

BUILDING A NATION OF MAKERS

Six Ideas to Accelerate the Innovative Capacity of America's Manufacturing SMEs



Commission Co-Chairs

Haley Barbour, Former Governor, Mississippi

Evan Bayh, Former Governor and U.S. Senator, Indiana

THE MILLER CENTER • UNIVERSITY OF VIRGINIA



About the Milstein Symposium

The Miller Center launched the **Milstein Symposium: Ideas for a New American Century** in September 2013. This multi-year initiative convenes distinguished stakeholders and eminent scholars to define and advance innovative, nonpartisan, action-oriented ideas, grounded in history, to help rebuild the American Dream. The Miller Center will organize three Milstein commissions each year. Funding for this initiative was provided by philanthropist, business and civic leader Howard P. Milstein.



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*Six Ideas to Accelerate the Innovative Capacity
of America's Manufacturing SMEs*

JUNE 2014

MILSTEIN COMMISSION ON NEW MANUFACTURING

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Historic Faulkner House, home to the Miller Center, University of Virginia

Table of Contents

Letter from Governor Gerald L. Baliles	5
Letter from Howard P. Milstein	6
Letter from the Co-Chairs	7
Executive Summary	8
Idea #1: Talent Investment Loans	12
Idea #2: Upside-Down Degrees	16
Idea #3: Skills Census	20
Idea #4: Mapping America's Manufacturing Supply Chain	24
Idea #5: High School "TE" Certifications	28
Idea #6: "Big Trends-Small Firms" Initiative	32
Commission Members	36
Sources	41
Acknowledgments	47



The Milstein Commission on New Manufacturing
Clockwise from top left: Aaron Bagshaw, Rebecca Bagley, Kate Sofis, Jennifer Clark, Howard Wial, Bernie Carlson, Matthew Burnett, Evan Bayh, Gerald L. Baliles, and Haley Barbour

Not pictured: John Engler, James Fallows, James Manyika

Letter from Gerald L. Baliles

*Director and CEO, Miller Center, University of Virginia
Governor of Virginia (1986–1990)*



What must we do to reinvigorate the American Dream in the 21st century? That question, so vital to the future of our nation, is at the heart of the Miller Center's newest initiative—**The Milstein Symposium: Ideas for a New American Century**.

By almost any measure, the American Dream is in peril. The robust middle-class growth that defined the 1950s and 1960s began to show signs of strain in the 1970s, and the core elements of the American Dream—homeownership, secure retirement, building a better life for your children—steadily eroded in the decades that followed. In September 2013, with the generous support of Howard P. Milstein, the Miller Center launched this multi-year initiative to develop nonpartisan, innovative, action-oriented—yet achievable—ideas to rebuild the American Dream.

In this first commission, co-chaired by two distinguished statesmen, Governors Haley Barbour and Evan Bayh, we brought together 12 eminent thought leaders to examine the future of small- and medium-sized manufacturing enterprises (SMEs). Throughout our nation's history, manufacturing SMEs have been an engine of well-paying, middle-class jobs. Over the next decade, advanced technologies, major shifts in global demand, and greater emphasis on customization will fundamentally redefine manufacturing and create significant growth potential for SMEs. But for American firms to thrive, we must out-innovate the global competition.

Over several months, the commission developed six fresh ideas to expand the innovative capacity of our manufacturing SMEs: *talent investment loans* to help firms upscale their human capital; *upside-down degrees* to encourage synergies between work experience and college education; a *skills census* to collect the data needed to enhance labor force efficiency; a *national supply chain initiative* to fully map America's manufacturing supply chain ecosystems; *renewed focus on technology and engineering skills* for high-school students; and a "*big trends-small firms*" initiative to connect SMEs with the latest technologies. Individually, these ideas have the power to produce meaningful change. Together, they can propel our "nation of makers" into a new era of global leadership.

Benjamin Franklin once counseled, "Speak little, do much." Our goal is not simply to contribute to the crowded marketplace of ideas, but rather to catalyze transformational policy change. We look forward to working with you, the reader, in rebuilding the American Dream.

Letter from Howard P. Milstein

Philanthropist, Entrepreneur



We are pleased to present the first commission report of the **Milstein Symposium: Ideas for a New American Century**.

Working with the Miller Center, we developed the Milstein Symposium to find practical, nonpartisan solutions to some of the most pressing economic issues facing our nation, and especially the middle class, in areas that include manufacturing, entrepreneurship, education, and infrastructure. Though our topic areas are broad, our vision for this ambitious undertaking is laser-like in its focus: to examine the steps our nation needs to take to ensure the continued vitality of the American Dream in the 21st century.

For generations, the American Dream was typified by the notion that each succeeding generation would be better off than the last: better educated, more stable and secure, with a chance for even greater success. Our forebears, immigrants all, held the belief that if they worked hard every day and took responsibility for their future, they had a good chance of providing a better life for their families. I believe this is a unique and critical aspect of American success and one that needs to be re-energized for each new generation of Americans. With this in mind, the Milstein Symposium is tasked with finding solutions that ensure our American Dream remains a viable, achievable goal.

Our first commission, led with great talent and energy by former Governors Haley Barbour and Evan Bayh, considered the future of small- and medium-sized manufacturing enterprises (SMEs). With changes in technology, logistics, and global economic conditions, we believe the United States can experience a manufacturing renaissance—if we, as a nation, have the fortitude to make the right decisions now. We must foster small- and medium-sized businesses that will drive the growth of American manufacturing in the 21st century. In the pages of this report, our 12-member commission of experts, academics, and businesspeople present six innovative ideas that we believe can revitalize a manufacturing engine that has, for more than a century, been the foundation of American economic prosperity.

We hope that these ideas serve to stimulate private and public sector action, at both the state and federal levels. We look forward to providing more ideas—practical, nonpartisan, and implementable—in the months and years to come.

Letter from the Co-Chairs

Hons. Haley Barbour and Evan Bayh

It has been an honor and a pleasure to co-chair the inaugural commission of the **Milstein Symposium: Ideas for a New American Century**.

Our commission, while very diverse, believes the United States can have a robust manufacturing sector as a bulwark of the national economy.

Our report is aimed at identifying and emphasizing ways to strengthen the manufacturing sector, especially advanced manufacturing by small and medium-sized enterprises (SMEs).

You will notice a strong focus on human capital. Improving the quality of America's workforce is necessary if manufacturers are to have employees who have the skills to effectively deploy ever-changing technology and successfully improve productivity so companies can stay competitive in the global marketplace.

Economic growth and the creation and maintenance of more high-quality, well-paying jobs will produce not only a stronger, more robust economy but also profound social benefits.

Thus, we consider the main goal of our recommendations to be “producing quality employees for our workforce so SMEs can grow, prosper and provide more jobs, higher pay, better benefits, local and regional economic growth and a bigger, more competitive American economy: That is the social benefit, first and foremost.”

We, and the other Commission members, unanimously approve this report.



Co-Chairs Haley Barbour and Evan Bayh during the Milstein Symposium

The Honorable Haley Barbour, Co-Chair
Former Governor, Mississippi

The Honorable Evan Bayh, Co-Chair
Former Governor and U.S. Senator, Indiana

W. Bernard Carlson, Chair, Department of Engineering and Society, University of Virginia

Rebecca Bagley, President and CEO, NorTech

Aaron Bagshaw, President, W.H. Bagshaw Co.

Matthew Burnett, Founder, Maker's Row

Jennifer Clark, Associate Professor, School of Public Policy, Georgia Institute of Technology

John Engler, President, Business Roundtable; Former Governor of Michigan

James Fallows, National Correspondent, The Atlantic

James Manyika, Director, McKinsey Global Institute; Senior Partner, McKinsey & Company

Kate Sofis, Founding Executive Director, SFMade

Howard Wial, Executive Director, Center for Urban Economic Development, University of Illinois-Chicago

Executive Summary

Sixty years ago, it was an article of faith that “as GM goes, so goes the nation.” For generations, manufacturing was a bellwether for the health of the U.S. economy and the vitality of the American Dream. Sadly, since GM President Charles Wilson first popularized this axiom, U.S. manufacturing has experienced a slow and painful decline. It is no coincidence that the promise of the American Dream—where individuals are rewarded for initiative and hard work and are able to achieve homeownership, access to health care and higher education, and a secure retirement, in hopes of providing a better life for their children—has in turn become more difficult to attain. Rebuilding the American Dream will require a national effort encompassing a broad range of policy areas. But if the Dream is to be restored, that work must begin with the longtime engine of middle-class jobs: American manufacturing. That was the charge of this commission.

We focused specifically on small- and medium-sized manufacturing enterprises (SMEs)¹. According to the 2010 Census, the more than 258,000 manufacturing SMEs in America represent more than 98 percent of all manufacturing firms and employ 4.9 million workers. While overall manufacturing employment declined from 21 million in 1972 to 10 million in 2010, the share of jobs provided by SMEs has grown from 29 percent to 45 percent. Even in the rubble of the Great Recession, SMEs were one of the few sectors of the American economy to thrive. Further, approximately 90 percent of the inputs used by multinational corporations come from SMEs, providing further incentive to dedicate our national attention to supporting this vital sector.

But as National Association of Manufacturers President Jay Timmons quipped, “Today’s manufacturing is not your grandfather’s manufacturing.” Much like other industries

1. The Small Business Administration defines SMEs as firms with less than 500 employees.

that have endured disruption in recent years, the sector is being forced to develop new models to adapt to a changing landscape marked by technological breakthroughs such as 3D printing, cloud computing, and the Internet of Things; increased demand for customized, high-value products; and burgeoning global markets. To be sure, America's economic future will be driven by the ability of our "makers" to fulfill the demands of the 21st-century global economy.

Recent history has demonstrated that SMEs have the agility to capitalize on this dynamic new environment. Nonetheless, barriers still remain. Outpacing the global competition requires a highly skilled workforce, yet there exists no efficient mechanism to match supply and demand within the labor market, leading to systemic inefficiency. The pipeline of skilled workers is impeded by a K-12 culture that often stigmatizes workforce training and careers in manufacturing, which then results in a lack of collaboration between private enterprise and higher education. Undertaking a serious, comprehensive effort to change how manufacturing jobs and workforce training programs are viewed is a critical part of supporting the next generation of makers and the future growth of America's SMEs.

Even when skilled workers enter the labor market, SMEs often lack access to the capital required to invest in these workers or in the vocational training imperative to keep their workforce current. And many SMEs do not possess the know-how to institute the latest technology trends, connect with other points on the supply chain, or bring their products to market.

Addressing these barriers is a significant undertaking. The connective tissue that binds these challenges is that they all relate to our nation's innovation capacity. Innovation is an important indicator of the overall economic health of a nation and, more broadly, of competitiveness on a global scale. The nimbleness and energy often associated with smaller firms poises SMEs to be on the cutting edge of innovation, driving change in products, services, processes, and overarching business models. It is at the core of growth and value creation for individuals, organizations, and society as a whole. Thus, it is vital to the restoration of the American Dream.

We therefore propose six bipartisan, action-oriented ideas (summarized on the next page) to accelerate the pace of innovation for America's small- and medium-sized manufacturers.



Talent Investment Loans to Expand Human Capital

Government-backed talent investment loans will give SMEs the capital to hire the workers necessary to expand their businesses, as well as to up-skill these and current employees. These loans will include incentives to encourage economic and social goods, such as worker retention, attainment of certified skills, and hiring from target populations.



Upside-Down Degrees to Connect Classroom Learning with On-the-Job Learning

“Upside-down” programs allow students to transfer accredited technical training, work experience, military training, or community college coursework as credit toward a bachelor’s degree. Expansion of such programs, with emphasis on manufacturing-related fields, will reduce barriers between skills training and degree attainment, and enhance the quality of the manufacturing workforce.



A Skills Census to Build a More Efficient Skilled Labor Force

A regular survey of employers to determine current and projected skills needs – commissioned by state governments, with data freely available to the public – will allow businesses, policymakers, and educators to tailor their programs in real-time in order to forestall projected imbalances between skills and employer needs.



A National Supply Chain Initiative to Fully Map America’s Manufacturing Ecosystems

A fully-mapped manufacturing supply chain will allow businesses and policymakers to fill gaps in the existing infrastructure and keep up with rapid changes to ecosystems formed around emerging technologies. A toolkit for SMEs will allow small manufacturers to extract maximum value from participation in the supply chain.



Up-Skilling High School Students with Expanded Technology and Engineering Certification Programs

All students should have the opportunity to acquire a certified technical skill before graduating high school. Just as Advanced Placement tests offer transferrable college credit, electives in technology and engineering with optional, industry-recognized certification exams should be available to high school students to build a more skilled and responsive labor market.



A “Big Trends-Small Firms” Initiative to Diffuse the Latest Technologies to Manufacturing SMEs

Emerging technologies promise to produce major disruptions to established business models, yet SMEs often do not possess the tools to leverage these technologies. A “Big Trends-Small Firms” initiative, implemented through the Commerce Department’s Manufacturing Extension Partnership, will connect small- and medium-sized manufacturers with the latest trends.

Together, these recommendations wield transformative potential. Talent investment loans allow companies to expand their human capital. Upside-down degrees move us toward a more flexible education system with emphasis on skills in demand. Market surveys help disseminate the data required to enable stakeholders to understand their strengths and shortcomings, and act on them. A fully-mapped supply chain will reveal new growth opportunities for SMEs. Certification programs give students a greater chance to both receive and qualify for meaningful employment in the new skills-based manufacturing economy. And finally, bringing the latest technology trends back to the manufacturing base will ensure that SMEs have the tools to compete in the global economy.

In developing these ideas, we were guided by three fundamental principles:

- » First, our focus was limited to what we deemed to be *remediable problems*. While all problems are theoretically solvable, some simply have little chance of being enacted in today's political climate. For instance, comprehensive tax reform and an overhaul of the nation's energy policy were two areas identified by this commission as critical to U.S. economic and manufacturing growth. While we strongly urge policymakers to identify a way forward on both issues, we agreed that the environment is not ripe for such grand reform and was thus beyond the ambit of this body.
- » Second, the recommendations had to have a *viable path to implementation*. A wide range of perspectives and interests across the political spectrum, both within the commission and outside, had to be considered. We had to possess reasonable confidence that the ideas could marshal broad support from key stakeholder groups. In addition, it was imperative that each recommendation included identifiable catalysts to action.
- » Third, the recommendations had to *add value to the marketplace of ideas*. In the course of our work, we found that there were key areas of our commission topic where either good work was being done or sound ideas had already been proposed. For instance, we believe the future of American manufacturing will be largely determined by our success in generating a skilled workforce. Yet, the Aspen Institute has already developed an outstanding model to address this challenge with its Skills for America's Future initiative. Therefore, rather than proposing new models to supplant this work, we focused instead on where we could add value.

In the broad historical sweep of American manufacturing, we are in the midst of fulcrum years. Our manufacturing SMEs are poised to capitalize on the opportunities available in the 21st-century global economy—and with it, the ability to create stable, middle-class jobs. But they must possess the tools needed to remain at the vanguard of innovative capacity. We urge policymakers, business and industry leaders, educators, and social entrepreneurs to act on these recommendations.



IDEA #1:

Talent Investment Loans

Challenge

Having the right talent is essential to the growth and success of SMEs. Small- and medium-sized firms can grow rapidly, and existing staff often cannot keep pace with the demands of growth, thus impeding the ability to exploit opportunities for expansion. In addition, the smaller the business, the more areas of specialization each employee has to cover. It is not uncommon for one person to manage marketing, communications, and IT at the same firm, for instance. Finding quality talent that is able to provide expertise in essential business functions is critical to a firm's ability to scale up.

SME owners often know the talent they require but lack the money to invest in new workers. Funding provided by microloan programs is often insufficient to hire a full-time worker for any meaningful duration—SBA's Microloan program provides up to \$50,000 in funding, with an average loan of just \$13,000. More traditional financing can be an onerous process as well. And the current lending environment prioritizes loans for equipment and other non-human investments over new hires or income replacement. The need for loans to hire new talent is particularly acute within the manufacturing sector, where high-skilled workers are pivotal to deploy the innovations that will increase productivity and enhance firm competitiveness.

As part of the 2009 American Recovery and Reinvestment Act (ARRA), states were permitted to allocate \$1.3 billion toward subsidized employment programs to reduce unemployment and teach new skills, thereby stimulating economic growth. More than 260,000 subsidized jobs were created before funding expired in September 2010. A new mechanism, sustainable in this time of fiscal constraint and broadened to include high-skilled and high-demand talent, is needed to stimulate similar employment and firm growth.

Idea

We propose the creation of low-interest-rate “talent investment loans” (TILs). Unlike incentive programs such as the Work Opportunity Tax Credit, where the injection of capital is delayed until taxes are filed, TILs would provide capital up front. The loans would be built according to specific guidelines with the government acting as guarantor, similar to SBA loans. However, we recommend that the loan application process be streamlined to allow easier access (the two-page pre-qualification under San Francisco’s Jobs Now program is an effective model). The loans would have low, fixed interest rates. Firms could be given a one-year, interest-free grace period on loan payments so that savings can be directed toward growth activities.

While loan programs should be tailored to the needs and objectives of each participating state for maximum impact, three general guidelines are suggested. First, similar to Social Impact Bonds, the terms of the loan should become more attractive based on certain value criteria being met; for instance, employee retention, hiring from a population in need, or enabling new and existing workers to earn an industry-recognized credential. Ultimately, loans will be forgiven for companies that achieve pre-determined benchmarks as determined by participating jurisdictions, such as passing employment thresholds or increasing tax receipts. While such incentives may advance economic or social goods, the main goal is to provide greater opportunities for companies to add—and retain over the long run—high-skilled and high-demand talent.

Lessons from **History**

Investing in Skills: FDR and the National Youth Administration

In 1935, President Franklin Roosevelt initiated the National Youth Administration to enable students to continue their educational training by providing grants in exchange for “work study” and to equip non-students with skills training to help them find gainful employment. While this grant program differs from TILs, some lessons may be instructive. The program succeeded in stanching unemployment, while also developing the skills and talents of America’s next generation. By 1937, there were more than 400,000 NYA youth either employed or in job-training programs, and growing numbers received skills training in defense-related industries following the outbreak of World War II. The NYA was dissolved in 1943 due to low unemployment and reduced worker numbers following America’s entrance into World War II.

MISSISSIPPI TAKES 'STEPS' TO LOWER UNEMPLOYMENT, GROW BUSINESS

In 2010, Mississippi Governor Haley Barbour launched the Subsidized Transitional Employment Program and Services (STEPS) program using ARRA funds. Initiated to meet the needs of Mississippi businesses while also providing income and transferrable work skills to the state's long-term unemployed, the program provided a wage subsidy to employers who hired from a specific population in need. Businesses received a 100 percent wage subsidy for the first two months, which was "stepped down" to 25 percent by the sixth month. After that, employers had to pay full salaries. Priority was given to businesses with 25 employees or less, and a quarter of the placements came in the manufacturing sector. Between January and September 2010, 3,228 adults were placed into new jobs, and 47 percent of workers were retained after the subsidy ended. Participating workers also saw their average annual earnings increase by 54.7 percent in the year after STEPS compared to the year before. Over 80 percent of participating firms said STEPS had a positive effect on productivity, profits, the number of workers able to be employed, and employee satisfaction. When federal funding ended, the state used the governor's discretionary funds to continue a four-month wage subsidy program, STEPS II, from August to December 2011.

Second, a September 2013 study by the Economic Mobility Corporation examining a set of ARRA-funded employment subsidy programs found that the subsidy duration correlated with employers' likelihood of participating. And since a majority of participating companies created new positions to bring on subsidized workers, greater participation equated to more jobs. Loans for new employees should cover no less than one year of wages to minimize the use of loans to hire temporary workers and give employees time to learn transferable skills and complete certification programs, which will in turn increase the prospects for retention or applicability elsewhere.

Third, since the principal goal of TILs is to increase the talent pool of the manufacturing workforce and improve human capital, loans must be structured to meet employer needs. Employers should be able to utilize these loans to attract new workers and augment the skills of current employees. Costs associated with training, test preparation, and credentialing should be allowed. Finally, policymakers must ensure that companies use TILs only to expand hiring and training rather than funding existing or planned activities.

Impact

- » **Workers** By giving SMEs access to the capital needed to bring on new talent, demand will more often meet supply. This provides a more favorable labor market for individuals seeking the income necessary to join the middle class. Expanded opportunity for certification programs will allow workers to gain important skills transferrable to better employment prospects. In addition, if TILs are combined with other existing loan and grant programs (e.g. Pell Grants—see Idea #2) to reduce the size of the needed loan, companies will have an added incentive to hire these employees.
- » **SMEs** Expansion of the current business lending model to include human capital could have a transformative effect on SME firm growth. An Economic Mobility Corporation survey of employers found that the investment in human capital generated a variety of “positive effects,” including increased productivity (79 percent), job growth (77 percent), profits (76 percent), and the ability to recruit qualified workers (68 percent).
- » **Local Economies** By reducing costs and expanding opportunities to hire new employees, TILs will increase the likelihood that a business will expand its workforce (and, thus, the ratio of income-earning people contributing to the local economy), leading to economic growth within participating jurisdictions.

Catalysts

- » **Federal Government** Federal appropriation, allocated to states to develop and execute their own programs, is recommended. The shift from subsidies to loans with performance benchmarks will reduce the needed funding and should enhance bipartisan support. Policymakers should consider the creation of a dedicated fund, similar to a state revolving fund, which would only require initial capitalization. Before allocating new funding, policymakers should review current federal job training and loan programs to determine if the necessary funding for TILs can be found within existing programs.
- » **State and Local Governments** The employment subsidy programs initiated using ARRA revenue demonstrated that the infrastructure exists to manage a TIL program at the state and local levels. If federal funding is unavailable, state and local governments will also have to find feasible ways to fund these programs, much as they did after ARRA funding ceased (see box on page 14). Consideration of funding options would be up to the governing bodies of each participating jurisdiction.



IDEA #2:

Upside-Down Degrees

Challenge

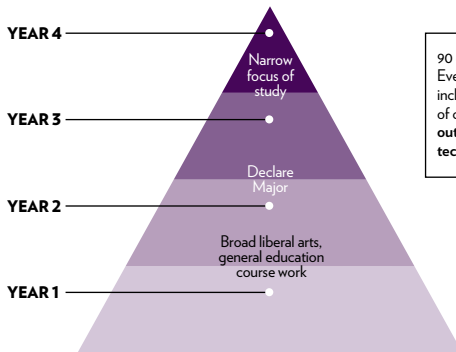
For generations, America's leading manufacturing SMEs have succeeded by combining practical production knowledge with the business acumen needed to raise capital, take goods to market, and grow organizations. Corning, Incorporated serves as such an example, founded in 1851 by glassmaker Amory Houghton and led by the Houghton family for more than 150 years. One key to that continuity was to ensure that various members of their extended family simultaneously acquired technical and managerial expertise to ensure cohesion across the firm.

Unfortunately, our current system tends to disconnect skills acquisition and higher education. If a young person wants to learn a skill—say programming, basic electronics, or welding—then he or she must learn that skill through classes at a vocational high school or community college, or via an apprenticeship program. Meanwhile, acquiring the management, finance, or marketing knowledge necessary to run a business presumably requires a four-year degree.

More troubling is that students are given little incentive to connect these two tracks. Colleges and universities frequently do not offer transfer credit for technical skills acquired either on the job, in community colleges, in the military, or through training. As a result, students must essentially start over when seeking a bachelor's degree. The time and money required to overcome that obstacle is often too large an impediment. Further, this decision is made with an ongoing stigma against the skills path as its backdrop. Consequently, young people are inherently swayed against attaining the skills necessary to pursue careers in manufacturing, not to mention that they have not received the well-rounded education required to succeed in the 21st-century industrial workplace.

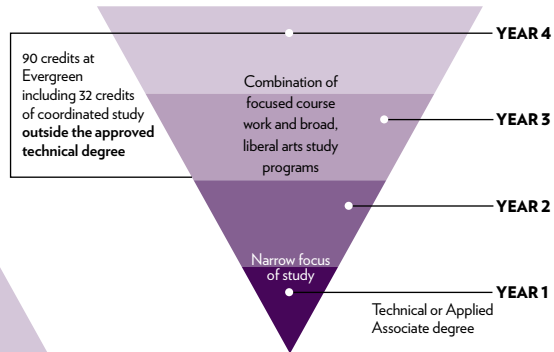
Traditional Four-Year College Curriculum Model

Bachelor of Arts = 180 quarter hours credits



Upside Down Degree at Evergreen Curriculum Model

Bachelor of Arts = 180 quarter hours credits



Source: Evergreen University Upside Down Degree Program

Idea

To overcome this disconnect, we propose an expansion of upside-down degrees. In a handful of states, educational institutions are experimenting with programs that allow varying combinations of technical training, military training, associate's degrees, or job experience to directly transfer as up to two years of college credit. Students then need only complete the remaining coursework to earn a bachelor's degree from a four-year institution. This type of program is referred to as being "upside-down" because it essentially inverts the traditional four-year college model. Undergraduates at most universities begin their studies with broad interdisciplinary subjects such as writing, mathematics, or science and then advance to more specialized courses. Upside-down students start with the focused technical training and then take the broader coursework to both expand their knowledge base and enhance their critical thinking (see diagram above).

Existing upside-down degree programs effectively facilitate the transfer of students from community colleges to public universities. Yet, they tend to focus primarily on the liberal arts. We recommend that colleges and universities expand the concept of upside-down degrees to include business and engineering programs. Should a major state university endorse the concept, it would significantly change the adoption curve and allow the integration of technical skills and business aptitude to move forward on a national scale.

EVERGREEN STATE COLLEGE STAYS AHEAD OF THE LEARNING CURVE

Evergreen State College in Olympia, Washington, is a trailblazer in the concept of upside-down degrees. Evergreen accepts transfer applications from students who possess either a two-year technical degree or an Associate in Applied Science-Transfer (AAS-T) degree. The applicant is considered eligible as long as his or her previous school holds accreditation. Two-year degrees transfer directly as two years of completed coursework toward a four-year degree from Evergreen. Applicants are also eligible to receive a full semester's worth of transfer credits for non-academic vocational or technical work completed. The program has been in place for more than thirty years and has seen steady growth, with additional degree offerings added every year.

Impact

- » **Students, Workers, and Military Personnel** The faulty premise that one must choose between becoming a technician or a college graduate is diminished. Degree seekers will have a stronger incentive to acquire technical skills. College will be more attractive for those already in the workforce or with military training who want to pursue a degree and view the upside-down path as a viable option. It will also be more affordable for those that have acquired in-demand skills and secured a high-paying job that helps cover costs. These costs would be further mitigated if Pell Grants were to become available for workforce training programs (see page 19). Concurrently, reduced classroom time translates to a diminished student debt burden, and increased program flexibility should positively impact retention rates.
- » **Employers** Companies would have access to a more dynamic and diverse talent pool. Potential employees would understand the specifics of production and also what it takes to run a business. Such versatile human capital would be of particular impact to SMEs, who rely heavily on workers who can perform a diverse set of tasks.
- » **Educational Institutions** Upside-down degree programs will allow community colleges and universities to attract more students, and thereby generate greater revenue. Further, enhanced cooperation with non-four-year institutions will improve the quality of transfer students.
- » **American Manufacturing** Upside-down degrees should aid in mitigating the stigma against manufacturing work amongst young people.

Catalysts

- » **State and Federal Government** The market alone has not generated widespread adoption of upside-down degree programs. Government has a few policy levers it can use to enact change. Financial incentives such as tax breaks or subsidies for participating institutions might be considered for both public and private universities. States must also aggressively market this idea as a viable path for both high school students and incumbent members of the workforce, and make it easier for degree-seekers to attain credits, not only when enrolled in an educational institution, but also when pursuing workforce training programs that will transfer as college credit. For instance, it is worth considering an expansion of Pell Grants to cover such training programs.
- » **Colleges and Universities** Upside-down degree programs will not reach a critical mass until larger universities with a national brand participate, especially major public university systems and leading private research universities (e.g., Carnegie-Mellon and MIT). Schools that emphasize manufacturing-related fields and possess strong ties to the private sector should take the lead in implementing pilot programs. It will also be important that schools offer night, part-time, online, and accelerated options as many prospective applicants will need to continue working while completing their degrees.

Lessons from History

The Upside-Down Education of Nikola Tesla

Although he didn't plan it that way, one of America's great inventors, Nikola Tesla (1865-1943), had a type of upside-down education. He began by studying mathematics and physics for two years at the Joanneum Polytechnic Institute in Graz, Austria. When his military scholarship was cancelled in 1878, Tesla dropped out and went to work in a machine shop. After his father died, Tesla was persuaded by his uncles to honor his father's memory and resume his studies, this time at the Karl-Ferdinand University in Prague. There, Tesla studied languages and philosophy. The result of this unusual educational journey was that Tesla could not only invent new electrical equipment but also could market his inventions by drawing on science, poetry, and business. His upside-down degree gave him the metaphors and stories he used to capture the imagination of both the public and investors.



IDEA #3: Skills Census

Challenge

A persistent problem confronting American manufacturers today is the so-called “skills gap”: employers would like to hire more workers but can’t find individuals with the desired skills. In a 2012 MIT survey of manufacturing employers, 41.4 percent responded that the most important reason for significant long-term job vacancies was that “candidates lack specific skills” for their industry; 17.8 percent of employers surveyed said that was the second most important reason. Groups within both the public and private sectors are working to address this gap. Among the more familiar themes are Common Core Standards in K-12 education; enhanced science, technology, engineering, and math (STEM) programs; skills certification initiatives; and a renewed focus on skills training at community colleges.

We laud these efforts in the main and are heartened by the mobilization of various stakeholder groups. However, expert opinion remains mixed as to the extent and composition of the skills gap. The lack of consistent and reliable data on the gap between skills in the labor pool and the current and projected needs of employers remains a significant barrier to progress. Employers misunderstand the labor market, job seekers cannot discern the skills they need, the government wastes resources on inefficient programs, and educational institutions do not offer the most relevant coursework. Each negative outcome is to the collective detriment of all parties.

This is a particular challenge for manufacturers. Industrial firms require dynamic individuals with precise skill sets. Unfortunately, firms are often left with suboptimal options as a result. Many choose to hire less qualified individuals and either expend precious resources on training, or not train them, thus functioning inefficiently. Some companies decide that potential workers are so unfit for a vacancy that the firm cannot justify hiring

anyone. The sector-wide figures speak for themselves. In a 2011 survey by Deloitte and the Manufacturing Institute, two-thirds of U.S. manufacturers said they had “moderate to severe shortages of available, qualified workers”—a figure that led to approximately 600,000 unfilled U.S. manufacturing jobs. Systemic inefficiencies on this scale put American manufacturing at a competitive disadvantage within the global economy.

Idea

We propose that state governments commission periodic surveys of manufacturing employers to determine their current and projected needs. Numerous sources of data collection might be utilized, depending on what is most effective for each state. Research could be conducted internally by the federal government, as it does with the Census, or by universities with strong survey experience. The state might also seek a public-private partnership with a polling organization. In any case, the surveys should be simple enough to justify the use of scarce time, particularly among SMEs. Findings would be available free-of-charge on a public website. Policymakers, business owners, educators, job seekers, and other stakeholders would all have input into what’s included in the survey, and equal access to its results.

One viable model for states to consider is Denmark’s “Flexicurity” program

Lessons from History

The National Employer Survey

The U.S. Census Bureau administered a broadly similar program at the federal level twice in the early 1990s. The “National Employer Survey” was conducted by the nonprofit National Center on the Educational Quality of the Workforce in 1993, with a follow-up in 1996. Officials used computer-assisted telephone interviews to question 3,000 businesses on a voluntary basis. The study focused primarily on the link between education and productivity. Data showed that just 80 percent of employers believed that they had a fully proficient labor pool. Companies were not making large investments in basic education or remedial training. And firms tended to look at education level and certification but not scores or performance. The lack of training investment proved to be costly. The data showed that productivity returns on investments in education far outstripped those made in capital stock.

DENMARK'S FLEXICURITY PROGRAM

The Danish government spends more than four percent of its gross domestic product on “job training and support”—nearly six times the U.S. figure in the corresponding area. This includes wage subsidies, unemployment support, and customized worker retraining. The latter is supported by what are known as “business trend surveys.” Danish officials utilize Gallup pollsters to survey employers every three months. Companies are asked to list their projected near-term labor needs. The government then takes the feedback and modifies training programs to avoid labor shortages. The European Union (EU) covers half of the costs, while Denmark pays the rest. The total outlay for 2012 was €335,000. It is difficult to discern the impact of the surveys relative to other elements of Denmark’s broader program to promote adaptability of employees and enterprises in the global economy, known as “Flexicurity.” However, aggregate job numbers are strong. The country’s unemployment rate of 2.8 percent is the second lowest in the OECD.

(see box above). The Danish government regularly surveys employers to uncover foreseeable employment needs. This feedback is then collated for the whole nation. The research is used to tailor training programs in a way that forestalls projected imbalances between skills and employer needs. While the Danish government has a more direct role in its training programs than exists in the U.S., such data would be useful nonetheless in responding to changing employer needs.

Other worthwhile efforts are attempting to address this challenge. For example, ACT recently produced a study that used a proprietary skills database to provide more precise labor market subheadings than the Bureau of Labor Statistics currently does. Starting in September 2013, the Alabama Department of Labor began conducting a telephone survey of manufacturers to determine the skills required of employees by industry. And JP Morgan Chase and Co. plans to produce a series of “workforce readiness gap reports” in selected major urban areas as part of its “New Skills at Work” initiative. However, we maintain that a more comprehensive and sustainable approach is imperative to meet the needs of American manufacturing writ large.

Data should be collected for entire states to ensure that a consistent and reliable information source is freely available to all stakeholders. Employers should offer input as to what they would find most useful in the surveys. Information gathered in the census should include: what workforce development training is available; what the demand is for specific skill sets; pay levels for skills, by industry; and occupation and pay for workers with

different amounts of education, training, and work experience. The skills census would be utilized as a cross-sectional study with comparative value over time.

Impact

- » **State Governments** The state would better grasp employer and regional demand. This data would help maximize the impact of tax incentives, regulations, applied programs, and relocation efforts.
- » **Educators** Educational and training institutions could better tailor their service offerings to meet current and future needs.
- » **Students and Counselors** Students and their counselors at the high school, college, and technical school levels will better understand where opportunities exist and will arise, aiding them in determining viable career paths.
- » **Unemployed Workers** Individuals out of work can use the information to identify which retraining programs will be most effective in their areas. Or, displaced workers could determine where their current skillsets are in higher demand and relocate.
- » **Private Industry** Employers will better understand the labor market using the same methods as the state government. They can alter strategic models using that data or opt to relocate to regions with a supply of human capital that better suits their needs. Employers can also collaborate with educational institutions to improve job placement rates.

Catalysts

- » **State Governments** Surveys should be initiated and managed at the state level where governments and local industry can collaborate with greater efficiency. Many states have a tradition of collecting and disseminating data in order to stimulate economic activity, and there is a vested interest in matching skills with employer needs. They are, therefore, well-positioned to catalyze action.
- » **Private Industry** To maximize the effectiveness of the skills survey, private companies will have to actively participate in the data-gathering process. Companies will also need to provide timely feedback on the precision of the research following each study and help consult as the state attempts to build a platform for the data. For instance, a partnership with a firm like LinkedIn that already has a strong reputation for providing a similar product could be beneficial in building a user-friendly website.



IDEA #4:

Mapping America's Manufacturing Supply Chain

Challenge

The recent improvement in the state of U.S. manufacturing is all the more remarkable when one considers its suboptimal supply chains. While many of America's global competitors have made considerable investments to build a more reliable and transparent supply chain system, U.S. manufacturers have essentially been left to navigate it on their own. Many large companies, such as Wal-Mart, invest heavily in supply-chain management as a source of competitive advantage. But for most manufacturers, particularly SMEs, who do not possess the resources to fully leverage the supply chain, the current system imposes high costs.

A September 2013 report by MIT's Production in the Innovation Economy initiative warned that many of our most innovative ideas—particularly those emanating from individuals and small businesses—are failing to reach the marketplace. This is not for lack of ideation or entrepreneurial spirit. Rather, many SMEs do not possess the know-how to work horizontally to locate the suppliers needed to move beyond the design stage. The potential suppliers, in turn, suffer as similar opportunities pass them by.

The inefficiency of vertical linkages between SMEs and multinational companies (MNCs) inflicts even greater costs. Nearly 90 percent of the intermediate inputs purchased by MNCs are sourced from SMEs, yet large firms often have little knowledge about current and potential suppliers. It is difficult for large firms to identify and certify a replacement if they are not integrated into the digital economy, especially those thousands of miles away. Conversely, when SMEs lose a customer in one industry, their ability to nimbly redesign and retool their product offerings for a different industry is impeded by the lack of awareness of opportunities in adjacent ecosystems. As a result, SMEs are missing out on significant business opportunities with large firms.

Current trends will only exacerbate these aggregate losses. The growth of new supply chain ecosystems driven by emerging technologies such as 3D printing, the increasing specialization of tasks and supply inputs, and the trend toward globalization add a new imperative for supply chain mapping. These ecosystems are highly fluid. They require a modern supply chain to keep up. Unfortunately, America's present infrastructure stalls growth and innovation. As global competitors rush to leverage new technology for their own domestic supply chains, building more fully mapped systems is critical to the future of America's manufacturing SMEs.

Idea

We propose a nationwide manufacturing supply chain initiative with two goals: 1) to fully map America's manufacturing supply chain ecosystems, and 2) to provide a toolkit for SMEs to extract maximum value from participation. The public sector has led some valuable efforts in this area. In July 2013, the SBA issued a request for proposals "to conduct supply chain analysis of disrupted or at-risk regional manufacturing communities." And the Defense Department is conducting an effort to fully map the supply chain of the U.S. industrial base. There also exists a variety of strong private sector and public-private partnership (PPP) models, including pay-for-access networks like Ariba, and platforms linking

Lessons from **History**

Philadelphia Takes on Lowell

While Massachusetts' "Lowell Mills" captures the popular imagination when thinking of 19th-century American textile production, Philadelphia also became a major player in this market by employing its own unique approach. Rather than trying to match Lowell's focus on bulk standard goods, companies in Philadelphia—many of whom were SMEs—concentrated on styled goods and high-value-added textiles with fragmented and variable demand, which firms in Lowell were not set up to produce. At its height, more than 20 percent of Philadelphia's labor pool worked in textiles. The model was based on a concentration of interests. Business owners found it easier to develop relationships owing to relative proximity, which led to expanded subcontracting, idea sharing, and favorable terms in securing financial capital among other benefits. Supply chain actors are less concentrated today, but proper mapping and connectivity can serve a similar function in narrowing the space between production phases.

MAKER'S ROW BUILDS 'MADE IN USA' MARKETPLACE

In 2011, while toiling at The Brooklyn Bakery, a leather accessories maker, Matthew Burnett and Tanya Menendez often struggled to find American manufacturers that could bring their designs to market. The problem was the lack of available information within their ecosystem's supply chain. To solve the problem, they developed a model for a "Made in USA" digital marketplace to connect domestic buyers and manufacturers. In 2012, they brought the concept to life with the creation of Maker's Row. In its first year, the site connected 26,000 buyers to 2,000 domestic manufacturers with its easy-to-access platform. In effect, their platform has plugged holes within a variety of manufacturing ecosystems. The company is working with makers, civic organizations, and government institutions to build digital communities grouped around both industry and geography, with the ultimate goal being an expansion of the framework to other regions across the country.

large firms with SMEs, like the National Supply Chain Network Initiative and Supplier Connection.

This concept is different: Rather than focusing primarily on certifying SMEs and linking firms within the supply chain, we have a broader goal of building a reliable and fully mapped supply chain. By taking a national view, this initiative will expose so-called "holes" and fragile points in the supplier ecosystem, which industries and innovation potential may be affected by those missing elements, and where action needs to be taken. The initiative will be ongoing, ensuring that the platform reflects the current composition of each supply chain. The platform will also include a toolkit for SMEs to fully leverage their participation in the ecosystem. Its focus on long-term SME vitality could help narrow the gap between small and large firms in productivity, input costs, process innovation, access to foreign markets, and other critical drivers of growth.

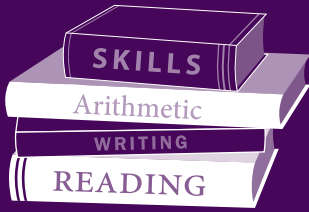
We recommend that this initiative be catalyzed at the federal level by the SBA, who would provide funding, develop norms and protocols, and build the architecture. Once this is completed, we recommend the SBA partner with private or non-profit actors to "steer" the initiative. This bottom-up approach to supply chain mapping, keyed to the rhythms of America's diverse manufacturing communities, offers the greatest prospect for success. The initiative's pilot phase would begin with mapping a small list (no more than three) of select industries and their supply chains to build the most effective framework. If successful, new regions and industries would be added.

Impact

- » **U.S. Manufacturing** This idea holds significant growth potential for SMEs, as well as the nation's broader manufacturing sector, including:
 - » **Job Creation** A March 2011 study found that when small businesses became corporate suppliers, revenues increased by 266.4 percent and job growth rose by 164 percent. In numerous cases, large firms will also be able to avoid offshoring or relocating if the smarter supply chain reveals local suppliers they did not know existed.
 - » **Accessing the Global Marketplace** In large capital goods, foreign MNCs already attracted to the U.S. market will find it easier to partner with American suppliers if they know where to find them, thereby increasing foreign investment. A stronger supply chain may also increase exporting opportunities for SMEs in foreign markets.
 - » **Community Building** Supply chain ecosystems will strengthen communities built around industries, regions, and specialties, and expand networking opportunities.
 - » **Increasing Innovation** The growth of communities also reduces the physical distance between innovation, design, supply, and production. That growth will facilitate cross-pollination across these four stages, leading to a virtuous innovation cycle.
 - » **Marketing** Participation in a mapped supply chain provides valuable awareness of buyers' needs and manufacturers' services. It enhances brand awareness for companies within that ecosystem, particularly SMEs with limited marketing budgets and well-run SMEs located in less economically vibrant regions.
- » **Policymakers** Policymakers at all levels will have more reliable and updated information about the manufacturing supply chain to inform policy development.

Catalysts

- » **Public-Private Partnership** We recommend that the SBA provide the funding and framework for this initiative to ensure that the protocols and resources offered advance the interests of America's SMEs, and that the consequences of mapping on SMEs are properly monitored. They would eventually partner with private and nonprofit actors to execute the project.
- » **State and Local Government** Facilitate growth across the platform by providing critical information on business and industry within their jurisdictions.
- » **Civic Institutions** Trade groups and other professional organizations can cooperate with the organizations conducting the mapping by providing data on manufacturing companies by geography and industry, advising on the framework of the platform, and generating broader awareness and buy-in. In addition, universities can provide original research.



IDEA #5:

High School “TE” Certifications

Challenge

Numerous high schools nationwide are failing to make classes like “shop” part of their offered curricula. For example, Los Angeles County has eliminated shop classes at 90 percent of its public schools. Other districts are following a similar path. The trend is emblematic of a longer-running shift in emphasis toward the completion of a four-year college degree. The problem, however, is that only about two-thirds of high school graduates even pursue post-secondary education. And of those, only 59 percent who enroll in four-year degree programs graduate within six years, and just 31 percent who enroll in two-year degrees receive them within three years. Thus, the more educators move to a one-size-fits-all approach, the more a significant portion of the population gets isolated.

Curriculum changes also underutilize employment projections. According to a December 2013 report from the Bureau of Labor Statistics, occupations that do not typically require postsecondary education (but need skills) are projected to add 8.8 million jobs between 2012 and 2022—more than half of all new jobs anticipated over that span. And yet fewer young people are being given the chance to acquire the skills to meet that demand.

American manufacturing, in particular, depends on employees who possess a wide range of skills not being taught in high school. For instance, the number of jobs in “computer systems design and related services” is expected to grow over 68 percent by 2020. However, according to the Hour of Code campaign, led by Code.org and supported by President Obama, nine out of ten high schools do not offer a computer programming class. Clearly, there are systemic deficiencies preventing us from meeting the skills demands of the 21st century.

A key problem is that numerous individuals still look at “shop” classes as an antiquated,

unnecessary expense. Experts concur at this point that education in science, technology, engineering, and math (STEM) is critical to the nation's future, and educators have answered the call by pushing math and science to the forefront. Yet, somehow the “T” and “E” in STEM are being overlooked. Educators are failing to connect the dots between vocational electives and their essential role in readying the nation for a future so dependent on technology- and engineering-based growth. A concerted effort must be made to enact a paradigm shift and break through the pervasive stigma that engenders these sorts of outcomes.

Idea

To reverse these trends, we propose an expansion of technology and engineering electives with optional, industry-recognized certification components. Every high school graduate—whether pursuing college, the workforce, or military service—should have the opportunity to acquire an industry-recognized skill that they can use to find work. Thus, the availability of electives in diverse areas ranging from pipe fitting to robotics should be expanded in high schools across the country. Students should then be able to convert these electives into a certification that will boost their marketability to employers.

We envision this program functioning similar to Advanced Placement (AP) courses,

Lessons from History

The Smith-Hughes Act of 1917

At the turn of the century, economic depression and rising competition from Europe revealed the need for more skilled labor in the United States. President Theodore Roosevelt emerged as an early advocate for technical training and began a national push for its inclusion in public education together with the American Federation of Labor, the National Association of Manufacturers, and various educators among other groups. With the support of President Woodrow Wilson nearly two decades later, these efforts resulted in passage of the Smith-Hughes Act of 1917. The Act provided federal funding to states for vocational education programs in the public school system, and thus “shop” class was born. Prior to the passage of the Smith-Hughes Act, U.S. vocational students numbered just 200,000, with a budget of under \$3 million. These figures grew to 3.4 million students and \$176 million in annual spending by the end of the 1950s.

A SHOP CLASS FOR THE 21ST CENTURY

Georgia's Dalton High School is redefining traditional notions of taking "shop." The school has outfitted its classroom with welding stations, 3-D printers, and a computer-controlled plasma cutter. Across the hall, students can participate in robotics projects. Seventy-four percent of Dalton High's students are enrolled in career or technical coursework. According to Principal Steve Bartoo, vocational training is part of a well-rounded education for today's economy—"it's not an either/or with us." The school combined these rigorous career and technical programs through a partnership with CTE. In the past decade, the school has lifted its graduation rate from 56 percent to 92 percent, doing so even as education funding in Georgia has contracted roughly 15 percent per student since 2002. Undeterred, Dalton officials supported the new CTE programs via state grants and a redirection of funding for previously offered electives deemed less impactful.

where students may take an exam that can transfer directly as postsecondary course credit. In our program, students will have the chance to demonstrate proficiency in a skill area and transfer the vocational certification to an employer rather than an educational institution. Taken on aggregate, all parties will benefit. Employers will access a stronger labor pool with reliable credentials. Individuals without postsecondary education will have expanded opportunity for quality, good-paying jobs. And the U.S. labor force will operate with greater efficiency, particularly in mid-skill positions. Managed in conjunction with the data provided in the skills census (see Idea #3), states can be agile in their programmatic offerings and ensure that the skills training provided matches the current and projected needs of employers.

Existing skills programs offer some useful lessons. The Career Technical Education Consortium (CTE) runs a skills certificate program popular in Utah, where it awarded 103,963 such certificates (though not a formal certification program) last year. Perhaps the most impactful way to certify skills would be via public-private partnerships with companies like Cisco and associations like CompTIA that are industry leaders in defining standards for employers (this would be the most costly option as well). There is also value in the "digital badge" developed by the Alliance for Excellent Education to help students track their acquired skills online. A program that includes an amalgam of best practices should be produced to ensure the most transformative impact, with the goal being to provide students with a path to the certification programs most prized by American manufacturers.

Impact

- » **Students** High school graduates looking to immediately enter the workforce would have something applicable to add to their resumes. College students could use the certificates to find part-time work while in school. College graduates would have something to augment their diplomas. Finally, if certifications became commonplace, the stigma surrounding skills-based careers would likely diminish.
- » **Manufacturers** While some may utilize these skills for positions outside the manufacturing sector, widespread adoption would greatly increase the quality and quantity of the labor pool available to manufacturing firms. And a skills certification movement could be coupled with broader efforts to promote the importance of manufacturing in American life and hence attract more young people to careers in the field.

Catalysts

- » **State Governments/Local Districts** State departments of education must take the lead with this concept, with implementation at the local level. The government can continue to work within programs such as CTE to strengthen the link between industry demand and academic programs. Governors could also become more actively involved by pursuing public-private partnerships with organizations such as Cisco and CompTIA to save money and ensure that students receive industry-standard accreditation. The state would need to seek similar partnerships with manufacturers of high-quality equipment for use in the classroom. Governors will also be instrumental in funding. Increasing portions of K-12 budgets directed toward workforce training and development would help. Another idea is to administer a cost-share plan with the federal government that includes financial incentives for participating schools and companies willing to subcontract their services. These financial measures should increase in areas of greater socioeconomic need, given that schools in lower income areas tend to need these options most, yet have the fewest resources.
- » **Federal Government** The U.S. Departments of Education and Labor can play a valuable role in broadly promoting the idea that skills are an essential part of a 21st-century education. For example, the White House could leverage a program like its “Skills for America’s Future” initiative and broaden its mission to form industry partnerships in order to increase high school certification programs. A federal imprimatur would give such programs greater clout within various industries.
- » **Trade Associations** Once implemented, other industry groups could articulate the need for skills and advocate for other forms of know-how available to high school students.



IDEA #6:

“Big Trends–Small Firms” Initiative

Challenge

In a May 2013 report, the McKinsey Global Institute identified a set of rapidly developing technology areas with the potential to “transform life, business, and the global economy.” For example, progress in the field of advanced robotics was projected to generate between \$1.7 trillion and \$4.5 trillion in economic impact by 2025. Also highlighted was the Internet of Things—placing sensors in physical objects and connecting data on these objects across a network—which is being heralded by some as the next Industrial Revolution. Many of the technologies listed will produce major disruptions to established business models, including in the manufacturing sector.

SMEs are especially vulnerable to technology-driven disruptions. Keeping current with technology—particularly cutting-edge technology—can require large capital investment and strategic commitment. SMEs are often late adopters compared to larger firms, and many are unable to overcome these barriers. As the power of technology increases, the gap between the haves and have-nots, and the attendant benefits (e.g., productivity gains, process innovation), widen. Most troubling, America’s global competitors are devoting comparably more attention to connecting SMEs with the latest technology.

Keeping American manufacturing at the forefront of innovation has been a key element of President Obama’s domestic agenda. He has proposed the creation of 45 “manufacturing innovation institutes” to generate breakthroughs in various manufacturing-related fields. The National Additive Manufacturing Innovation Institute was launched as the pilot program in August 2012, and the administration has announced the creation of three more institutes, on next generation power electronics, digital manufacturing and design, and lightweight and modern metals manufacturing.

As new advances are made by these institutes and others, diffusion of the latest trends back to the nation's SME manufacturing base will be critical. To achieve these goals, two elements are essential: a standing national effort to track the latest trends and analyze how they impact the work of manufacturing SMEs, and a vehicle to connect with SMEs and empower them with the resources in order to leverage these technologies.

Idea

We propose broadening the scope of the Commerce Department's Manufacturing Extension Partnership (MEP) to include a "Big Trends-Small Firms" initiative charged with examining the latest technology trends and delivering them back to the manufacturing SME base. For the past 25 years, MEP centers in each of the 50 states have provided SMEs with a variety of performance-enhancing services. While the program focused traditionally on facilitating lean manufacturing expertise, in recent years MEP has shifted to its Next Generation Strategy, which aims to make SMEs more competitive and innovative. We agree that this course is sound, and adding this new element on technology trends remains in line with the program's broader strategic objectives.

MEP's existing public-private model is well-positioned to implement a "Big Trends-Small Firms" project. Under our plan, the National Institute of Standards and Technology (NIST), which oversees MEP, would be responsible for tracking the latest technology

Lessons from History

The Morrill Acts of 1862 and 1890

As agriculture grew more mechanized in mid- to late-19th century America, the federal government grew concerned that not enough citizens had the requisite knowledge in science and engineering to keep up. Thus, Congress offered free federal land to states that would establish "land-grant colleges" to teach a variety of critical subjects, such as agriculture and mechanic arts. Through the indirect provision of human capital improvement, the federal government was able to assist small businesses and entrepreneurs to adapt to changing trends. The Act fundamentally altered education in two key ways. Land-grant colleges marked a shift from classical studies to more applied coursework with direct ties to work outside of the classroom. The legislation was also significant in its provision of educational support directly from the government.

INNOVATION: CANADA'S INDUSTRIAL RESEARCH ASSISTANCE PROGRAM

Those advocating a stronger role for the public sector in facilitating national innovation capacity often point to Germany's Fraunhofer Society or Taiwan's Industrial Technology Research Institute (ITRI) as the vanguard of this concept. Also on this shortlist is a program that has generated success right in America's backyard: Canada's Industrial Research Assistance Program (IRAP). For more than 60 years, IRAP has been the primary mover in expanding access to new technology trends among Canada's nearly two million SMEs. Designed to "stimulate wealth creation for Canada through technological innovation," IRAP provides "technology advice, assistance and services to SMEs to help them build their innovation capacity." Unlike the Fraunhofer and ITRI, IRAP does not conduct research, focusing more squarely instead on supporting SMEs. The success of IRAP and the importance of innovation in the 21st century global economy led the Canadian government to double the program's support in 2012, to CA\$220 million per year.

trends, including those emanating from the manufacturing innovation institutes referenced above. It would then work with state MEP centers to assist SMEs in leveraging these new technologies. NIST MEP headquarters would also look to state MEP centers, nonprofit organizations, consultancies, and international peers to discover and apply best practices.

The market for dispersing big ideas back to the manufacturing base is already strong. For decades, in the absence of a viable public model, non-profits have cropped up to advance innovation and economic development among small- and medium-sized firms. For instance, NorTech was founded in 1999 to advance economic vitality in Northeast Ohio by accelerating the pace of innovation and fostering clusters in high-tech industries. But organizations such as NorTech can only reach a small percentage of existing manufacturers, and where they do not exist most SMEs cannot afford private consulting fees. To advance these goals on a national scale, support at the federal level is imperative.

Impact

This initiative offers significant advantages for manufacturing SMEs, including:

- » **Firm Growth** It is estimated that each dollar of federal investment in MEP yields nearly \$19 in new sales growth and \$21 in new client investment.
- » **Participation in the Digital Economy** Increased technological know-how will allow

SMEs to continue to leverage new technology going forward and be more active participants in the rapidly growing digital economy, which is projected to add up to three billion more potential consumers by 2025.

- » **Flexible IT** By delivering applications and services via networks or the Internet, cloud technology (one of the leading trends) has the potential to reshape how SMEs utilize and manage their IT. Rather than investing capital in a sophisticated IT infrastructure, SMEs can opt for a pay-as-you-go model, scaling up or down as necessary. This allows them to test the value of new technology without a significant capital investment. They can also access this technology anywhere through mobile technology.
- » **Efficient Workforce** Technology allows companies to build a more efficient and productive employee base. Social networks enable companies to access a much larger talent pool. With online meeting tools, companies can hire workers who would be unable to work in the office, and can work remotely and tap into part-time and contract work more easily as business demands rise and fall.
- » **Operational Improvement** The list of operational improvements enabled by technology is seemingly endless. By accessing part-time or off-site workers to fill certain administrative tasks, higher-paid workers will be able to focus on the most high-value tasks. Sensor technology will enhance productivity from those monitoring equipment, inventory, and product flows. Financial transactions will be streamlined. Mobile internet applications will aid knowledge workers at all levels—from those monitoring the supply chain to those in marketing, sales, and customer service capacities. If harnessed properly, technology can yield significant savings for SMEs via operational improvements.

Catalysts

- » **Government** The role of NIST MEP headquarters in driving this initiative has been outlined above. Proper funding will be crucial to its long-term success. In 2013, the federal government contributed roughly one-third of MEP's approximately \$300 million budget. Additional funds for MEP centers come through state governments, client fees, and philanthropic organizations, with a federal match of one dollar for every two dollars raised by each center. To avoid the ebbs and flows of these revenue streams, we recommend revising the match formula to ensure sufficient and sustainable funding.
- » **MEP Centers and Nonprofits** Existing MEP centers and nonprofits devoted to fostering connections between businesses, research institutions, and government will ultimately provide the implementation capacity to power this initiative.
- » **SMEs** In FY2013, MEP served more than 30,000 SMEs nationwide. We anticipate continued buy-in to services provided by MEP centers under the Big Trends-Small Firms banner.

Commission Members

Co-Chairs

»» **Evan Bayh**

Partner, McGuire Woods; Former U.S. Senator (D-IN) and Governor of Indiana

Evan Bayh is a partner at McGuire Woods and a senior advisor at Apollo Management in New York. He served two terms as the governor of Indiana from 1989 to 1997 and two terms in the U.S. Senate (D-IN) from 1999 to 2011. While in Congress, Bayh was a member of several committees, including Armed Services; Banking, Housing and Urban Affairs; Energy and Natural Resources; Small Business and Entrepreneurship; Aging; and Senate Intelligence.



»» **Haley Barbour**

Founding Partner, BGR Group; Former Governor of Mississippi; Former RNC Chairman

Haley Barbour is a founding partner of government affairs firm BGR Group. Barbour returned to BGR after serving two consecutive terms as governor of Mississippi from 2004 to 2012. During his tenure as governor, he attracted numerous large economic projects in the energy, aerospace, and automotive fields to Mississippi, and per capita income in the state rose by 34 percent. While governor, Barbour served concurrently as the chairman of the Republican Governors Association from 1993 to 1997.



Lead Scholar

» W. Bernard Carlson

Chair of the Department of Engineering and Society; Professor of Science, Technology, and Society; Professor of History, University of Virginia

W. Bernard Carlson chairs the Department of Engineering and Society at the University of Virginia. He is also professor of science, technology, and society and professor of history at U.Va., and his specialties include the history of technology, American business history, and entrepreneurship. Carlson is the author of *Tesla: Inventor of the Electrical Age* (Princeton University Press, 2013), and he is editing *The Handbook of the History of Technology* for Oxford University Press.



Commissioners

» Rebecca Bagley

President and Chief Executive Officer, NorTech

Rebecca Bagley is president and chief executive officer of NorTech, a technology-based economic development organization focusing on Northeast Ohio. She joined NorTech from the Pennsylvania Department of Community and Economic Development (DCED). At DCED, she served as director of venture investment and deputy secretary for the technology investment office, with responsibility for the administration of several major state initiatives and investments. Bagley writes about regional economic development as a contributing writer for Forbes.com.



» Aaron Bagshaw

President, WH Bagshaw Co.

Aaron Bagshaw is the president of WH Bagshaw Co. Formed in 1870, the family-owned company, based in Nashua, New Hampshire, is the oldest pin manufacturer in the United States. It has evolved its manufacturing to perform computer numerical control machining for the medical, aerospace, defense, and high-tech industries. Bagshaw has testified before the House Small Business Committee on the contributions of small manufacturers to the American economy.



>> Matthew Burnett

Founder, Maker's Row

Matthew Burnett is the founder of Maker's Row, a company endeavoring to simplify the manufacturing process by connecting designers to domestic manufacturers. The site presently links apparel and accessories manufacturers but plans to expand further this year. Burnett previously served as a designer and manufacturer of a line of watches called Steel Cake and for a leather goods and accessories company named The Brooklyn Bakery. Those experiences served as the impetus for developing Maker's Row as a resource for new designers.

**>> Jennifer Clark**

Associate Professor, School of Public Policy; Director, Center for Urban Innovation, Georgia Institute of Technology

Jennifer Clark is an associate professor at the School of Public Policy and director of the Center for Urban Innovation in the Ivan Allen College at the Georgia Institute of Technology, where she specializes in regional economic development, manufacturing, industry clusters, and innovation. Her book, *Working Regions: Reconnecting Innovation and Production in the Knowledge Economy*, examines U.S. policy models attempting to link innovation and manufacturing, and she also co-edits *The Handbook of Manufacturing Industries in the World Economy*.

**>> John Engler**

President, Business Roundtable; Former Governor of Michigan

John Engler is president of the Business Roundtable (BRT), an association of member-CEOs from global companies boasting close to 16 million workers and more than \$7 trillion in annual revenues. He joined BRT after serving as president and CEO of the National Association of Manufacturers from 2004 to 2010. Engler also served as the governor of Michigan from 1991 to 2003 and chairman of the National Governors Association from 2001 to 2002.



>> James Fallows

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