THIRD WAY

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Promoting Rural Entrepreneurship and Rural Economic Development

Neil A. Belson

The ongoing population and business declines in rural America are undeniable, but they need not be inevitable. Those who say that rural America is destined for perpetual decline forget that this was the prediction for large urban centers in the 1970s. People who work closely with rural economic development passionately believe that rural communities can, in fact, become revitalized, creative entrepreneurial centers. Rural communities can offer many attractions including lower costs, lack of congestion, a greater sense of community, and a slower pace of life. Additionally, rural areas have built-in advantages for certain kinds of businesses. Furthermore, technological advances make it possible for rural businesses to reach customers across the country and even around the world without having to sacrifice a rural lifestyle.

Rural communities will not succeed on a grand scale on their own, however. Rural success stories, while they reflect considerable vision and hard work by entrepreneurs and local community leaders,

have often involved injections of public funding and other policy support at critical moments. The federal government can be a valuable partner in realizing the full potential of rural America.

This paper examines challenges facing rural communities, with a general focus on the Midwestern United States. The paper also discusses examples of promising economic development approaches, as well as a look at some industries where rural communities may have competitive advantages. It concludes with a number of policy recommendations for enhancing rural entrepreneurship and rural economic development.

Three Rural Economic Challenges

Population levels in rural America have declined since 2010, perhaps the first time that rural populations have declined through a decade. [1] Rural America now represents less than 20% of the U.S. population. Nonetheless, with 97% percent of U.S. land area considered rural, [2] rural America will continue to have an outsized importance economically and politically. The United States Senate, for example, is a rural-dominated institution with a majority of the Senate seats coming from states that in total represent just 18% of the US population. [3] Nonetheless, economic development in rural America faces a series of challenges.

Traditional industry is not a solution.

First, reliance on traditional industries is unlikely to succeed. The size of individual farms has continued to expand as technological advances allow farmers to efficiently farm ever-larger acreage. As a result, while per-acre production increases, the number of individual farms and persons directly employed in agriculture is continually declining. Similarly, increased automation means that traditional agricultural processing facilities are likely to require fewer employees.

"Smokestack chasing"—attempts by economic development offices to recruit a single major employer to a community by offering attractive incentives—is not a viable strategy for most communities. Such an approach does not stimulate the inherent creativity in a community but rather is dependent on the internal decisions of outside companies. It is in many ways a zero-sum endeavor: one community's gain is several others' loss. Often, even for the community which is successful in bidding for the relocating company, the incentives provided to a company as an inducement to relocate exceed the financial benefits the company will bring. [4] That does not mean that a community should not seek to attract prospective large employers if an opportunity arises. However, an economic development strategy that relies primarily on attracting outside large employers to relocate to a particular community is a strategy that is not likely to be replicable across many communities.

Broadband is far from ubiquitous.

Second, too many rural areas still lack broadband. Approximately 39% of the U.S. rural population, or 23 million people, lack access to "fast" broadband internet service—as defined by the Federal

Communications Commission—compared with 4% of urban residents. [5], [6] The primary reason for this lack of broadband is well-known: broadband is much more expensive to bring to rural communities, with low population densities, than it is in an urban environment where many residents live in a compact area. As a result, rural broadband is often not a profitable option for major carriers.

The importance of broadband cannot be overstated. Lack of broadband in a community is, in the words of one rural developer, a "death sentence" for a community. [7] In fact, a 2013 study found that rural counties in which at least 60% of the population used broadband internet had a faster rate of income growth and a lower rate of unemployment growth than counties without broadband internet. [8]

Without broadband, businesses cannot compete with businesses located in areas with broadband. Farmers cannot utilize precision agriculture tools which help them more efficiently use fertilizer, irrigation and other inputs, follow market prices, or find customers. [9] Communities that lack broadband cannot compete with communities that have broadband when it comes to attracting new business and investment.

Entrepreneurial environments are a challenge.

Finally, access to capital and creating an entrepreneurial environment in rural America continue to be a struggle. Rural businesses increasingly struggle to obtain loan financing: the value of small loans to rural businesses declined by more than half between 2004 and 2017, after adjusting for inflation. [10]

Once adequate infrastructure (such as broadband internet) is available, the most significant determinant in whether a rural community will be able to thrive or will continuously decline is probably the creativity and initiative of the community and its leaders. If they are able to create an environment where creativity and entrepreneurship are visible and encouraged, then even communities seemingly in inexorable decline have an opportunity for revitalization.

A Series of Promising Approaches

These trends and challenges are fundamentally changing the face of rural America and having a profound impact on how Americans in those areas sustain themselves and their families. Even so, some promising approaches offer case studies for revitalizing vast areas of the country.

Case Study #1: Attracting Broadband to Rural America

One of the most successful New Deal programs of the 1930s was the federal Rural Electrification Act (the "REA").The REA played a critical role in bringing electricity to rural communities. Prior to the REA, only about 10% of rural America had electricity, while approximately 90% of urban dwellers had electricity. [11] The REA was enacted in 1936. By 1939, over 400 rural electric co-ops had formed

and approximately 25% of rural Americans had access to electricity. [12] By the time FDR died in 1945, over 90% of rural America had access to electricity. [13] The analogy is not perfect—internet connectivity is continually improving and any physical infrastructure will likely require continual updating to avoid obsolescence in a way that rural electrification did not. Nonetheless, the REA example demonstrates the impact that well-targeted public programs that encourage private initiative can have.

Some cooperatives formed under the REA have been instrumental in bringing broadband internet to their communities. For example, Co-Mo Electric Cooperative, Inc., a customer-owned cooperative in Central Missouri formed in 1939, has built connections to 25,000 members in a relatively sparsely populated area. [14]

In other instances, states have stepped in. For example, the State of Minnesota has established an Office of Rural Broadband, with the statutory goal of making broadband accessible to all homes in Minnesota.

Below are some examples of broadband being deployed and effectively leveraged:

Rock County, Minnesota. Rock County, Minnesota has been particularly effective at making broadband a springboard for economic development. Although located in the far southwest corner of the state, with a population under 10,000, Rock County has achieved the highest rates of broadband access of any county in the state. Over 99.9% of the county has access to high speed internet, at speeds which substantially exceed the FCC's minimum definition of broadband internet. [15], [16]

Once internet was available, Rock County's economic development office used internet service as a selling point to pitch the community to businesses. The county scored a success when a maker of agricultural slats, Midwest Dry Cast, set up operations in the county. The county then used this success as evidence of its attractiveness as a business location, to lure new wind and solar projects to the community. Additionally, the county attracted a new shrimp production facility, anticipated to generate approximately 20 new jobs and over $10 million in new construction. (In the case of the shrimp facility, the hookup of the community to a public water system also played an important role in the company's decision to locate in Rock County.) [17] The county's demonstrated success in serving as a good location for business serves in turn as a springboard to attract additional business.

Significantly, Rock County has also used broadband to improve the general quality of life for its residents. For example, it has established an "e-visit" arrangement with a hospital in neighboring South Dakota to provide telemedicine services to its elderly residents.

Mitchell, South Dakota. Mitchell has utilized broadband to become an entrepreneurial hub, even as surrounding counties have lost a third of their populations since the 1930s. Mitchell is a town of about 15,000 located in southeastern South Dakota, best known as the home of the world's only

Corn Palace and also the childhood home of 1972 Democratic Presidential Candidate George McGovern.

Mitchell's transformation began in the late 1980s.The local community college, Mitchell Technology Institute (MTI), developed a technology center, which soon became a co-location facility for communications providers. MTI then obtained a federal grant to upgrade the center to a Network Operations Center which met industry and governmental security standards, which in turn began to host more and more networks to the internet. This evidence of demand led a local carrier to establish a fiber network directly to MTI. [18]

Access to high-speed telecommunications generated a new tech-based economy which supplemented the town's traditional agricultural economy. The school system has implemented a 1:1 laptop and tablet program for middle and high school students, MTI invested $40 million in a new technology-based campus and another small local university created centers of entrepreneurship and health sciences. Two major health systems have established facilities in Mitchell, a local angel investor network has formed, and engineering, communications consulting and software companies have helped the town become a regional technology hub. [19] , [20] Combining the town's historical, agricultural, and more recent technology-based focuses, MTI has established a precision agriculture technology curriculum. [21] In 2015, the Intelligent Communities Network, a New York City think tank, named Mitchell one of the world's top seven "Smart Cities". [22]

Chattanooga, Tennessee. Chattanooga used ultrahigh-speed internet to transform its image from a mid-size southern city with no significant technology industry to an entrepreneurial hot spot. The city's municipal power board, supported by a $111 million grant from the U.S. Department of Energy, set up an internet service capable of speeds up to 1 gigabyte per second – the world's fastest publicly available internet service in 2009. While the new infrastructure was important, what was perhaps just as important, according to the city's mayor Andy Berke, was the way the new service transformed the city's image of itself to a community at the front of the technology curve. Responding to that spirit, new incubators soon opened in the city, together with a diverse range of new technology companies. By 2015, the faster internet service, along with the entrepreneurial ecosystem around it, was credited with generating over $800 million in new revenue in the city, together with 2,800 new jobs, and the third-highest wage growth in the nation of any mid-sized city. [23] In 2015, the city established a new "Innovation District," perhaps the first U.S. mid-sized city to do so. The District, which contains business incubators and accelerators, has a walkable environment that nurtures a "collide and collaborate" environment where entrepreneurs, technology innovators, students, and other creative individuals are able to meet and develop new ideas. [24]

Case Study #2: Creating an Entrepreneurial Ecosystem

Entrepreneurs everywhere can expect to confront skeptics who cast doubt or even belittle the entrepreneur's dream. Such discouragement, though, can be particularly powerful in rural settings.

Prospective entrepreneurs in rural communities often lack positive local examples of successful entrepreneurs, and there is little they can look to in order to push back against the negative feedback they receive when they share their dreams. Far too often, this leads to them either abandoning their dreams or moving away to towns where they believe more opportunity exists. [25] Therefore, one objective of a rural entrepreneurship program is establishing an environment where residents can see other people with similar backgrounds, education, and resources becoming entrepreneurs. [26] Two examples, Network Kansas and Fablab, offer models for creating an entrepreneurial mindset which, with appropriate public support, could be replicated on a large scale.

Network Kansas. "Network Kansas" began with state funding but is now mostly self-sustaining. Network Kansas focuses on creating incentives within communities for entrepreneurship while also creating opportunities for entrepreneurs throughout the state to exchange resources. Network Kansas is not a government-run program. Rather, it is a 501(c)(3) non-profit that leverages the state's Entrepreneurship Tax Credit, operated by former entrepreneurs.

Network Kansas, among its various activities, operates an "e-communities" program which began in 2007 with six communities and has now expanded to approximately 60. The program relies on local leaders in each community to make loans available to new businesses and as an incentive, is able to provide financing to support these loan programs.

A community-based local review team reviews project loan applications submitted by local entrepreneurs seeking to start, expand, or purchase a business. The program, which matches public financing and bank loans, can provide up to $45,000 for each project. [27]

Importantly, the program combines financial incentives with local responsibility to encourage local initiatives. The availability of revolving loan funds creates a powerful incentive for local community leaders to form project review teams and submit proposals. The prospect of funding encourages existing and prospective entrepreneurs. Additionally, the reliance on local review of proposals provides community accountability and encourages participation by members of a community who are committed to its revitalization. It also allows community members to evaluate what makes the most sense for their own community, rather than having the decision made by individuals outside of the community.

Network Kansas also offers several other services of value for actual and prospective entrepreneurs. For example, it includes a "Connections" website which is a one-stop site of potential nonprofit resources available to entrepreneurs in the state. [28] Additionally, Network Kansas operates a "One Million Cups" program in several communities around the state. The "One Million Cups" program was developed by the Ewing Marion Kauffman Foundation in Kansas City, Missouri, and was based on the idea that entrepreneurs could develop ideas by engaging with other entrepreneurs, and with their communities "over a million cups of coffee." [29] At the Network Kansas One Million Cups meetings, entrepreneurs have an opportunity to present their startups to other entrepreneurs

(with coffee "highly encouraged"). [30] , [31] The Wichita program advertises that the last question at each meeting is always "What can we as a community do to support you as a startup?" [32]

FabLab."FabLab" is an MIT-initiated worldwide program which is not limited to rural communities, but might be particularly impactful in rural regions. The FabLab program seeks to provide people around the world with access to tools and knowledge to innovate and invent using technology, and digital fabrication to make new things. The goals include "democratizing access to the tools for technical invention" [33] and providing opportunities for people around the world to improve their lives and livelihoods. FabLab's Network consists of approximately 1,000 FabLabs located in over 75 countries.

A particularly active Fablab program exists on the campus of Independence Community College (ICC), in Independence, a town of approximately 9,000 people in southeastern Kansas whose population has slowly declined in nearly every decade since around 1930. The college has established a "Fablab" with a focus on advanced manufacturing and digital fabrication (including 3D printing), where persons with ideas can explore and "tinker" with their ideas on a no-risk basis. They can refine and improve their creations and then use these creations as the basis for launching new businesses. The Fablab facility recently expanded to 6,400 square feet in Fall 2018. [34]

The ICC program also offers training for entrepreneurship based on an innovative "ice house entrepreneurship" model which is different from many traditional entrepreneurship programs. While many entrepreneurship programs focus on writing business plans and preparing entrepreneurs to "pitch" to prospective investors, the ice house entrepreneurship model is geared to the large number of entrepreneurs who are unlikely to receive meaningful investment from sources other than friends and family, and does not require entrepreneurs to attempt to project in detail a new business's growth several years into the future. The program's philosophy is built around training individuals to develop an "entrepreneurial mindset", an approach that trains individuals to identify opportunities in practically any environment and is as applicable in a small rural community as in Silicon Valley. A premise of the program is that "ice house entrepreneurs" exist in any community. [35] The ice house entrepreneurship program was developed with support from the Ewing Kauffman Foundation in Kansas City, which supports projects that encourage entrepreneurship, as well as the Entrepreneurial Learning Initiative based in Ohio.

Underutilized Resources for Rural Entrepreneurship

Several resources already exist for promoting rural entrepreneurship. Some are well-known. The federal Small Business Administration (SBA) has Small Business Development Center offices across the country, which offer mentorship and other training opportunities for small business. USDA's Cooperative Extension Service (CES) played a central role in increasing U.S. agricultural productivity in the 20 th Century, making agricultural research findings accessible to farmers.CES once maintained offices in each U.S. county and still maintains nearly 3,000 offices across the country.

Both USDA and SBA maintain loan programs (which partially guarantee private loans) which are accessible to small businesses in rural communities.

Other resources also exist which are much less known and used. This section focuses on a few underutilized programs and resources which are potentially available to rural entrepreneurs. The resources described below could, if utilized more widely, offer possible "multiplier" benefits, such as the ability to attract and mobilize private investment far beyond the size of the programs themselves.

Rural Business Investment Companies

USDA's Rural Business Investment Program is an underutilized program for making investments available to rural ventures. This program permits USDA to license "Rural Business Investment Companies" (RBICs).

RBIC's, which do not receive public funding, have some similarity to traditional venture capital funds. They are run as investment funds, with some funds investing in early-stage investments, while others focus on expansion or growth capital. They are also sometimes owned by private equity firms that manage separate non-RBIC funds.

However, RBIC's are subject to requirements aimed at assuring a focus on rural areas. At least 75% of RBIC investment funds must be made in rural areas with a population of 50,000 or less, and no more than 10% may be made in urban areas. At least 50% percent of funds must be invested in smaller enterprises. [36] Another difference between some RBIC's and venture firms is that RBICs are often "double bottom-line" companies – they often look for investments that will benefit rural communities, along with good returns on investment.

The main attraction of RBICs for funders is that they provide a vehicle for banks in the Farm Credit System to make equity investments. The Farm Credit System consists of approximately $200 billion in funding, controlled by 83 separate financial institutions. Banks in the Farm Credit System are restricted in how they can utilize their funds, and direct investments in private companies are tightly regulated. Their primary mechanism for making equity investments is through the RBIC program. As a result, a large portion of the current RBIC funds has come from Farm Credit banks. The RBIC program gives the banks an opportunity to obtain higher returns - perhaps a 12-15% return on investment – than they could obtain from traditional loans. [37]

There are currently approximately five licensed RBICs, and their combined available funding is probably under $200 million. Their investment has been diverse and has included seed companies and AgTech companies among other types of ventures.

There is probably room to substantially expand the RBIC program. RBIC investment is regarded as "community development" for purposes of the Community Reinvestment Act (CRA). [38] However, the program, including its qualification under the CRA, remains relatively little known. Increasing

investment from financial institutions and investors outside the Farm Credit system could increase the total available investment capital, and some existing RBICs are exploring that possibility. It would be worthwhile and advisable to reevaluate the existing RBIC requirements and regulations and explore with various stakeholders whether any revisions could attract greater and more diverse capital to the program.

Packaging and Monetizing Rural Loans

USDA currently operates a number of rural loan programs, such as the Rural Water Loan and Waste Disposal Grant and Loan Program. [39] Rural communities with populations of less than 10,000, together with tribal lands in rural areas, are eligible for low-cost loans for drinking water and waste disposal projects with a 40-year repayment period.

It may be possible to leverage private sector resources to expand the size of this program as well as the range of fundable rural projects, by marketing these loans to private investors. However, the size of individual loans under this program is too small to interest major private investors.

If it were possible to package these loans in a manner similar to Fannie Mae, then these loan packages might become a more attractive opportunity for private investors. If USDA (or another entity created for this purpose) were able to sell such loan packages, then this might free and increase the amount of capital available to fund new rural infrastructure projects. [40]

Utilizing Land-Grant Colleges as an Entrepreneurship Center

Land-grant universities are a valuable resource which could be more systematically utilized to launch and attract new technology-based businesses in rural communities. The Morrill Acts of 1862 and 1890 established land-grant universities, granting federal land to the states to establish educational institutions which would teach such topics as agriculture, science, and engineering. Many land-grant universities became today's major public universities.

Land-grant universities are important research centers. They typically have technology transfer offices, which license university-created technology to private companies and sometimes spin off new companies based on university technology. As an added attraction for prospective entrepreneurs and technology businesses, Midwestern land-grant university towns consistently rank among the best places to live in America – four of them made the top 25 best places to live in America in a recent survey! [41]

Kansas State University (KSU), located in Manhattan, Kansas, has an innovative technology transfer arrangement with its surrounding communities. KSU has established the "Knowledge-Based Economic Development, LLC" (KBED), which is a partnership between KSU and other entities in the Manhattan area, to support local growth in knowledge-based companies. KSU provides access to its research and facilities, and the partnership helps to provide business services and

capital. KBED focuses on six industries that complement the university's academic strength, four of which involve food and agriculture, while the remaining two are mechanical and nuclear engineering and nanosciences. KBED also works to recruit companies to the Manhattan area and expand their ties with KSU. A pair of animal health companies recently located to the Manhattan area through KBED's efforts. [42]

Other Midwestern land grant universities also have entrepreneurial or rural development programs. For example, Iowa State has an agricultural entrepreneurship program. [43] The University of Nebraska has established a Rural Futures Institute whose mission to help build "a thriving high-touch high-tech rural future," including promoting entrepreneurship. [44] Despite these and other programs, the vast technological, educational and business resources of these institutions could almost certainly play a more active role in helping to establish innovative new entrepreneurial ventures.

Industry Opportunities

Rural areas have inherent advantages in some emerging industries because they offer lower costs or access to relevant raw materials. One component of a rural development strategy could be focusing on expanding industries where rural America has unique competitive advantages. Below are examples of a few such industries.

AgTech

"AgTech" has surged in recent years, particularly following Monsanto's 2013 $1 billion acquisition of The Climate Corporation, a company whose software allowed farmers to evaluate weather, soil, and crop data to identify possible yield-limiting conditions. Venture investments in AgTech quickly increased from approximately $309 million in 2013 to $1.4 billion in 2015. [45]

AgTech includes a range of technologies, including "precision agriculture," seed technologies, crop protection, farm equipment, sensors, and ag-related marketing and financial services. AgTech, notably including precision agriculture and agricultural software, represents an important target of opportunity for rural America. Precision agriculture utilizes software and other information technology (IT) products and services to monitor the condition of soil and crops on a real-time basis, allowing farmers to provide inputs such as irrigation, pesticides, or fertilizers where and when needed. As such, it increases efficiency by allowing farmers to apply inputs where they can have the most impact while avoiding wasteful and unnecessary expenses. Precision agriculture has become an important part of U.S. agriculture, even though the lack of access to broadband has limited its use in some areas.

Nonetheless, while rural America participates in a significant way in precision agriculture as consumers, a relatively small proportion of precision agriculture business ventures have come from the Midwest. The majority are based in California or other traditional IT hot spots. Only about 10%

of recent U.S. venture funding has involved companies in the Midwest (with the West Coast representing over 50% of such funding). [46] Fewer than 20% of the companies on the *Forbes* 2018 list of the 25 most innovative AgTech2018 companies were headquartered in the Midwest. [47]

There are, though, significant opportunities for rural America. Farmers regularly comment that a lot of agricultural software is not practical for their purposes. They could undoubtedly benefit from software solutions developed by people with a better understanding of the needs of farmers and others involved in the agricultural supply chain. Opportunities likely exist for collaborations between agricultural software coders on the coasts and people in rural communities who are familiar with agricultural production, logistics, and processing.

"Farmshoring"

Outsourcing is a common practice in the IT industry. IT outsourcing often involves having certain functions, such as tech support and some IT coding, performed in lower-cost locations, such as India and the Philippines.

"Rural outsourcing" (sometimes referred to as "farmshoring") is similar to overseas outsourcing—except that IT functions are outsourced to lower-cost rural areas in the United States rather than to foreign countries. U.S. rural communities offer several advantages for U.S. companies looking to outsource compared to less-developed overseas competitors: similar time zones, a common culture and idiom, and much greater ease of travel for in-person interactions. Rural outsourcing reduces the need to comply with requirements of multiple legal systems and may offer major data privacy advantages compared with international off-shoring. Additionally, owners of rural outsourcing companies claim that they are able to compete even on cost with their competitors from developing nations.

An owner of one rural-sourcing company stated that a single rural-sourcing facility can bring approximately 200 IT jobs to a rural community, many held by people with less than a college education who were formerly underemployed. [48] That company uses a "bootcamp" to train employees in IT skills. The company has also attracted highly-trained IT professionals, who are looking for the lower costs and absence of congestion that rural communities can offer.

A handful of companies have emerged as leaders in this industry. Among them are On-Shore Outsourcing, Inc., based in Macon, Missouri, and Rural Sourcing, Inc. which is based in Atlanta but has facilities in such towns as Augusta, Georgia and Mobile, Alabama. Though located primarily in small-to-mid-size communities, their clients include some of the largest companies in the U.S.

Rural outsourcing may have only scratched the surface of what the industry could possibly achieve. Realizing its potential, though, will require both infrastructure and planning. Access to broadband internet is an obvious prerequisite for rural sourcing. Additionally, workforce training focused on the needs of the IT industry would make a community a more desirable location for a rural sourcing facility – obtaining a skilled IT workforce is one challenge of rural sourcing. Any such workforce

training should be conducted in careful coordination with rural sourcing and other IT companies so that the training addresses real industry needs.

The fact that rural outsourcing companies have been able to attract major U.S. corporations as clients is evidence of its potential. Given their cultural, linguistic, and geographical advantages, there is no reason why rural U.S. communities cannot be much more active competitors in IT outsourcing with appropriate policy, training, and infrastructure support.

Niche Food Products

Exports are a critical part of American agriculture, representing 19% of U.S. farm and ranch income in 2015. [49] The U.S. Grains Council performed a futuristic study in 2011 entitled *Food 2040: The Future of Food and Agriculture in East Asia*, regarding long-term agricultural export opportunities for U.S. agriculture in East Asia. [50] Among their conclusions was that niche markets, containing high quality branded or preprocessed foods, would come to represent a greater share of the market in Japan, China, and emerging markets. Demand would also grow for value-added foods and ingredients. Providing food traceability and origin sourcing information would grow in importance and help branded product producers differentiate their products.

Growing demand for higher-value specialty and preprocessed products could create major new opportunities for innovative American producers and processors. In addition to providing higher margins per unit, specialty products are more difficult to replace than commodities and are much less susceptible to trade or political disputes.

Bioeconomy

The "bioeconomy," if its potential were realized, could have a transformational impact on rural America. Approximately a decade ago, the prospect of a "biobased economy", in which agriculturally-derived materials would be a primary source of energy, industrial chemicals, and other industrial raw materials, was envisioned as an opportunity for a rural renaissance. The National Research Council predicted in 2000 that biobased materials could account for 25% of all industrial raw materials by 2025. [51] Large-scale "biorefineries" were contemplated, which would process huge volumes of agricultural residues such as corn stover, wheat straw, and fast-growing grasses like switchgrass into ethanol plus a combination of industrial products. Rural America, as the largest source of renewable plant-based material, or "biomass", would power the bioeconomy, and was poised to be a great winner.

In the first decade of the 2000s, expanding domestic production of new biofuels to replace imported petroleum was seen as a matter of national security. Congress enacted the Energy Independence and Security Act of 2007 (EISA) which required production of 16 billion gallons of "cellulosic ethanol", a new second-generation or "advanced" biofuel which could be produced from agricultural residues rather than the food-producing parts of crops, by 2022. At least a half-dozen biofuels companies had IPO's in 2010 and 2011. [52] The Obama Administration released a "National

Bioeconomy Blueprint" in 2012. DuPont opened a $225 million cellulosic ethanol "biorefinery" in central Iowa in 2015, which it envisioned as the first of several such facilities. [53]

This burst of activity proved short-lived. Rapidly expanded production of natural gas changed the energy market. The technological, financial, and logistical challenges involved in collecting and transporting large volumes of agricultural residues to processing facilities and then converting it into ethanol turned out to be more complicated than predicted. Many early cellulosic bioenergy start-ups failed, while others switched to products such as dietary supplements or specialty chemicals with the potential to offer higher profit margins although much lower volumes. A pioneering farmer cooperative in Missouri that formed to market biomass pellets shut down and sold its mill. DuPont abruptly closed its facility in late 2017.Venture capital investment in cellulosic ethanol nearly ceased. [54] As we approach the third decade of the 2000s, it seems apparent that the ambitious targets envisioned two decades ago for the biobased economy will not be achieved on schedule.

There have, nonetheless, been meaningful successes. Production of renewable diesel fuel, produced using wastes from soy and livestock production, has grown rapidly in recent years. Renewable diesel is chemically identical to traditional fossil fuel-derived diesel and can utilize the same infrastructure and be used in diesel vehicles without blending limits. The first new U.S. petroleum refinery to be built in 30 years, in Dickinson, North Dakota, recently announced plans to convert the refinery to produce 100% renewable diesel fuel from soy oil and other organically derived feedstocks by December 2020. [55] , [56] (Note: "renewable diesel" is a different product from "biodiesel", which can only be blended in limited proportions with traditional diesel). [57] In April 2019, a subsidiary of Valero Energy and a partner announced a $1.1 billion investment to expand a renewable diesel plant in Louisiana – a project anticipated to bring 50 new direct jobs with an average salary of $130,000. [58]

Some biobased industrial chemical products have become commercial. Biodegradable plastics, made from renewable biobased materials, were a $21 billion market in 2017, with predictions that this market could triple by 2024 (although much of this growth is predicted to occur outside the U.S.). [59] A second generation corn-based ethanol is now being produced which not only utilizes the starch from corn kernels (as traditional corn ethanol did) but also uses fibrous materials from the kernel (allowing greater ethanol production from corn). Biomass gasification to produce hydrogen fuel is a mature technology that might become commercially feasible if feedstock and capital equipment costs are reduced. [60]

Major, largely unrealized, opportunities for the bioeconomy remain. It is theoretically possible to produce many new industrial chemicals now derived from petroleum, including adhesives, sealants, paints, coatings, lubricants and cleaning agents, from agricultural residues. Approximately 7% of petroleum is currently used in the U.S. to produce industrial chemicals, [61] and nearly 90% of all commodity chemicals currently used are derived from petroleum. [62] In 2016, the U.S. Department

of Energy prepared its third edition of the "Billion-Ton Report", which evaluated total U.S. biomass resources which could be available for energy and industrial uses. [63]

The bioeconomy could have an especially powerful impact on rural America if rural communities could participate as owners and investors in new biomass-based projects rather than simply as suppliers of raw materials. The President of the North Dakota Farmers Union recently commented, in discussing a possible new cellulosic ethanol facility in North Dakota, that area farmers might be able to double their revenue if they were able to form a farmer-owned cooperative to handle biomass collection and transportation logistics in conjunction with the facility. [64]

Policy Recommendations

With the vast majority of the nation's land area and a disproportionately large representation in the Senate, the future of rural America is inseparably linked with the future of the United States. With vision, initiative, and effective policy support, rural America can thrive. Indeed, numerous examples exist where creative rural communities have established entrepreneurial centers in regions where other communities are declining. It is important to learn from these successes, as well as what has not worked. Several guidelines emerge from the examples provided above.

First, *broadband internet* is essential – without it, meaningful entrepreneurship will not happen. It is important to remember, though, that while private initiative and local champions are essential, public support and funding have also typically played a critical role in making private successes possible.

Second, *connections* – in many different respects - are critical in fostering rural entrepreneurship. Rural residents need to see examples of people like themselves starting businesses, to understand what they too are capable of. Additionally, rural entrepreneurs need connections to available resources, to other entrepreneurs, to customers, and to information, in order to be successful. Facilitating connections between AgTech coders in IT hubs and farmers in the Midwest can benefit both groups and likely result in improved AgTech apps. Public policy can play a major role. One of the most successful examples of a connections program, Network Kansas, though substantially self-funded, could not have happened without initial and continuing public support, including seed funding and supportive legislation. The federal government can play a much larger role than any state government in facilitating these and other kinds of connections in making sure they reach rural communities.

Third, *local involvement and local champions*. Local residents and community leaders generally have the best ideas of what will work in their communities. As noted, successful broadband internet projects generally involve a local champion. Network Kansas relies on local communities and their leaders to submit proposals and select projects which will receive loan funding. In addition to providing local insights, including local leaders creates an emotional investment in the success of rural development projects.

Fourth, *create opportunities to experiment and "de-risk".* The FabLab program at the community college in Independence, Kansas is an example of creating a welcoming environment that encourages tinkering and experimentation at little or no risk to participants, while also making entrepreneurship training available to them. It would be worthwhile to encourage and assist other rural communities in providing similar opportunities for their residents.

Fifth, *invest in basic research*. Public investment in pre-commercial research is often necessary in science-based industries, in order to sufficiently advance scientific knowledge to the point where private investment becomes viable. As the 2012 White House Bioeconomy Blueprint explained, "Although many studies show that research provides a healthy return on investment, a major justification for government investments in science and technology is to overcome market failures; these occur when private investors invest less in technology than the socially optimal level because they cannot reap the full benefits of their investment. In this context, scientific discovery is a public good that benefits all." [65]

Appropriately targeted investment in basic research could unlock many of the technical and logistical issues that constrained the growth of the rural bioeconomy. Among the areas where federal investment in basic research might have the greatest impact are (i) improving the logistics of harvesting and transporting large volumes of biomass to places where it can be processed; (ii) developing efficient "preprocessing" technologies which allow biomass to be partially processed on or near the farm in order to make it easier and less expensive to transport; and (iii) improving conversion technologies which allow biomass to be converted into industrially useful sugars. Improved efficiencies in these areas could significantly "de-risk" investment for private investment and also make it possible for farmers and other members of rural communities to become investors in new biomass ventures. Achieving the full potential of the bioeconomy to transform rural America will require that rural communities participate in new ventures not only as suppliers of biomass raw material but also as entrepreneurs and owners.

Sixth, *make use of rural competitive advantages.* It makes sense for rural economic developers to identify industries where rural communities have a competitive advantage. Among these are industries which relate to agriculture or utilize agricultural raw materials, industries where large areas of open space are required, and industries which can take advantage of lower costs in rural areas.

Seventh, *create appropriate incentives*. Properly created incentives can help spur investment and rural entrepreneurship. The availability of business loans in the Network Kansas program has been instrumental in encouraging communities to participate in the program. Minnesota's rural broadband program has relied on state 1:1 matching grants to encourage the private sector and municipalities to invest in local broadband.

Creating market-based incentives for reducing greenhouse gases could also spur investment in biomass-based industries. Biomass-based products offer major environmental benefits compared

with their petroleum-based counterparts. Cellulosic ethanol can reduce greenhouse gas emissions compared to fossil fuels by up to 108%, - in other words, an overall net negative greenhouse gas production – using a fuel life cycle analysis! (The negative value is possible, because the growing plants absorb carbon dioxide from the atmosphere). The U.S., however, currently offers minimal market rewards for energy producers who reduce greenhouse gas emissions and virtually none to biobased chemical manufacturers—essentially an enormous subsidy to fossil fuel producers who are able to pass on society at large the cost of their greenhouse gas emissions rather than absorbing it themselves.

California, in contrast, has become a renewable energy leader in part by creating aggressive regulatory and market incentives to replace fossil fuels with renewable alternatives such as a Low-Carbon Fuel Standard (LCFS), together with a carbon "cap-and-trade" system. There are currently over 30 operating biomass power plants in California— half of the nation's biomass industry (although there were more than twice that number before a state price support expired). Additionally, California has become the primary U.S. market for renewable diesel, where LCFS incentives have made it cost-competitive with petroleum diesel fuel. An international energy company recently announced that it will convert a refinery in California into a facility capable of producing over 300 million gallons of renewable diesel annually, while its CEO stated, "This facility is a direct and tangible result of environmental policies passed by the California State Legislature."

Several options for creating market incentives for carbon reduction exist, among these a "carbon tax," which would tax greenhouse gas emissions on fuels and other products in order to make the actual price paid by consumers reflect the full costs paid by society and various cap-and-trade systems which allow producers of lower-emissions products to obtain tradable credits they can sell to other producers or on public markets. Any such system should focus not only on energy products but also on biobased chemicals, which provide environmental benefits comparable to advanced biofuels but currently receive virtually no market rewards for doing so. Regardless of the approach used, any system which creates an appropriate market reward for the greenhouse gas reductions generated by biofuels and biobased chemicals is likely to increase interest and investment in rural biobased ventures.

This paper is not an exhaustive list of strategies for expanding rural entrepreneurship, but that is not its purpose. Rather, its key point is that the current decline in many rural areas is not any more inevitable than the predicted urban decline of several decades ago. Proactive rural communities have demonstrated that they can create an environment that fosters innovation and encourages entrepreneurs. Many of their successful strategies seem replicable and scalable.

New technologies are creating opportunities in rural areas that never previously existed. With effective policies, efforts, and a willingness to learn from successes and failures, it is possible to realize these opportunities, and envision a thriving, revitalized rural America.

Bio

Neil A. Belson is a life sciences and technology attorney and a former biomass products entrepreneur. Mr. Belson practices law in Southern Maryland, where he advises biotechnology and digital health clients. He regularly works with entrepreneurs and early stage companies, and has multiple clients who provide services to rural communities. Additionally, he has been a mentor to technology business incubators. Mr. Belson also founded, served as President and sold a business, NewAgriculture, Inc., which produced naturally occurring proteins and co-products from plant biomass. He is a manager of LeafPro, LLC, which acquired NewAgriculture's assets. Mr. Belson received his J.D. *cum laude* from Harvard Law School and has two degrees in Agronomy from the University of Maryland. He is a co-inventor on five U.S. and Canadian patents. Mr. Belson's career-long interest in rural development dates back to his service as a Peace Corps Volunteer in the Dominican Republic shortly after college, where he initiated a rural energy farm project. Mr. Belson can be contacted at nabelson@msn.com or tel: 240-416-7239.

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