

AMAZING SHRINKING MACHINES

The Movement Toward Diminishing Economies of Scale by Michael H. Shuman

The mantra of virtually every local politician in the United States these days, taught by economic-development and city-planning gurus, is to go global. Proclaims Mayor Kurt Schmoke of Baltimore: "I strongly believe that if cities are to be competitive in the twenty-first century, they need to be international. (Soslow) By this, he means not only their finding global sales opportunities for local firms but also their "creating an environment that will enable international companies to use Baltimore as a gateway to the United States. Whether liberal or conservative, Democrat or Republican, municipal officials are following this advice and offering huge financial packages worth \$25,000 to \$350,000 per job (and in some eye-popping cases, much more) to lure the Toyotas of the world into building a new factory in their community, or worse, bribing hometown companies not to leave.

Former British Prime Minister Margaret Thatcher coined the word TINA to sum up the new reality - there is no alternative to the global economy. But a small but growing number of communities are concluding that the TINA path to economic development is neither desirable nor inevitable. Promises about global corporations bringing new jobs to the community and providing lucrative new opportunities for suppliers and spinoffs turn out to be highly inflated. And once the subsidies expire, the beneficiary firms begin to shop around the planet for new gullible jurisdictions willing to foot the bill.

Plus there are other hidden costs of TINA. To pay the nearly \$200,000 per job needed to lure Mercedes-Benz, "winners like Alabama have had to raid public education coffers. (Myerson) Grassroots groups in the state, desperate to protect a meager education budget that already ranks last in the nation in spending per student, blocked this looting in the courts. How did state officials respond? By borrowing from public pension funds.

The biggest cost of TINA is that every community playing this global game finds itself weakening old laws or opposing new laws that would raise labor or environmental standards, all in the name of creating a better "business climate. Economic prosperity seems to require social neglect.

Fortunately, localities are discovering an alternative to TINA named LOIS. Locally owned, import-substituting development aims to move the community toward greater prosperity through greater self-reliance. And what is making this strategy surprisingly viable is the emergence of new kinds of competitive, community-scale businesses. Despite all the rhetoric about globalization, specialization, and growing scales of production, a quiet revolution is occurring worldwide: Economies of scale for more and more businesses are shrinking. This revolution, if it continues, promises to reshape the way politicians and planners pursue community development worldwide.

David Ricardo's Frankenstein

The main economic theory propelling communities to go global is free trade. When the architect of this theory, David Ricardo, first made the case for tearing down tariff walls in 1817, he used the example of Britain and Portugal. British factories might specialize in making cloth, Portuguese factories in making wine. If each does what it can do best and pursues its comparative advantage, both will find that by trading they each can enjoy a cheaper combination of wine and cloth.

Ricardo had enormous intellectual integrity and conceded that for his theory to work, factories must stay within their own countries. If they're able to move freely to seize advantage of lower wages, the result would be absolute advantage, in which Britain's factories would move to Portugal for lower wages and British laborers would become guest workers in Lisbon. The only way remaining British factories could then respond would be to cut their wages to Portuguese levels, which would bring down British living standards. In all, not a very desirable outcome ?and one that resembles today's world much more closely than the comparative-

AMAZING SHRINKING MACHINES

The Movement Toward Diminishing Economies of Scale by Michael H. Shuman
advantage world Ricardo had in mind.

A bigger problem with the free-trade theory is that it was never intended to be the only theory in economics. Another theory, equally important but seemingly forgotten by many city officials, is that of the economic multiplier. The expenditure of a dollar in a community generates more than just one dollar's worth of activity. A mechanic who receives a paycheck of, say, \$500, might spend half on food and half on rent. The store that sold the food might use its \$250 in revenue to buy more produce from local farmers, and the landlord might spend her \$250 on electricity bills from the local utility. Every expenditure cascades into a larger series of transactions which, if they remain local, can enrich the entire community.

A poor community can be defined as one which has few assets and a weak economic multiplier. Any place where money leaks out and never returns slowly bleeds to death. For example, three out of four dollars the federal government spends in Indian reservations leave within 48 hours. (Douthwaite) In the poorest regions in rural Britain and Ireland, roughly one in four dollars deposited in banks gets reinvested locally, and in some areas the ratio is as bad as one in six. (Ibid.)

One way a community can keep its economic multiplier strong is to convince residents to hire local, buy local, save local, and invest local. If your grocer buys apples from a local farmer, the purchase benefits both the store's employees and the farmer, who in turn spend their money in the community economy. If apples are bought by mail order from Japan, this economic stimulus is enjoyed thousands of miles away.

Moreover, there are important tax benefits of buying local. Every local purchase returns a percentage to the public sector through local property, sales, and income taxes paid by the store, the farmer, and their employees. A mail-order transaction means that the property and income taxes are assessed elsewhere, and the sales taxes are ducked altogether. Going local, therefore, translates into stronger public services like schools, parks, and roads. And these public expenditures, in turn, further pump up the local multiplier.

There Is An Alternative: Self-Reliance

Contemporary economic thinkers like Jane Jacobs, Herman Daly, and Thomas Michael Power believe that cities should pursue development that systematically aims to replace imports rather than to stimulate exports. An export-led strategy usually creates one or two anchor "globally competitive industries in a region. These, unfortunately, open the community to the inevitable ups and downs in the global economy. Third World nations encouraged by the World Bank to grow cash crops like coffee or cocoa for export have learned about this vulnerability the hard way. (Rwanda, for example, was plunged into its civil war, in part, by plummeting coffee prices.) So have cities like Detroit and Pittsburgh, which once bet their livelihood on global automotive and steel markets.

Import-replacing development, in which a city produces more and more of the goods and services it needs, leaves it less vulnerable to mistakes, misdeeds, and misfortunes totally outside its control. As author Kirkpatrick Sale writes, "[A] self-sufficient town cannot be the victim of corporate-directed plant closings, or a truckers' strike, or an Arab oil boycott or California droughts. . . . Making community economies more self-reliant is the only reliable way to insulate them from the tidal waves of global capital flights and consumer frenzies.

Another advantage of import-replacing development is that it maximizes all kinds of challenges for the community, whether intellectual, technological, or social. Observes Sale, "[Self-reliance] makes a place expand instead of contract, create instead of borrow, use instead of discard: just as a man left on his own, thrust on his own devices, develops strengths and uncovers inner resources and becomes the fuller for it, so too a community.

A flaw of neoclassical economics is that it promotes the pursuit of specialization uncritically. The narrower the range of tasks an individual performs, the better he or she becomes at it. But

AMAZING SHRINKING MACHINES

The Movement Toward Diminishing Economies of Scale by Michael H. Shuman

as any person who has sweated on an assembly line knows, a job reduced to the turning of a screw does little to satisfy the soul or self-esteem. Real people are not satisfied with the role of Chaplinesque automatons that economists have assigned to them - they look for more from a job than just a paycheck. They seek a challenge, pride, and respect. Indeed, if given the choice, many people (especially young people) will gladly choose a more exciting job with lower pay.

The same emotions are at play in a community. Why should a multinational make choices about specialization that dictate everyone's careers? To invoke Ricardo's hypothetical scene, must the Portuguese become vintners and the English textile workers? Most of us believe that one indication of the health of a community is the breadth of jobs available. We can still recall that our parents or grandparents experienced some version of a community in which neighbors included their doctor, baker, butcher, banker, stationer, accountant, and lawyer. Like a well-balanced ecosystem, this kind of diversified economy was not easily vulnerable to outside events.

A final advantage of self-reliance over global dependence is that it forces us to be better custodians of our own environment. A community that embraces the principles of self-reliance will take care not to dump its air and water pollutants on neighboring communities, either directly or through distant manufacturers. Self-reliance is an invaluable tool for ecological protection and restoration. As Native American tribes demonstrated for thousands of years, a community that relies exclusively on its own forests, rivers, and farms - and doesn't see the use of outside resources as either necessary or desirable - will take special care to safeguard these natural resources for future generations. A community that refuses on principle to export pollution and waste will take greater care to minimize or eliminate them.

Toward A New Glocalism

Can the theories of the economic multiplier and self-reliance be reconciled with those of free trade? Potentially yes. One key is to create a global system of trade rules that are community-friendly, the details of which I've elaborated elsewhere. (Shuman, 1995) Another is to be mindful of economies of scale. There are many complex products that communities cannot manufacture on their own, such as computers or jet engines, and these are the primary items a community should seek to trade.

But for any item that can be produced just as well locally, global dependence should be seen as a sign of failure. Just as the basis for a good marriage is for the partners to relate to one another from positions of mutual strength and independence, the basis of a good trading relationship should be for each partner to be relatively self-reliant. And an import-replacing local economy is one that is prepared to take advantage of the global economy without losing its shirt or its soul.

One crucial clarification: A community practicing import replacement would not isolate itself from the world. Suppose, for example, that a city like Bismarck, North Dakota, were to ascertain that it was 90 percent dependent on imports of electricity from Canada. To become more self-reliant, it might build wind-electricity generators. Then, realizing that it was dependent on machinery and spare parts manufactured elsewhere, it might build its own windmill factory. Later, it might seek to redesign the windmills so that they were made out of metals mined in North Dakota. This process of replacing imports, only to create new import dependencies, never ends. But unlike export-led development, this path of development creates an increasingly diversified base of businesses, skills, and experience, which in turn minimizes Bismarck's vulnerability to events outside its control, maximizes its economic multiplier, and strengthens its tax base.

The only real objection economists and regional planners raise to an import-replacing theory of development is this: In the new global economy, the number of goods and services that any community can produce cost-effectively on its own is diminishing. As corporations go global,

AMAZING SHRINKING MACHINES

The Movement Toward Diminishing Economies of Scale by Michael H. Shuman
they can deliver cheap goods by spreading their fixed costs for management, machinery, warehouses, marketing, and lawyers over more and more units of production. This explains why in sector after sector - banking, insurance, telecommunications, agriculture, manufacturing - mergers are proliferating. The real challenge for a city, as former Secretary of Labor Robert Reich argues, is to attract one of these diminishing number of corporate giants. (Reich) It's like musical chairs: If you don't grab your global seat now, you'll soon be out of the game.

This is a compelling argument. But underlying it is an assumption that economies of scale are rising. In fact, there's lots of evidence that in many industries just the opposite is occurring: Community-supported agriculture (CSA) arrangements between farmers and nearby consumers deliver cheaper food by eliminating the wasteful marketing, advertising, packaging, and middlemen, that account for two thirds of the price of food.

Local recycling operations are providing cheaper metal, glass, and paper than the global producers who extract and process virgin resources.

Community credit unions typically have lower overheads and lower charges than the megamerged "bankosaurs like Bank of America.

Over the next generation, most Americans will get the cheapest electricity, not from centralized coal- and nuclear-dependent utilities, but from local windmills and rooftop photovoltaic cells.

Why Economies of Scale Are Shrinking

Economists and planners might counter that these examples are just inexplicable exceptions to the general trends of globalization. In fact, however, there are at least ten contrary trends that help explain why many economies of scale are shrinking and why LOIS is becoming a more viable strategy for communities.

(1) Inefficiencies of Global Production and Distribution

One diseconomy of global-scale industry is that complex distribution networks often carry new costs. Consider food. In 1910, for every dollar Americans spent for food, 41 cents went to farmers and 59 cents to marketers and providers of inputs like seeds, energy, and fertilizer. Today, 9 cents go to farmers, 24 cents to input providers, and 67 cents to marketers. (Smith) Those 67 cents are largely unrelated to the end product consumers really want. It's wasted on packaging, refrigeration, spoilage, advertising, trucking, supermarket fees, and middlemen. If farmers were linked more directly with nearby consumers, these inefficiencies could be wrung out. Either food prices would come down or farmers' incomes would go up - or both.

This helps explain the recent spread of community-supported agriculture (CSA), pioneered initially in Japan and then Switzerland, where a farmer is supported by 60-70 families who each pay about \$400 for an annual subscription fee. (Imhoff) Each member family agrees to pay a set fee for the growing season, and in exchange the farmer promises to deliver a box of vegetables each week, enough to feed a family. The contents of the box vary throughout the season. One week it might be mostly asparagus and melon, another it might be potatoes and pumpkins. Some CSAs add farm products like eggs, milk, honey, herbs, flowers, or firewood. Most give consumers some opportunity to pick from a list of what's available each week. Subscribers can pick up their box of produce at a nearby distribution point or have it delivered to their doorstep. More than 600 such community-supported agricultural or horticultural operations now operate in 42 states, with 100,000 members, which means that most people living in major U.S. cities can find nearby CSAs to join.

The new economics of food production also explains the growth of urban farming. (Smit et al.) Over the last 20 years New York City has opened a thousand community gardens on public land and 18 public markets to sell produce grown in them (though Mayor Rudolph Guiliani has tried to sell off the lots). Boston has even more gardens per capita. The Pennsylvania Horticultural Society's Philadelphia Green Project estimates that the 2,000 gardens in the city produce nearly \$2 million of food for 12,000 people. The U.S. city with most community gardens per capita is

AMAZING SHRINKING MACHINES

The Movement Toward Diminishing Economies of Scale by Michael H. Shuman
Newark, New Jersey. In all, according the National Gardening Association, about three out of ten urban families in the United States raise some of their own food, and the U.S. Department of Agriculture estimates that each gardening family saves \$400 a year in food costs.

To generalize for a moment: Whenever the cost of production is low relative to distribution, linking local producers directly with nearby consumers can lead to economies of smaller scale. Even when the cost of local production is much higher in such cases, new economies of scale are possible.

(2) Niche Marketing

Another inherent problem with bigness is acquiring and employing high-quality information. The conservative economist Friedrich Hayek's most convincing argument against state socialism was that knowledge is too complex, too subjective, too dependent on particular circumstances of time and place for even the best-intentioned, national-scale bureaucracy to succeed. Big Brother's efforts to average, to generalize, to abstract data necessarily filters out key bits of information that make national policymaking inherently insensitive to local needs. The same problem afflicts global-scale corporations.

In principle, a globalized producer can wield its resources to produce different products for different local tastes. But in practice a local producer is better situated to intuit, design, manufacture flexibly, and deliver just-on-time the most appropriate products. (Dawar & Frost) Consumers can better communicate their needs to local producers. General Foods will probably never be able to convince New Yorkers to replace their locally-baked bagels with Minnesota-made generics. Microbrewers have flourished throughout the United States and the United Kingdom because they cater to highly specialized consumer tastes. The nuancing of the eating habits of the San Francisco Bay Area's consumers, with its inclusion of more varieties of locally-grown fruits and vegetables, has expanded the region's agricultural economy by 61 percent over the past decade. That translates into \$915 million of additional agricultural activity in the local economy each year. (King)

Further evidence of the superiority of local information can be found in banking, where personal knowledge about a borrower - about his or her trustworthiness, family, personal ties, previous business efforts, and so forth - necessarily leads to better results than a computerized glance at income and credit rating. Researchers at the Federal Reserve in Minneapolis have concluded that "the available data show . . . [that] after banks reach a fairly modest size [of about \$100 million in assets], there is no cost advantage to further expansion. Some evidence even suggests diseconomies of scale for very large banks.(Boyd & Graham) More recently, the Financial Markets Project has found that, compared to banks with far-flung portfolios, those lending only to geographically-restricted borrowers were typically twice as profitable and wound up with fewer bad loans. (Morris) One key reason is that community banks actually know their lendees.

As consumers demand more specially-tailored goods, manufacturers have responded with new, decentralized modes of production. The high costs of inventories and bottlenecks led Toyota to build small plants with shorter production cycles, situated closer to specific markets, each capable of just-in-time delivery of automobiles. The General Accounting Office estimates that the number of flexible manufacturing systems worldwide has grown by 20 to 30 percent since 1975. (GAO) Some 40 percent of U.S. raw steel production - and its most profitable sector - is made up of "minimills that reprocess scrap steel with electric arc furnaces, each located close to its market.

A related concept gaining broad acceptance is flexible manufacturing or economy of scope. Paul Kidd, author of Agile Manufacturing, writes, "We are moving towards an environment in which competitive products need customers, specific tailoring and high quality. At the same time new trends are shortening the product's life cycle, making the number of repeat orders smaller

AMAZING SHRINKING MACHINES

The Movement Toward Diminishing Economies of Scale by Michael H. Shuman and reducing batch sizes, while adding variety. . . . While economies of scale is based on mass manufacturing and the idea that it is always more profitable to produce a large quantity of goods in large batches, economies of scope relies on the principles that machines should be used to make a wide range and product lines with small batch sizes. Economies of scope is the ability to convert fixed capital from one purpose to another. (Kidd)

All these examples underscore that personal relationships between producers and consumers matter. In the early stages of industrialization, Stalinist-style plants cranking out vast quantities of homogenous products like steel or machine tools might have made sense. Today, consumers everywhere are demanding more exacting products that local producers are best situated to comprehend and supply.

(3) Personalized Services

A third piece of good news for communities is the transformation of the U.S. economy from the manufacture of goods to supply of services. The main reason for this shift, according to Massachusetts Institute of Technology's Paul Krugman and Harvard's Robert Lawrence, is that technological advances have brought down the prices of many manufactured goods. As Americans spend less to acquire the same refrigerators and toasters, they are free to spend more on nannies and amusement parks. These changes, Krugman argues in *Pop Internationalism*, are moving the U.S. economy inexorably toward what he calls localization: "A steadily rising share of the work force produces services that are sold only within that same metropolitan area. With most services - whether health care, teaching, legal representation, accounting, or massage - consumers demand a close, personal, trusting relationship. "And that's why most people in Los Angeles produce services for local consumption, writes Krugman, "and therefore do pretty much the same things as most people in metropolitan New York - or for that matter in London, Paris and modern Chicago.

Even where parts of a service can be mechanized or delivered from afar via the Internet, customers will demand, as John Naisbett once put it in *Megatrends*, "high tech/high touch. Yes, some terrific courses are available on the World Wide Web, but good teaching still requires - as it has for millennia - that real humans work side-by-side with the students to facilitate learning through empathy and support.

The limits to automating services are now becoming apparent in banking. The following item recently appeared in the journal of the American Banking Association (Asher):

Ron Reinhartz, president and CEO of the Bank of Santa Clara, an eight-branch bank south of the San Francisco Bay Area, . . . says his big-bank competitors are in his market all the time, sending in sharp, well-spoken types who visit his small-business customers, pull out laptops, crunch some numbers, then offer the customers unsecured lines of credit for very decent amounts of money. Many are dazzled and delighted to go with the big bank. But six months or a year later, many of those customers are back with his bank. How come? Because the customers often have a hard time finding someone at the big bank to answer a question or fix a problem quickly.

"That's our salvation, Reinhartz says. Of his 22,000 customers, he estimates that some 18,000 are known to his staff by their first names.

. . . When banks merge, . . . this often "unhinges the small-business customer, who fears the loss of the personal attention he or she enjoyed. What frequently happens is that the small-business owner marches out and goes with another local bank, where the chances for personal attention are much better.

(4) Brains, Not Brawn

The shift from goods to services in our economy will benefit community economies in a fourth way as well. Scholars at Princeton's Center for Energy and Environmental Studies have documented that Americans and Western Europeans consume fewer raw materials as GNP

AMAZING SHRINKING MACHINES

The Movement Toward Diminishing Economies of Scale by Michael H. Shuman rises. (Larson) U.S. steel use per dollar of GNP, for example, has dropped to the same level it was once at in 1880. Similar declines can be observed in our consumption of most basic materials including cement, ammonia, chlorine, and aluminum. One reason for this is that advances in technology have liberated products from bulky materials. Today's cars are made with composite materials that are stronger, lighter, and cheaper than steel. These trends are becoming apparent even in low-GNP countries, which can use newer technology to circumvent materials-intensive designs altogether. The uncoupling of production from bulk materials diminishes the advantage certain communities once had in being situated near natural resources. Location doesn't matter nearly as much as it used to, provided you have access to state-of-the-art information technology.

If services, knowledge, and technology are replacing materials, it follows that the most competitive communities will be those that are smartest, not largest. A small community is not limited in the amount of skill it can develop, the knowledge it can retain, or the technology it can acquire. Nor does size determine the quality of local research or public education, as many small college towns demonstrate. Among the nation's smartest and most economically successful communities in America are Redmond, Washington (home to Microsoft); Santa Clara County, California (home to Intel, Apple, and hundreds of other high-tech firms); and the Research Triangle area in North Carolina (home to major pharmaceutical conglomerates.)

What's true for the macroeconomy of a community is also true at the micro level. Small companies can now fit what used to be gigantic departments overseeing accounting, management, taxes, communications, and publications neatly onto the top of their desk in a workstation. The Internet has given home-based businesses the ability to compete against established, large-scale players in sales of practically everything, including books and CDs, stocks and bonds, airline travel, and hotel rooms. To give just one example, new kinds of software and computer models have substantially brought down the administrative costs of community banks making modest loans to small businesses. (Asher)

It is worth noting that e-commerce, while a boon for small companies, is a mixed blessing for communities. Many virtual companies emphasize global markets ahead of local ones. Moreover, most not only don't replace imports but also increase the community's dependence on outside software and hardware. And for the next few years at least, e-companies will remain deadbeats with respect to the public sector, since Congress has given them permission to tiptoe around local taxation. Still, the Web and electronic communication also can be used to facilitate almost every decentralizing trend discussed in this article, including direct consumer-producer relationships, niche marketing, local service provision, local research and development, and emerging consumer and government preferences to buy locally and invest locally.

The communications revolution also makes it easier for small firms in different communities to converse and work together, whenever economies of scale of production are larger than any one firm could realize alone. In northern Italy, small locally owned firms involved in flexible manufacturing networks have been world-class exporters of high-tech products like robotic arms. Of the 90,000 manufacturing companies in the Emilia-Romagna region, 97 percent employ fewer than 50 employees. (Meeker-Lowry) A network typically forms to create a specific project for a well-defined "niche market. Participating firms pool their resources and share the risk. Once the project is complete, the network disbands. Following successful models in Europe, more than fifty smart, flexible manufacturing networks have been set up in the United States. (ACE-Net)

(5) Greater Investment in Small-Scale Technology

While technological progress does not inherently favor any particular scale, it's fair to say that investments in large-scale enterprise tends to yield advances most usable in other large-scale ventures. In part, this owes to the mindsets of the participants. If the managers, investors,

AMAZING SHRINKING MACHINES

The Movement Toward Diminishing Economies of Scale by Michael H. Shuman and employees are accustomed to thinking about global markets, it's awkward for a member of the staff to think small. There's also the issue of path dependency. Innovations in one technology necessarily beget innovations that follow in its footsteps. Once the market establishes that Microsoft's operating system is the standard for computers worldwide, other software manufacturers write programs that operate with it, all with a global market of users in mind.

Over the past generation, the U.S. government has spent two-thirds of its R&D budget on military projects and weapons systems. (Shuman & Sweig) Most of the rest has gone to megaprojects like the Clinch River Breeder Reactor, the Synthetic Fuels Corporation, the Hubble Telescope, the Space Shuttle, and the Genome Project. These large-scale projects begat large-scale commercial innovations. Thus, the spinoffs from defense spending over the past two generations have included rockets, aircraft engines, and supercomputers, which in turn have boosted the prospects for globally-minded firms like Motorola, Boeing, and Cray.

Had similar investments been made in appropriate, small-scale technology, similar degrees of innovation - more useful to community-scale business - might have occurred. Indeed, there's some evidence that small firms generate innovations faster than their dinosaur-scale competitors by experimenting more and taking greater risks. (Almeida & Kogut) Despite little government support, small firms have demonstrated themselves to be invaluable innovators in the software industry, pharmaceuticals, biomedical research, and even the steel industry (many credit minimills with reviving the U.S. industry).

The good news for community-scale business is that this kind of R&D now appears to be taking off. Particularly good examples can be found in the electricity industry. After throwing billions of dollars down the ratholes of nuclear power and synthetic fuel R&D, government and industry are finally beginning to invest in small-scale alternatives like windmills and photovoltaic cells, with remarkable results. Today, windmills are being built at a tenth or a hundredth the size of a nuclear or coal-fired power plant. In 1994 the average retail price of electricity in the United States was eight cents a kilowatt-hour - and rising - and some areas, like New York State, face prices as high as 15 cents. (Berger) Wind "farms" are now delivering highly competitive electricity for five to seven cents per kilowatt-hour, with facilities in the windiest areas pushing the cost below four cents a kilowatt-hour. (Ibid.) The cost of wind-generated electricity has fallen by 10 percent a year for the past 15 years, and as the technology matures and enters mass production, it should fall still further. (Romm & Curtis) Royal Dutch/Shell projects that annual sales of windmills by the year 2020 could reach \$50 billion. (Ibid.) Shell is even more bullish about the prospects for photovoltaic (PV) cells, which convert sunlight directly into electricity, predicting annual global sales growing to \$100 billion by 2030. (Ibid.) Currently, PVs are most cost-effective in specialized uses, such as electrifying homes (100,000 U.S. residences use PV power), pumping, signaling, and communicating in remote areas. To avoid spending an estimated \$40,000 to \$60,000 per mile to extend an overhead power line (or \$130,000 for an underground line), utilities already find the installation of PVs at the point of use cost-effective. (Berger) PVs also may be cheaper than upgrading or rebuilding old distribution systems.

But even in places where conventional electricity hook-ups are available, the economics of PVs are rapidly improving. The costs of PVs have steadily dropped from \$75 a peak watt in 1975 to about \$4 wholesale today. (Brown et al.) The Sacramento Municipal Utilities District (SMUD) is pioneering the use of photovoltaics on residential rooftops at a cost of 17 cents per kilowatt-hour, which is less than the cost of peak power in 35 U.S. cities. (Berger) (The comparison with peak power is relevant because the output of PVs varies with the intensity of the sun and peaks at mid-day, which coincides nicely with the peak of demand in certain locations for electrical needs like air conditioning.) Solec International, the only U.S. manufacturer of PVs to make a profit as of 1994, projects that the commercialization of several

AMAZING SHRINKING MACHINES

The Movement Toward Diminishing Economies of Scale by Michael H. Shuman
recent breakthroughs will soon bring PV-electricity costs down to 12 cents a kilowatt-hour. (Ibid.)
In 1994, Enron Corporation entered a contract with the U.S. government to build a 100-megawatt solar-cell power plant using a thin-film PV technology, and agreed to sell electricity for 5.5 cents per kilowatt-hour. (Ibid.)

The economies of scale for applying renewable technologies are naturally small. Ultimately, the devices for tapping renewable resources - windmills, PVs, boilers for burning straw or algae - might be mass-produced economically by a small number of large producers. But the installation, operation, and maintenance of these devices is best done by local firms. Some renewable resources, like agricultural waste and algae, weigh too much to haul around cost effectively. Others, like windpower and PVs, are most economic if they are used locally rather than transmitted over long distances.

It's worth noting that emerging renewable-energy technologies will enable more and more regions to increase their level of self-reliance. Communities in open plains, on the sides of mountains, or along the coasts have wind resources that can be used for pumping or for making electricity. Southern communities are bathed in solar energy usable for heating, cooling, and electrical generation using both photovoltaics and solar-thermal-electric power technology. Western communities can tap geothermal resources. Landlocked communities can tap the power of rivers through small-scale hydroelectric dams. Rural communities have a surplus of agricultural, forestry, and animal wastes that can be converted into combustible fuels. Urban areas may have a high enough population density to construct a district heating system in which a central heating unit pumps hot water to nearby houses and factories.

(6) Energy Cost Escalation

One of the linchpins of large-scale production and distribution systems is low-cost transportation of goods and people, which since World War II has depended on cheap petroleum. That era is almost certainly coming to a close. Economically-recoverable reserves of oil are physically limited, and new discoveries are occurring far more slowly than increases in consumption. With expected increases in global population and per capita consumption, the U.S. Energy Information Administration projects that demand for oil worldwide will grow by 20 million barrels a day (total consumption today is about 60 million barrels a day). (Romm & Curtis)

Governments also will be increasingly inclined to place a "green tax on oil, as well as on other fossil fuels, to account for the environmental effects of burning them. There is a virtual consensus among scientists today - except for a few cranks supported by self-interested oil companies and the Reverend Sun Myung Moon - that the planet is warming. A recent report of the United Nations-sponsored Intergovernmental Panel on Climate Change, which represents 2,500 scientists from around the world, suggests that current trends of fossil fuel will release enough carbon dioxide into the atmosphere to raise global temperatures 1.5 to 6 degrees Fahrenheit over the next century. (Stevens) This will melt enough polar ice to raise ocean levels 10 to 32 inches and displace tens of millions of people living in coastal settlements from the Maldives to Bangladesh. Global warming also is predicted to unleash more violent hurricanes, diminish the productivity of many agricultural regions, accelerate the extinction of plants and animals, and spread tropical diseases like dengue fever and malaria. By the time the multi-trillion-dollar costs of global warming are clear enough to affect the market price of fossil fuels, it will be too late to prevent it. Political pressures will surely mount on governments to place higher taxes on oil, per unit of pollution (a carbon tax) or per unit of energy (a BTU tax), that will raise the price of oil and reduce annual releases of carbon into the atmosphere.

Whether caused by dwindling supplies or higher taxes, a rise in oil prices will raise the costs of transportation - and improve the economics of local production for local consumers. It also will improve the economics of renewable energy production.

AMAZING SHRINKING MACHINES

The Movement Toward Diminishing Economies of Scale by Michael H. Shuman

Rising energy costs will fuel an already burgeoning conservation business at the local level. Over the past decade, electric utilities have had to face a radical change in their business: Saving a unit of energy has become cheaper than producing a unit. We can go a long way with cost savings before the construction of a single new hydroelectric dam or coal-fired power plant is either necessary or justified. Installation of the best lighting technologies could save up to three-quarters of the lighting energy we now use, displacing dozens of large power plants. (Lovins & Sardinsky) Electric motors use over half of all electricity in the world. One analysis of 35 types of motor improvements found the potential to save about half of all the electricity used in motors, at a fraction of the cost of just operating a coal or nuclear plant. (Lovins et al.) If the United States were as energy efficient as, say, its Western European competitors, it could save about \$200 billion annually - an amount which exceeds recent federal deficits. (Geller et al.)

Nothing about the business of conservation inherently requires a large economy of scale operating through a protected monopoly. Only hands-on inspection, conducted house-by-house or business-by-business, can uncover which walls and ceilings need to be insulated, which appliances need to be replaced, which use patterns need to be altered. Some energy-efficiency devices such as compact-fluorescent light bulbs, super-efficient windows, or reflective materials for rooftops may be best manufactured in large, centralized plants. But the installation of these devices can be done best by a local workforce that is intimately familiar with the local terrain, architecture, and business culture.

Because of these changing economies of scale, a whole new industry of "energy-service companies or ESCOs has taken root. The National Association of Energy Service Companies estimates that by 1996 ESCOs had provided \$2 billion of energy-efficiency hardware, software, and services. (Lefevre) The typical ESCO is a small- or medium-sized company that oversees energy conservation projects for a period of seven to ten years. It enters into a contract with a business, school, or public agency, and promises to save a set amount of energy and energy expenditures. It conceptualizes, implements, and finances the project. And it receives payment based on achieving or surpassing the promised efficiency targets.

ESCOs are also getting into small-scale energy production. NORESKO, based in Framingham, Massachusetts, recently helped the University of Rhode Island save more than \$1 million by supplementing conventional conservation measures with the installation of three natural gas-fired engines that cogenerate electricity and steam for dorms. Whether ESCOs ultimately replace the electricity-generation capacity of utilities or just supplement them will depend on how utility deregulation proceeds at the national, state, and local level. Either choice will enable communities to harness their natural endowments for local electricity needs.

(7) Expanded Environmental Consciousness

The oil example above can be generalized into another factor that's shrinking economies of scale - growing ecological consciousness around the country. Four out of five Americans now consider themselves environmentalists. If consumers increasingly demand that environmental costs be internalized, a wide variety of local industries will benefit. There will be, for example, rising pressure to replace throw-aways with recyclables.

Every American, every week, consumes an average of 36 pounds of resources and creates (directly or indirectly) more than 2000 pounds of waste. (Hawken) Much of this waste lies in landfills, where contaminants leach into the soil and the groundwater. Some is incinerated, sending toxic substances like mercury and lead downwind or leaving them in ashes that are placed in leaky landfills. Over the past generation the United States has spent more than a trillion dollars to curb pollution and manage wastes, but the problem seems only to be worsening.

A growing number of U.S. communities have discovered that recycling not only is ecologically better than incineration or landfill but also saves money. Recycling creates more jobs per dollar

AMAZING SHRINKING MACHINES

The Movement Toward Diminishing Economies of Scale by Michael H. Shuman invested, and opens opportunities for setting up local scrap-based manufacturing enterprises. West Palm Beach, Florida, was able to save \$43 per ton of material by replacing expensive landfill practices with recycling - or \$700,000 per year. (Platt & Morris) New Jersey was able to use its recycling programs to provide materials to 5 glass manufacturing plants, 13 paper mills, and 8 steel mills, which together employ 9,000 people and generate over \$1 billion in sales each year. (Ibid.) Another materials problem is presented by the vast number of plastics, fertilizers, paints, inks, medicines, and synthetic fibers made from petrochemicals. How can these materials, which are responsible for generating most of our toxic wastes, be replaced? The answer is to look to the fields and the forests. (Morris & Ahmad, 1992) In 1935 Henry Ford joined 300 other scientists, industrialists, and agronomists in forming the Farm Chemurgic Council, which aimed to enable "a variety of surplus products of the soil to be transformed through organic chemistry into raw materials usable in industry. During World War II, Ford converted soy beans into plastic and envisioned manufacturing a new vegetable-car, with its wheels made out of goldenrod and its fuel derived from corn. Cheap oil after the war doomed the idea.

Now the dream of creating a "carbohydrate economy is emerging again, thanks largely to the work of the Institute for Local Self-Reliance. The analysts at ILSR point out that Americans consume 109 million tons of petrochemicals each year, compared to only 7 million tons of biochemicals. (Morris & Ahmad, 1993) But the potential supply of an organic feedstock is huge. U.S. farms generate 350 million tons of agricultural and forestry waste a year in the form of corn cobs, husks, straw, saw dust, pulp mill wastes, vegetable oils, cheese whey, and many other substances. Conversion of just half these wastes could replace virtually all petrochemicals.

Most products derived from oil are now cheaper than their plant-based substitutes. Inks made from renewable resources cost 25 percent more than their petroleum-based counterparts, detergents 60 percent more, dyes 75 percent, paints 120-140 percent, and plastics 400 percent. (Morris & Ahmad, 1992) But some industrial products, such as acetic acid, adhesives, fatty acids, surfactants, and carbon black, can be produced from organic materials at the same cost - or cheaper. Improvements in technology and increases in production levels have cut the costs of many biochemical products, like inks and dyes, by a quarter or more since 1985. And as the price of oil rises and governments impose green taxes on oil and oil-based products, the cost advantages of petrochemicals may disappear altogether.

Already, regional differences in input costs and an emerging market of environmentally minded consumers and businesses is enabling green products to displace petroleum-based competitors. Half of the 9,100 newspapers in the country print with soy ink, and 10 percent of detergents on the market are plant-based. (Morris & Ahmad, 1993) Minnesota Corn Processors runs a cooperatively owned biorefinery that is the largest corn-to-ethanol converter in the state. (Ibid.) Since 1990 processing plants have been built to convert sawdust to oil in Missouri, wood waste to chemicals in Wisconsin, whey to ethanol in California, and yard and paper waste to ethanol in Texas and Florida. (Ibid.)

The coming carbohydrate economy will open up vast commercial opportunities for community-based businesses. Because agricultural and forestry waste is harder to collect and heavier to ship than oil is, the most efficient location of processing plants will be close to the farms or forests providing the feedstock. David Morris of ILSR estimates that conversion of half the country's agricultural waste could provide the inputs for as many as 2000 new biorefineries, meaning at least one plant for every rural county in America. (Ibid.)

(8) Fewer Anti-Community Subsidies

More good news for community-scale business: Time is running out for corporate welfare. A remarkable left-right consensus is emerging that is gaining enough political clout to undo the vast fabric of subsidies that make large-scale production artificially cheap and small-scale

AMAZING SHRINKING MACHINES

The Movement Toward Diminishing Economies of Scale by Michael H. Shuman production artificially expensive. The Green Scissors Coalition, spearheaded by the National Taxpayers Union Foundation, a conservative anti-government group, and Friends of the Earth, a liberal environmental group, has identified \$33 billion of annual government subsidies to mining, logging, fishing, farming, arms, and energy-production industries that are simultaneously wasteful of taxpayer dollars and destructive of the environment. (Kenworthy) Nearly all the beneficiaries are large-scale, export-minded corporations.

The Cato Institute estimates that the government annually gives corporations \$51 billion in direct subsidies and another \$53 billion through various tax breaks. Most of these subsidies undermine local self-reliance. Farm price supports and water subsidies give national agribusiness an edge over community-supported agriculture. Depletion allowances and insurance liability limits that benefit the oil, gas, coal, and nuclear industries slow down the transition to community exploitation of renewable energy sources. Below-market sales or leases of publicly-owned land, forests, and minerals encourage overexploitation for export rather than sustainable use for local consumption. In short, a comprehensive end to corporate welfare would be a tremendous boon for community economies.

Perhaps no subsidies are more damaging to local self-reliance than those for transportation. Without them, local production for local markets would become the cost-effective choice for communities. But shipping of goods over long distances today is affordable thanks to cheap oil and cheap transport. A recent study found that the federal, state, and local governments spend more than \$3 billion a year to build, maintain, operate, and oversee highways in New Jersey. (Komanoff & Sikowitz) Various agencies bring in offsetting revenues through tolls, gas taxes, licensing fees, and traffic fines, but the net subsidy is still \$700 million per year. Extrapolated to the United States as whole, the national highway subsidy totals about \$25 billion annually. This does not take into account the "external environmental costs of accidents, congestion, air pollution, traffic noise, and vibration damage. A study of New Jersey's transportation system estimated these in the range of \$23.5 billion a year. The World Resources Institute, employing a somewhat different methodology, estimates that the annual federal subsidy to cars and trucks is \$300 billion a year, more than 30 times federal aid to cities. (MacKenzie et al.) Strip away subsidies to oil, roads, and transport vehicles, impose green taxes on these activities to cover the environmental costs, and suddenly long-distance trade is no longer such a great bargain. Once Americans start paying the full costs of hauling people and goods halfway around the world, consumers will find the prices charged by local producers more attractive.

Would any politician dare tinker with these subsidies? Recent history gives reason for pessimism. When President Clinton proposed a modest tax on gasoline in his first budget package in 1993, interest groups went ballistic and Congress killed the measures almost immediately. Yet the emergence of strong voices on the left and the right who oppose corporate welfare gives hope. And there's also a precedent that shows Congress how it can proceed without risking retaliation from PACs. It could set up a panel of experts analogous to the Base Realignment and Closure Commission. Congress recognized that the end of the Cold War necessitated closure of many redundant military bases but that politics as usual would make it impossible to close them one at a time. Congressional leaders appointed a bipartisan panel of experts to come up with a list of sensible targets for shutdown. The rules governing the commission's recommendation specified that Congress could vote only once, thumbs up or down on the entire package, with no possibility of amendment. Politicians could tell their constituents that even though the local base was on the list, the policy was fair because everyone across the country was being asked to make sacrifices. A similar commission should be set up concerning corporate welfare. Put every pork-fed industry on the list - oil, gas, coal, nuclear, tobacco, agriculture, livestock, timber, sugar, helium, chemicals, automobiles, utilities, defense - and let's put the whole thing to a vote.

AMAZING SHRINKING MACHINES

The Movement Toward Diminishing Economies of Scale by Michael H. Shuman

Of course, what will ultimately kill these subsidies is not just a concerted left-right assault on corporate welfare but also growing left-right consensus on devolution. Conservatives embrace states, rights and a new federalism, while progressives promote communitarianism and Green politics. There is a growing recognition that communities would be better off if they had more power to manage their own affairs. As the federal government removes its subsidies for globally-minded corporations, communities may wisely refocus theirs on locally-minded ones.

(9) Consumer and Investor Preferences for Going Local

There's some intriguing evidence that at least some consumers are willing to pay some premium for locally-produced goods, some of the time. Most people would gladly spend a nickel more for a fresh loaf of bread from the local baker instead of its cheaper equivalent at Safeway. The movement toward community-supported agriculture, farmers, markets, and urban farms reflects this preference for locally grown fruits and vegetables. One indication of the size of this growth is that organic food production has been expanding for the past decade a whopping 20 percent per year. (Julian) Another sign: More than 40 communities in the United States - and some 2,000 worldwide - now issue their own local money to promote local buying and selling.

Consumers who discover that the electricity they're using is being transmitted from coal plants hundreds of miles away may be willing to spend another penny or two per kilowatt-hour for local generation alternatives. The Sacramento Municipal Utilities District (SMUD) launched a "green pricing program in 1994 in which residential users were invited to pay a surcharge of \$6 per month to have a 4-kilowatt photovoltaic array attached to their roof and plugged into the community grid. More than 2,000 customers thus far have volunteered. (Berger) Retail sellers of "green power, which also tends to be locally produced, are now emerging across the country to take advantage of this consumer preference. Nearly 7,000 customers have switched to green power in Wisconsin, 11,000 in Colorado, and 100,000 in Pennsylvania. (McLaughlin)

The same consumers who favor locally produced goods and community banks will increasingly search for local re-investment opportunities for their pension funds. Already, socially responsible investment (SRI) funds are moving from negative to positive screens along with the understanding that many of their clients also wish to invest in their own communities. Recent interest here in Canada's four labor-sponsored investment funds (which reinvest in labor-, eco-, and community-friendly businesses) is one indication of this emerging industry. (Kreiner) The presence of such funds, of course, will expand the quality and quantity of local businesses looking for equity capital.

These preferences for going local are percolating through state, county, and local governments. Look at their employee pension funds. A survey of 119 public funds by the Institute for Fiduciary Education in 1993 found that 50 made "economically targeted investments, primarily to develop local business, jobs and low-income housing. (Zanglein) The "Invest in Pennsylvania program, launched by the state in July 1991, redirected \$100 million of retirement funds into certificates of deposit in community-friendly banks throughout the state. The state's Public School Employee's Retirement System created Pennsylvania Venture Capital, to support riskier in-state businesses. Tennessee claims that a decade's worth of venture investments by its pension funds created 26 companies and 16,000 jobs.

Many economists claim these preferences are irrational. Why would an informed consumer spend more for any good of comparable quality? But here's where economists have a thing or two to learn from consumers. Many citizens are beginning to recognize, quite rationally, that the local quality of life depends on the health of the local economic multiplier and that they should adjust their buying preferences accordingly.

(10) Large Companies Have Lower Employee Morale

A final diseconomy of global-scale firms is that many are simply unpleasant places to work. Less power over decisions made in a central office thousands of miles away lowers morale and

AMAZING SHRINKING MACHINES

The Movement Toward Diminishing Economies of Scale by Michael H. Shuman
productivity, especially when large firms compete through wage cuts, outsourcing, and plant relocation. Jim Kelly, chair and CEO of United Parcel Service, recently noted that the average corporation now replaces its entire workforce every four years. ("Employment Briefs) A survey by Right Associates Benchmarking Research found that nearly two-thirds of firms that downsized also suffered decreased employee productivity. (Edey)

Smaller firms that value personal ties between management and the workforce and that don't think seriously about moving facilities overseas are better equipped to keep worker morale and productivity high. Studies suggest, for example, that the best way to communicate a major change in a corporation is through small, face-to-face meetings. Large companies, either by necessity or habit, tend to convey news through auditorium-sized meetings, videotapes, or newsletters. Smaller firms avoid this kind of clumsiness and improve the bottom line by reducing costs of recruitment, stress management, health care, worker lawsuits, and absenteeism.

Given the unpleasantness of the global assembly line, it's hardly surprising that more and more Americans are turning to home-based work. More than 20 million are now working at least partly at home, and the number of salaried workers using home as a base has more than doubled since 1991. (U.S. Bureau of Labor Statistics)

Similar growth can be seen in other community-based types of firms. Between 1990 and 1996, the number of sole proprietorships grew at over 3 percent per year. (SBA) There are also hundreds of thousands of nonprofits (constituting 6.5 percent of the U.S. economy), 47,000 cooperatives, 6,300 municipally owned enterprises, and 2,500 firms with employee stock-ownership plans in which workers hold a majority of the shares. (Shuman, October 1998)

Conclusion

Do these trends mean that sooner or later every good and service can be cost-effectively made and delivered within a community? Not necessarily. The economics of every industry will depend on how these new diseconomies of large scale balance with the old economies of spreading fixed costs. But the bottom line for communities is encouraging. The trends suggest that more opportunities for LOIS firms are fast becoming available, provided localities are wise enough to mobilize their assets to seize them.

So why, then, the dizzying proliferation of mergers and acquisitions? The answer is not necessarily greater efficiency. The downsizing that often accompanies mergers, according to Yale economist Kevin Foster, tends to reduce profitability in 65 and 75 percent of the firms making mass layoffs for at least three years. For example, CSX's stock fell 20 percent after its merger with Conrail. (Scribner) Consumers, of course, often lose out as well. A recent analysis of the post-merger performance of SBC/PACIFIC Telesis and Bell Atlantic/NYNEX concluded that "despite various attempts by the state PUCs and federal regulators to protect public interest during the review process, consumers to date have received little tangible benefit. . . . (Lundquist et al.)

Perhaps the best explanation of merger-mania is an odd coincidence of interests between the acquiring and acquired firms. As we've seen in recent years, the acquiring company is willing to pay shareholders of the acquired company a nice premium to gain control of the company. Meanwhile, the CEO of the acquiring company usually gets a handsome raise and bonus for the maneuver. As the Federal Reserve of Minneapolis observed about banking consolidation: "The data suggest that, regardless of bank profitability, the bigger the bank, the bigger the compensation package its top managers receive. (Boyd & Graham)

If economies of scale continue to diminish, the entire field of economic development may need to be rethought. Casual pronouncements about the vital importance of regional economies are dubious if even inner-city neighborhoods and rural counties are capable of becoming their own self-reliant economic engines. The current national dialogue on sprawl, which suggests that cities will only find prosperity through partnership with the suburbs, also becomes suspect. The

AMAZING SHRINKING MACHINES

The Movement Toward Diminishing Economies of Scale by Michael H. Shuman
key to a community's prosperity may no longer be global competitiveness, regional industrial clusters, or anti-sprawl regional compacts, but rather the careful creating, financing, and nurturing of a new generation of small-scale corporations adhering to the principles of LOIS.

As the poet Wendell Berry once predicted, "The real work of planet-saving will be small, humble, and humbling, and (insofar as it involves love) pleasing and rewarding. Its jobs will be too many to count, too many to report, too many to be publicly noticed or rewarded, too small to make anyone rich or famous.

Michael Shuman is co-director of the Institute for Economics and Entrepreneurship for the Village Foundation in Alexandria Virginia. He is the author of five books related to community and international affairs, including *Going Local: Creating Self-Reliant Communities in a Global Age*. His numerous articles have appeared in periodicals such as *The New York Times*, *The Washington Post*, and *The Nation*.