firm goes bankrupt or changes its production process to reduce a waste product that is another firm's input, the supply chain is disrupted. One solution has been to shift attention toward regional eco-industrial networks, but this model is not yet well developed (Schlarb 2001). In other cases eco-industrial park projects in the U.S. are evolving toward environmentally oriented science

parks with incubators with support from various levels of government (National Alliance of Clean Energy Business Incubators 2002).

This brief typologization of three types of emergent green technopoles suggests some significant commonalities in a field of substantial variation. First, the emergent changes are largely in response to changes in national and regional government policies, both of which have generated mixes of regulations and resource provision (usually through research tie-ins) for experimentation with new technologies. A reversal of government policies could easily lead to a collapse of the new innovations. For example, the Danish wind industry went through one boom-and-bust cycle with the rise and fall of the California wind rush of the 1980s, and it is undergoing a new phase of uncertainty as European Union directives have implemented the Kyoto Protocol in a way that allows carbon dioxide trading to replace green energy credits (Jørgensen and Karnøe 1996; Jørgensen and Strunge 2002). The dependence of two strands of the triple helix (industry and research) on the third strand (regional governments and nation-states) suggests that if governments were to modify the profitability environment, such as by withdrawing funds and regulation due to financial hardship caused by economic reversals or warfare, the industries could revert to less green products and production technologies. In other words, pace the treadmill of production criticism there seems to be little evidence for one of the subtheories of ecological modernization theory, that there is a graduate emergence of ecological values that compete in a significant way with profitability in investment decisions. However, the emergence of green technopoles or environmentally oriented regional industry clusters is itself a historical development of the type that ecological modernization theory attempts to describe.

A second commonality among the various types of the green technopole is that the productive technology is incremental or "clean" rather than sustainable in the sense defined above. There is a tendency for firms to opt for the most minor change in existing technologies and call it green or clean. Even where the technological changes are more substantial, such as the Freiburg solar industry or the development of other forms of renewable energy, the entire production process is not necessarily sustainable in the sense of near zero waste. Waste can be displaced from one part of the production cycle to another, thus generating “cleaner” technologies from one perspective but dirtier ones from another and a difficult interpretive problem about whether there is a net ecological gain.

A third commonality is that the regional industry clusters are generally manufacturing firms that are producing for markets that go well beyond the region. The products may be sold regionally, but ultimately most manufacturing firms need to reap the economies of scale from production for broader continental and global markets. The intended market leads to two vulnerabilities from the perspective of regional economic development. First, the environmentally oriented industries are not necessarily less subject to global boom-and-bust cycles than other industries, and they may be more so given their relationship to government regulatory policies. In other words, a solar energy cluster could go through a bust cycle if another renewable energy technology is developed that offers similar benefits at lower costs, or if a new government policy reduces incentives for rooftop solar. Second, the firms may be headquartered in a region and show interest in the quality of life in the region because they are located there, but their loyalties are driven primarily by economic considerations such as quality and price

of the labor force, access to inputs, and the positive externalities of participating in a regional innovation cluster. Because their orientation of investment and sales is continental or global, the loyalty to the region is always subject to revision.

A fourth commonality is that the firms operate without any significant change in organizational structure or orientation toward trade-offs between profitability and other values such as poverty reduction or regional quality of life. High-tech manufacturing jobs will tend to benefit the educated and professional labor market, and benefits to the poor will tend to accrue through multiplier effects on the local economy or employment in low-wage positions. Environmentally oriented manufacturing is not necessarily clean, and it may increase local pollution, although concerns with corporate image may make this less of a problem than in other high-tech industries.

In short, the green technopole suffers from significant shortcomings as a model of regional development, but one might still prefer the green technopole to the brown or silicon technopoles of most regional development policies. Furthermore, in theory some of the green technopole firms could have organizational forms and labor policies that address issues of equity and regional quality of life, and product labeling programs could highlight those firms as good local citizens. In other words, the green technopole has potential, albeit mostly unrealized. In general, the shortcomings of the green technopole suggest that at the minimum it could be balanced by some other form of regional development. The remainder of this essay will focus on the potentials and limitations of green localism.

Green Localism

Although technopole advocates will tend to reject green localist projects as utopian and not viable economically, those perceptions do not square well with the continued vibrancy of green localism. The localist, grassroots side of appropriate technology/sustainable technology movement of the 1970s and early 1980s did not undergo a decline and degeneration during the subsequent decades; rather, it underwent its own modernization process. Although in some cases the large corporate firms have absorbed these developments or will do so, in other cases green localism offers some strategies for avoiding incorporation into the treadmill and solving the problem of scaling up.

The green localist sector is far from stagnant or moribund due to several ongoing processes. First, the organizational structure of green localist production continues to evolve in ways that allow profitability concerns to be encompassed by other values, such as sustainability in the broad sense defined here. Second, regional production is characterized by networks of organizations or a clustering phenomenon that allows resource sharing and generates conditions for innovation. Third, through a transformation of consumer preferences via product labeling and informational campaigns, products that meet a degree of red-green sustainability standard are also being produced for broader continental and global markets. The development of red-green product labeling and consumer education allows firms to expand into specialized products that are not economically feasible to produce for a regional economy, but to do so in a way that resists treadmill dynamics that would move them to reduce concerns with equity or ecology. The second and third developments provide some overlap with the

technopole model and allow the two models to be envisioned as ideal types that form poles of an empirical continuum of green regional development strategies.

The organizational form is crucial for understanding green localism. Although corporations may exist and the pursuit of profits may be paramount for some of them, there is a tremendous variety of organizational forms among the green localist networks. For example, family-owned businesses and partnerships represent private-sector organizational forms in which the paramount goal is often production for reproduction rather than production for profit. In other words, concern with providing employment and income for networks of family and friends may take precedence when firms are faced with the choice between increasing their profitability by eliminating workers or restructuring in ways that decrease quality of life for the workers. From a neoclassical economics perspective, these firms could be characterized as "inefficient" and archaic. However, the firms may be more efficient in the sense of providing a better quality of life and equitable wages than the larger firms that are owned nonlocally and are oriented toward nonlocal production. Some of the localist firms recognize formally their concern with goals other than profitability by acquiring a nonprofit status or other legal protections, such as land trusts for farms. The legal protections allow firms to continue to produce goods and services but also to satisfy educational and charitable goals that may make them "inefficient" from the perspective of the marketplace. They become hybrid organizations at the frontiers of the private sector and civil society.

The success of the localist firms is largely contingent on building regional networks that include participation from local governments and households, and civil society organizations play a crucial role in developing those networks. Local

occupational organizations and churches help spur governments to set up programs that connect green localist firms to consumers and investors, such as farmers' markets, resale markets, community banks, green community development corporations, home energy information programs, and publicly owned transportation agencies and utility companies. In addition, production of goods and services also takes place within civil society organizations, such as community gardens, neighborhood and church rummage sales, and voluntary organizations that engage in home improvements for the poor. Civil society organizations are also developing the labeling programs that allow products to find markets outside the region. By building community responsibility and equity concerns into continental and transnational green labeling programs, civil society organizations help solve the problems of scale and allow green localist projects to expand into manufacturing. Green and fair trade labeling provides a mechanism to reduce the possibility that increases of scale will cause firms to forsake concerns with equity and quality of life in their home communities.

The organizational diversification, development of regional networks, and red-green product labeling practices do not mean that the logic of the treadmill is absent from the world of green localism. TPMs have tended to innovate new technologies and develop new markets, only to have their technologies adopted and redesigned by major industries that are seeking out the higher profitability levels of specialist niche markets. However, the localist projects are not swept aside by the incorporation and transformation process; rather, they continue to grow in an economic and technological field that undergoes diversification. For example, although agribusiness and major food manufacturers have entered organic food production, displaced and acquired smaller

farms, and developed natural products sections in supermarkets for what they view as a high-profit niche market, the long supply chains (stale produce) and cold ambience of supermarkets have not replaced the vitality of localist institutions. Rather, the quality of fresh produce, the value placed on helping local farms as a consumer "vote" for a regional quality of life, and the noneconomic exchanges found in the festive atmosphere of farmers' markets are factors that drive the simultaneous growth in the localist sector of the economy. Likewise, the entry of major energy power companies into the renewable energy market for grid-based production has occurred alongside the continued development of technologies for the home power movement. In other words, grassroots innovations have been taken up by established industries, but the grassroots innovations have also continued to expand and develop. Thus, although individual cases of green localist failure and cooptation can be found, when one steps back and examines green localism as a whole, it is far from a failure and in fact continues to expand.

Green localism involves networks among three basic types of organizations: households, locally owned for-profit firms and non-profit organizations, and publicly owned agencies and governments. At the household level, examples include community gardens, dietary interventions as a substitute for some drug therapies, garage sales and the rummage sales of voluntary organizations, energy-oriented home improvements and home power, eco-villages, ride sharing, and foot and bicycle modes of transportation. For-profit and non-profit firms include community-supported farms, farmers' markets, diet-oriented health-care professionals, the resale industry, home contractors that specialize in renewable energy, and community-oriented financial institutions. Government agencies include organizations that support the various green localist

projects already mentioned as well as municipal utilities and public transportation systems that are undergoing a transition to renewable energy.

Statistics are hard to develop for green localism, but several aggregate statistics support the assertion that green localism has developed in size and organizational diversity. Farmers' markets are one example of the impressive growth of green localism. In the U.K. they grew from none in 1997 to 300 in 2001 (BBC News 2001), and in the U.S. they grew by 79% from 1994 to 2002, when there were 3100 farmers' markets embracing 19,000 farmers (USDA 2003). By 2000 sales had topped $2 billion in the U.S. (Bullock 2000), and by 2002 82% of the farmers' markets had achieved financial viability (USDA 2003). Likewise, community-supported (subscription) agriculture has spread from Japan to Europe and the U.S. and Canada, where this organizational innovation grew from the first farm in 1985 to over 1000 farms in 1999 (UMass 2003). Although the sustainable, local agricultural market is skewed toward the middle classes, there are numerous developments that also address concerns with equity. For example, community-support agriculture farms are developing programs of scholarships, internships, and other ways of providing access to low-income residents; farmers' markets are being set up in low-income neighborhoods; and community gardens have continued to grow in low-income neighborhoods in many cities.

In the building redesign field, there are no accurate statistics on the number of people who have taken some of their home off-grid through conversion to renewable energy, but one metric of growth is the circulation of the main magazine of the home power movement in the U.S., which grew from 4,000 readers in 1986 to over 100,000 in 2001 (Griscom 2001). Tatum's ethnographic research traces the movement to the 1960s

back-to-the-land counterculture of hippies who located homesteads in areas inaccessible to power grids (Tatum 1994, 1995, 2000). Much of that flavor can still be found at Woodstock-like events such as the Solarfest camping expo in Vermont. As in farmers' markets, marketplace transactions with local producers take place alongside socializing, music, children's events, and other nonmonetary exchanges, thus embedding economic activity in broader practices of regional community building. At the same time, increases in the cost and declines in the reliability of grid-produced energy have made this movement more than a domestic hobby of questionable economic viability. Solar energy equipment--the main energy source for home power--grew sixfold from 1995 to 2001, to $2.5 billion, and growth was particularly strong in California after the power outages of early 2001 (Griscom 2001). In rural areas of California the use of small wind turbines also grew rapidly in the wake of the power outages, and the manufacturer of one microturbine claimed that business had grown threefold in 2002, with more than half the business in California (Gipe 2002).

Although the home power movement retains the tech-fix orientation that characterized much of the 1970s appropriate technology movement (Winner 1986), the movement has diversified into the political sphere. For example, home power and renewable energy advocates have become increasingly involved in the politics of grid sell-back and net-metering, and their political action overlaps with broader environmental struggles for greater accountability from the utility industry. Home power activists have engaged in civil disobedience by forming illegal grid connections, and the movement has led to regulatory changes in many states that now allow net metering and grid sell-back (Home Power 2003a, 2003b). Although the low-income side of the movement has

tended to be limited to weatherization and energy-savings programs for the poor, there are interesting developments at the interfaces of middle-class home improvements and social justice issues. For example, efforts to extend renewable energy have increasingly included publicly owned municipal utilities, rural electric cooperatives, and Native American reservations, where investments in renewable energy are seen as ways of ensuring greater independence from fossil fuel sources controlled by treadmill industries (e.g., Dickerson 2000, Lane and Marken 2003, NativeEnergy 2003).

The resale and reuse field is another example of the growth of green localist networks. The resale industry is one of the most rapidly growing portions of the retail sector, with over 15,000 shops in the U.S. in 2003 (NARTS 2003). The industry includes nonprofit thrift shops ("charity" shops in the U.K.), such as Salvation Army stores, as well as for-profit consignment and resale stores. Whereas the home power movement has arguably moved downward in the class structure as it has grown and diversified, the resale industry has moved upward as some of the shops have developed stocks (e.g., clothing, sporting goods) that are marketed to the middle class. Although there is some consolidation going on in this industry in the U.S., such as the development of used sporting goods franchises, there is a parallel growth in the informal reuse economy based around neighborhood yard sales, estate sales, church and school rummage sales, auctions, and household-to-household hand-me-downs. In the U.K., "car-boot" sales, or sales where people drive their cars to a lot and sell items from the cars, grew rapidly during the 1990s (Gregson and Crewe 2003). As in the case of farmers' markets and renewable energy fairs, the events involve a variety of nonmarket exchanges and community-building activity (Hermann 1997). In addition, many cities now have nonprofit reuse

centers that recover old building materials and provide job training and community development work, such as the Rebuilding Center in Portland, Oregon, and the Green Institute in Minneapolis (Dressel 2002, Green Institute 2003). Again, the resale sector of the local economy combines a vibrant mixture of organization types, and civil society organizations (such as churches and neighborhood associations) play a crucial role.

Health care in general is a service industry with a strong community orientation, and despite the consolidation that has occurred in hospitals and other clinical institutions, many health-care providers in the U.S. continue to practice as independent, locally owned businesses. However, the close connections between conventional health care and the pharmaceutical industry connect health-care expenditures to the profits of distant corporations. Furthermore, drugs are highly toxic and of limited efficacy for some types of diseases, such as chemotherapy for many solid tumors (Hess 1999, Moss 1995). The development of dietary interventions for the prevention and, on an experimental basis, treatment of some chronic diseases, provides a linkage to local sustainable agricultural projects (Hess 2002a). Likewise, mind-body therapies tend to funnel patients not only to alternatives to drugs but also toward ethnic religious organizations and civil society organizations associated with spiritual development and community quality of life. Again, this area of the local economy is undergoing rapid growth, both in the changing practices of medical doctors and in the growth of alternative professions such as oriental medicine practitioners, naturopaths, and meditation instructors. Survey data of patients in the U.S. and other countries confirm that this is a rapidly growing field in which patient expenditures run into the billions of dollars (e.g., Eisenberg et al. 1993, 1998).

Finally, microfinance and community banking institutions have grown rapidly since the development of the Graemen Bank in the 1970s. Ambitious new plans under the banner of the "Microcredit Summit Campaign" (2003) promise to reach 100 million of the world's poor. In the U.S. in 2001 the total amount invested in community development financial institutions--that is community-oriented credit unions, loan funds (including microfinance funds), venture capital funds, and banks--was $7.6 billion, and the total assets in community development credit unions had tripled from 1999 to 2001 (Social Investment Forum 2001: 20-23). The number of low-income credit unions grew from 134 in 1991 to 419 in 1998, and the National Federation of Community Development Credit Unions membership grew to 215 members in 2003, representing 700,000 members and $2 billion in assets (National Federation of Community Development Credit Unions 2003). Figures are not available on the percentage of community finance institutions devoted to green localist projects, but the point here again is to document the growth and vibrancy of new economic forms that offer some alternatives to the technopole model. One example is ShoreBank Pacific (2003), which provides loans to individual and community projects that bring together conservation and economic development.

A few comparisons show some of the similarities among the green localist developments. First, in conflict with the criticism that undercapitalization leads to economic nonviability and ecological inefficiency, many of the projects have achieved economic viability. Furthermore, some of the technologies of production—such as organic, local agriculture—could be classified as much closer to the sustainable end of the green technology spectrum than the efforts found in the greening of existing

industries. In other words, the localist projects are different not only in terms of their orientation toward ownership and markets, but also in terms of their technologies of production and products.

A second commonality is that for each of the types of green localism, there are instances in which large corporations have entered the new markets. Large farms and agribusiness have entered the organic field, the food industry has acquired organic food labels, large oil companies produce solar panels for home power activists, franchises and chains control part of the resale and thrift sector, pharmaceutical companies have acquired supplements firms, and some commercial banks have entered the microfinance market. However, even as this process is occurring, there is a parallel growth in farmer's markets, community-supported farms, urban gardens, home power installations, publicly owned renewable energy, garage and rummage sales, nutritional medicine, and community finance organizations. In other words, colonization of the localist sector by treadmill industries has not led to its demise but has coincided with its continued growth. The reason why localist projects are able to maintain their viability is because the hard work of social movement organizations have created shifts in consumer preferences that take localist production into account, and, on the production side, changes in organizational structure (such as nonprofit status) allow localist organizations to undertake production with legal protections for sustainability goals. Of course, if the cooptation process had not also been taking place, the localist organizations and networks would probably have grown considerably more. The point here is that the incorporation and transformation process does not destroy the localist networks, even if it may weaken them.

Another common ground is that localist projects continue to have an ambiguous relationship to redistributive or equity issues, pace Schnaiberg's observations (1982). However, to the extent that the localist projects have their origins in middle-class environmentalism, they have tended over time to diversify out in the class structure, pace Huber's observations (1989). Each of the types of green localism identified here reveals emergent organizations and projects that show concern with social justice issues, such as urban gardens, thrift stores, Native American renewable energy, medical traditions of low-income ethnic groups, and microfinance. Although on the whole green localism is not as concerned with social justice issues as the environmental justice movement, which examines the unequal distribution of green "bads" in society, the redistributive issues are also not absent and possibly growing in the green localist focus on the distribution of "goods." The problem of how the "red" and "green" dimensions interact in localist projects will be examined in a future research project (Hess and Winner 2003).

Conclusion

This essay examines two types of environmentally oriented regional economic development, the green technopole and green localism, and various subtypes within them, and it uses two theoretical frameworks from environmental sociology to provide some guidance into processes and dynamics. Pace the ecological modernization framework, there is evidence for a significant shift toward environmentally oriented production and products in industry, and those shifts are occurring in regional development processes that have been the focus of this essay. However, pace the treadmill of production framework, those changes are dependent on ongoing regulatory pressure from the state,

which in turn has been driven toward environmental reform by social movements and reform movements (Gould et al. 1996). Although the ecological modernization of production is a significant historical development, it is by no means irreversible, and it is also more advanced in some national and regional contexts than others.

Both frameworks have shown some skepticism of the projects of green localism and their potential. The skepticism is grounded up to a point. When social movements are successful in generating new technologies of production and new products, such as the movement for organic agriculture, the firms tend to outgrow localist markets, and the goal of production for reproduction can shift to production for increased profitability. Likewise, major corporations in related industries will tend to acquire the small firms or develop competing product lines in order to capture the higher profits of the niche markets that social movement activism has helped to generate. One finds this process of incorporation into global capital and transformation of product design in many TPMs and related industries (Hess 2002b). An exemplar of the process is the case of Cascadian Farms, which began as a community-oriented organic farm for local hippies and ended up as a food products subsidiary of General Mills (Pollan 2001).

However, the analysis of green localism presented here suggests that its fate is much more complicated than an inevitable absorption into large, corporate industries. Rather, the vibrant growth of green localist institutions in agriculture, retail, and energy suggests that the use of nonprofit status and the mobilization of civil society organizations for direct involvement in production and consumption has allowed the growth of economic activities that potentially can better approximate a full instatiation of sustainability, in contrast with the tendency toward incremental reforms in the corporate

sector. Due to shifts in consumer preferences (in part via public education work of social movement organizations) and organizational innovations, green localism flourishes in organizational forms that allow some insulation from market forces. As the discussion of green localism here suggests, networks of households, civil society organizations, small businesses, and public sector organizations that are engaged in green localist production are growing. Furthermore, some of the networks have some of the characteristics of the triple-helixes of the technopole. For example, local government programs and nonprofit groups work to support the greening of buildings or the increasingly dense relations among local farms, restaurants, gardens, and consumers. Those networks also are capable of operating at a translocal level, due to linkages of green localist products to remote consumers through product labeling campaigns such as fair trade (Hess and Winner 2003). Through fair trade labeling and practices, consumers can buy in effect nonlocal localism; that is, the benefits of global trade can be aligned more closely with concerns of environmental and social sustainability.

Understanding the emergence of green localism requires understanding producer and consumer behavior that appears nonrational in a traditional economic sense, yet which cannot be reduced to the volunteerism of civil society organizations because production and consumption take place through markets. There is a hybrid form of organization in which the profitability concerns of the private sector are mixed with the greater public good concerns of civil society organizations. New forms of producer organizations emerge out of this interface, such as nonprofit and subscription-based farming. On the consumer side, participation in the green localist economy is a mixture of classical utility maximation and social movement politics (Gabriel and Lang 1995).

People may be willing to pay more for organic, local agricultural produce not just because it is healthier or tastes better, but because the purchase is also a political act, a "buy-cott" in favor of a type of society that moves off the treadmill. Belonging to a community-supported agriculture farm or community garden, developing a solar-powered home heating system or engaging in home energy conservation, or selling and buying on the circuit of neighborhood or church rummage sales are both economic and political acts that represent attempts to step off the treadmill of consumption. Both ecological modernization theory and treadmill of production theory have largely focused on production, with some exceptions (e.g., Spaargaren and van Vliet 2000), but the emergence of green localism also requires a theory of consumption as both economic and political action.

In summary, attention to the problems and prospects of green localism posit a challenge for environmental sociology that may require syntheses and extensions of existing frameworks. Ecological modernization theory and treadmill of production theory focus largely on the potential or lack of potential for environmentally oriented production changes in the large, corporate private sector. There is evidence that corporations are innovating technologically in ways that could have significant positive environmental impacts, but there is also evidence that they are caught on a treadmill of production that leads to the potential for ongoing environmental destruction. Yet, a greening of capitalism or its enforced taming through greater regulation only provide partial solutions. Although the green technopole will probably never be displaced by green localism, there is room for more careful consideration of green localism as a complementary strategy for job creation and economic development, particularly at a

regional level, where not every city is capable of becoming a "global city" (Sassen 2000). In a world long on problems and short on solutions, analysis of the problems and possibilities of green localism warrants attention.

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