Small Things that will Increase Innovation in Your Company the Most

written by Lauri Moon | July 5, 2016

(Innovation Excellence — Yoram Solomon: 6-13-16) Last month I delivered my "un-kill innovation" executive workshop to an executive team of a Fortune 500 technology company in Florida. It was a great experience all around, but at the end I was asked for the key takeaways, and I narrowed them down to the following.

There are three key things that will increase innovation in your company the most.

They are small things. They have no investment or budget associated with them. They don't require you to roll out new processes or infrastructure. They don't need company-wide training. All they need is a change of attitude — ***yours***.

Accept that you are not driving (or even fostering) innovation. You are *allowing* innovation.

Your employees already know how important innovation is. They know it's good. You don't have to tell them that. All they need is the ***autonomy*** to do it. Innovation is like the sport of curling than golf. It is not the driving of the stone that gets it there–it's the swiping and altering the state of the ice in front of it that allows the stone to reach its destination. And you can only make small adjustments. You can't drive large ones.

Ask yourself: how do I react when one of my employees tells me that he (or she) tried something I didn't authorize and failed?

If you react severely, and let them know that there will be consequences for trying unauthorized things–they will never do it again. But here is the thing–you know who never fails? Only those who never try. Accept that there will be trial and error on the way to success.

Let your employees try, and help them get on their feet again after they fail. This will give them the autonomy and creative freedom to try again. When your toddler starts walking, soon thereafter they start running. Very quickly they fall. What is the first thing they do after they fall? No, the first thing is not crying. The first thing is ***looking at you*** to see your reaction. Your reaction will tell them whether they should cry, or get up and keep going. If you yell "oh, no!" or react in horror–they will cry. But if you yell "come on! keep going!" they will get up and keep going.

When an employee comes to you with an idea, avoid "I'll be the judge of that" or "I'll know it when I see it." Replace these reactions with "Let me tell you what will make me say yes."

One of the most powerful factors affecting creativity (and thus innovation) is sharing the "big picture." If you share the big picture with your employees and let them know what will make you approve a product idea (and the budget and other resources they are looking for)–you are forcing ***them*** to consider all aspects of their idea, and not just throw it over the fence to you for approval. You also ***reduce*** your workload (what a concept…), empower your employees, increase the probability that ideas are well vetted (your employees are in the front line of technology and customers, and are better positioned to assess the viability of their idea. I'm sorry to say, but you are highly disqualified to vet an idea from your position…)

Do those three things and you are guaranteed to increase the level of innovation in your company by orders of magnitude. As one of the participants in my workshop last week said: it will be transformative to the organization. Try it!

(Dr. Yoram Solomon is an inventor, a creativity researcher, coach, consultant, and trainer to large companies and their employees … is active in regional innovation and technology commercialization … and is a speaker and author on predicting the technology future and identifying opportunities for market disruption.)

How U.S. Manufacturers Can Compete

written by Lauri Moon | July 5, 2016

(Forbes – Bill Fotsch and John Case: 6-15-16) Nearly every politician these days bewails the loss of American manufacturing jobs. Nearly every politician promises—somehow—to bring them back. We're skeptical of these promises. Many thousands of factory jobs have been lost, and will continue to be lost, to automation, just as millions of farm jobs were lost to new technologies a century ago. And some manufacturing industries, such as garment making, will always find it impossible to produce goods in high-wage environments like our own.

All that said, US manufacturing may still be poised for a comeback. Some companies have found that overseas suppliers can't deliver top-quality goods. Others have discovered that transportation costs and long shipping times undermine whatever cost advantage they get from producing abroad.

Some large manufacturers, like GE, have learned to compete with anyone in the world. But what about the smaller suppliers that every big plant relies on? They'll have to step up their game if they expect to compete in a global marketplace. To see how, it might help to pay a visit to Trinity Products.

Trinity is a steel pipe manufacturer and custom fabricator, located not far from St. Louis. It employs about 160 people and does close to $100 million in annual revenue. The company makes big, infrastructure-size pipes and structures. You can see its handiwork in everything from bridges and power plants to giant signs and scoreboards. This is a tough business, dependent as it is on the level of infrastructure spending around the nation—something that Trinity's leaders have no control over.

But Trinity is thriving, because CEO Robert Griggs and his team know something about manufacturing that many executives and company owners seem to have forgotten: no one knows how to do a job better than the person who is doing it. They have turned Trinity into a kind of learning organization, with people on the shop floor making the company more and more competitive every day. (For a fuller description of how Trinity goes about this, see our article in this month's Manufacturing Leadership Journal.)

Trinity's journey started with open-book management. Griggs and CFO Jim Nazzoli helped employees learn about—and track—the company's revenue, costs, and profits. Today, the company circulates a scoreboard every morning showing billings and backlogs by product or process, along with key monthly statistics such as total orders and total mill tons.

Then they began working with a firm called the Cycle of Success Institute, known as COSi. (We have no connection to this organization.) COSi coaches helped Trinity create a system in which employees flag obstacles and bottlenecks and figure out how to solve them. "You identify a problem, put it on a list, monetize it, and prioritize it," explains Nazzoli, who has added the title of chief continuous improvement officer to his CFO job description. High-priority projects are assigned to a team, and every two weeks the team reports back to the COSi steering committee on its progress.

"We've accomplished 125 projects at the mill over five years," says Griggs. "We have all the data. We took coil splices from 25 minutes to 15. Changeovers from one size to the next size went from eight hours to five and then to three or three-and-a-half. We continuously organize and prioritize the projects. These lists never go away."

US manufacturers have long experimented with continuous improvement systems, of course.

But this one is a little different. Because the books are open, employees can see the effects of their efforts on costs and productivity. They can also see when they're on track for a profit-sharing bonus. That answers the question "Why should we worry about all this?" that some employees might ask. In the last five years, annual bonuses have ranged from $1,000 to $6,000 per employee.

Getting employees involved, helping them learn to think like businesspeople, sharing the wealth that they help create—this is what it will take to make American capitalism competitive again. And in the process, it just might save or generate a few more manufacturing jobs.

(We work with and write about companies that are improving business results and the lives of their employees through open-book management. *Bill*, founder and president of Open-Book Coaching, has more than 20 years' experience as a business coach and has helped nearly 400 companies bring the economics of the business alive for their people. *John*, editor of the online publication RetoolingCapitalism.com, is author of the classic books Open-Book Management and The Open-Book Experience. His articles appeared in Inc. and Harvard Business Review.)

Gilson Snowboards Summer Snow Day

written by Lauri Moon | July 5, 2016

Best Practices for Creating an Innovative, Advanced Manufacturing Culture

written by Lauri Moon | July 5, 2016

Promoting innovative, advanced manufacturing cultures within a community involves strategic planning and effective partnership with public institutions.

(Area Development – Dan Levine: 6-16-16) Advanced manufacturing – broadly defined as the integration and utilization of new technologies to improve products and processes – is a sector that Oxford Economics estimates now accounts for 44 percent of all U.S. manufacturing employment and supports 19 percent of U.S. GDP through its operations, supply chain, and payroll.

Companies all too often must choose between introducing advanced manufacturing equipment and processes into existing plants or shutting down operations and beginning production somewhere else. Consequently, many communities are anxious to support manufacturers that are modernizing plants rather than risk seeing those plants close.

At the same time, forward-thinking manufacturers understand that partnerships with public entities can accelerate and ease the cost of introducing complex new equipment and production processes into their plants. By examining two best-in-class examples, this article highlights ways in which supportive public-private partnerships can be established to help facilitate the promotion of advanced manufacturing. Each partnership helps companies improve productivity through either advanced manufacturing skills training or by offering advanced technological research development. This productivity improvement is the key to company survival, wage growth, and regional competitiveness.

Companies all too often must choose between introducing advanced manufacturing equipment and processes into existing plants or shutting down operations and beginning production somewhere else. During a recent engagement, Oxford Economics calculated that productivity in the U.S. advanced manufacturing sector is an estimated $226,071 per worker — more than twice the productivity of a worker in non-advanced manufacturing ($106,143).

Higher worker productivity is typically associated with higher wages and educational attainment (or higher skills training), and our data supports that assertion. In a non-advanced manufacturing plant there are approximately three workers with no more than a high school education for every worker holding a bachelor’s degree (or higher). In contrast, that ratio is nearly one to one (high school educated worker to bachelor degreed worker) in advanced manufacturing plants. However, even in an advanced manufacturing plant, one third of all workers typically hold only a high school degree (and an equal number have less than a four

year degree).

A Best-in-Class Example of *Company Training*

Let's look at *B. Braun Medical's* highly innovative program to train its existing workforce in the use and operation of the advanced manufacturing equipment that the company has been introducing to its Allentown, Pa., plant. B. Braun is one of the world's leading manufacturers of medical devices. Like many other manufacturers, managers at the Allentown plant noticed a skills gap in their existing workforce as increasingly sophisticated equipment was introduced into plant operations.

The company reviewed the key competencies that workers require in order to understand the theory of how the equipment works and the principles that govern line operations in an advanced manufacturing plant. These competencies include mechanical, electrical, hydraulic, and pneumatic functions. A *Progression Based System* ("PBS") was introduced to make sure that all employees receive basic training in each of these functional areas. The underlying strategy behind PBS is to train all workers in these core competencies, and then help the employee learn to apply this theoretical background to the operation, maintenance, and repair of equipment in the plant.

Training is divided into five levels: entry, basic, intermediate, comprehensive, advanced (with a master's level under development). The expectation is that each employee will advance to the comprehensive level. An estimated 90 percent of all current operations in the plant are covered at the comprehensive level. In other words, an employee completing the comprehensive level of training will possess the theoretical knowledge needed to understand (at the practical level) 90 percent of the plant's production operations.

Each level takes approximately one year to complete and training is done through a mix of company time and employee's time (depending on the current level of the employee). All training was initially provided by a local vocational school but has since been expanded to include the local community colleges as well. PBS has allowed B. Braun to retrain and upskill its employees, and the better skilled workforce has, in turn, helped the company reduce its operating and maintenance costs. The program is now being introduced to other B. Braun facilities in the United States.

The success of B. Braun's PBS program reflects, in part, upon its excellent relationship with the Lehigh Valley Workforce Investment Board (WIB). The WIB helped the company navigate different agencies; helped identify grants that offset some of the training costs associated with PBS; and put the company in close touch with the community's K-12 educational leaders. Educating guidance counselors, students, and parents at the high school level about opportunities in advanced manufacturing is an important part of the company's recruitment strategy.

Key to the program's success was its design around carefully researched training needs. Too often, training providers and companies rely on anecdotal evidence or ready-made solutions without first undertaking the careful data-driven analytics necessary to ensure strategic alignment among employees, managers, training providers, and other interested partners. This data-driven foundation, in turn, accelerates the process of engagement, articulation, program development, and effective implementation strategies. The B. Braun program is a best-in-class example of a company training its core workforce in the skills needed to succeed in an advanced manufacturing environment.

A Best-in-Class Example of *University Support*

The *National Institute for Aviation Research* (NIAR) at Wichita (Kansas) State University is a best-in-class example of a university supporting advanced manufacturing in its community by providing research and development services in key technological disciplines. From its inception in 1985, NIAR was organized to research and develop technologies identified by its industry advisory board (which is comprised of the vice presidents for engineering from many of the leading aviation and other advanced manufacturing companies in Wichita).

NIAR is organized around labs that operate as independent business units. Labs open and close under the direction of NIAR's advisory board, with each lab pursuing a specific technology identified by the board. This orientation around the research objectives of local industry (an industry-centric organizational approach) is quite different from the faculty-centric organizational approach found in many other offices of research and technology transfer (in which commercialization of faculty innovation is the primary objective).

Because each lab is self-funded, its research must be highly relevant to the advanced manufacturers whom it is organized to serve. Current labs, for example, are

organized around additive manufacturing, computational mechanics, composites and advanced materials, and more than a dozen other cutting-edge technologies. Large capital expenditures (for state-of-the-art equipment) are typically priced into research and certification testing projects done for private clients, although approximately 15 percent of NIAR's budget comes from the Kansas Aviation Research and Technology Growth Initiative. The university itself funds only a small amount of administrative overhead expense.

Higher worker productivity is typically associated with higher wages and educational attainment. One recent but not atypical success story involves *Airbus Americas*, a company with a large engineering presence in Wichita. NIAR's initial relationship with the company was to provide Airbus engineers with training in composites and advanced materials. The relationship has since been expanded to include full-scale structural testing in Wichita (the first time this is being done by the company at locations outside of Europe).

NIAR provides a best-in-class organizational model for university-business partnerships in advanced manufacturing. It has applicability to any community with a large research university and a cluster of companies with common research needs. It may also have applicability to communities seeking to leverage the technological expertise found on large military bases.

For example, one can easily imagine how (former) military personnel can be organized around technological competencies that are specific to the research and certification needs of military contractors (and civilian companies utilizing comparable technologies). The establishment of such a research institute in military communities might be an important first step in attracting the advanced manufacturing operations connected to the research and testing being conducted.

****

The experiences of B. Braun and Wichita State University demonstrate that best-in-class practices to promote innovative advanced manufacturing cultures within a community do not happen in a vacuum. They involve strategic planning and effective partnership with public institutions. Educational institutions — ranging from K-12 right through advanced university research programs — have a vital role to play. This article profiled effective partnerships in

advanced manufacturing skills training and technological research and development. However, similar alignment is needed in energy, tax, and other regulatory arenas.

But one critical lesson learned from the B. Braun and NIAR experiences is that *best-in-class practices can only emerge when leading companies view local public partnerships as strategic and take the lead in making sure that their communities create environments that are supportive of advanced manufacturing.*

(Dan Levine is Practice Leader, Location Strategies and Economic Development, Oxford Economics, Inc.)

Automation Investment High Among U.S. Manufacturers

written by Lauri Moon | July 5, 2016

MAPI survey shows actual, planned automation investment high among U.S. manufacturers

(Logistics Management – Patrick Burnson: 6-13-16) A new report from the MAPI Foundation indicates that despite the economic slowdown in the industrial sector over the past year, the incidence of actual and planned automation investment is very high in American manufacturing.

The report is based on a national survey of U.S. manufacturers and non-U.S. manufacturers with a presence in this country and is the second in a series of studies on productivity that the MAPI Foundation is producing this year.

Written by Cliff Waldman, director of economic studies at the MAPI Foundation, and sponsored by Rockwell Automation, a global leader in industrial automation, the findings of the national survey show that the high incidence of automation investment spans various company sizes and manufacturing subsectors:

- 83% of respondents indicated they engaged in automation investment in the past five years.
- More than three-quarters (76%) plan to engage in such investment during the next three years.
- 45% indicated their automation investment was part of a broader technology upgrading and 35% said it was a stand-alone investment. The remainder of respondents indicated they engaged in both.

"Automation implementation exhibits characteristics of both capital investment and innovation investment," observes Waldman. "While deploying machinery into a production line has characteristics of capital equipment investment, it does not appear to be as short-term oriented as capital investment."

Waldman added, "Automation also does not appear to be an element of business expansion. Rather, *it is more like process innovation whose principal goals are cost reduction and product quality improvement."*

"The findings in the MAPI Foundation's second study confirm that automation is a critical driver of productivity and quality improvements for manufacturers as they seek to stay competitive in this challenging environment," said Joe Kann, vice president of global business development at Rockwell Automation.

"The study also points out that automation investments are more often seen as part of a broader business-wide technology upgrade as opposed to a stand-alone application. This is consistent with Rockwell Automation's vision of *The Connected Enterprise* in which operational technology is converged with information technology to drive higher levels of productivity and competitiveness," Kann noted.

(Patrick Burnson is executive editor for *Logistics Management* and *Supply Chain Management Review* magazines and web sites.)

DCED Releases Business Services Matrix

written by Lauri Moon | July 5, 2016

Pennsylvania offers a variety of financial and technical assistance programs to support business location, expansion and industry growth. The Department of Community & Economic Development (DCED) has compiled a list of the department's business assistance programs.

IMC is part of the state's Partnerships for Regional Economic Performance (PREP) program.

DCED Business Services Matrix 2016

Technology Driving Convergence of Industries & Their Workforces

written by Lauri Moon | July 5, 2016

Packaging, processing, food service and restaurant operations are all automating

(On the Edge Blog – Keith Campbell: 5-31-16) This past week, I had the opportunity of combining my attendance at The Automation Conference and Expo, focused upon manufacturing and produced by PMMI Media Group, with a visit to the NRA Show 2016, focused upon food service and produced by the National Restaurant Association. Both events were held in the Chicago area. I expected to find some elements in common, especially workforce issues, but I was surprised to find so many common elements related to both workforce and automation.

It is but a small step from a food processing and packaging line in a low volume manufacturing plant to a food service kitchen for a caterer or institution such as a school, hospital, or military base. And it is but another small step from food service to retail restaurants. Recognizing this, it should be no surprise to find a convergence of issues driven by technological change.

Food service operations, restaurants and bars are automating using many of the same technologies found in manufacturing. The NRA show floor included exhibitors selling sensors, controllers, pumps, valves and motors. It included processing and packaging machines for performing unit operations and combinations of these machines organized into workcells. It included robots and 3-D printing. Automation systems integrators, business systems integrators, and IT companies were promoting products and services, and the Internet of Things (IoT) was a popular theme.

What appears to be an exciting growth area for these food services industries are what manufacturers would call Human Machine Interfaces (HMI), Supervisory Control and Data Acquisition (SCADA) systems, and Manufacturing Execution Systems (MES). Many of the solutions shown were based upon the use of tablets and the cloud. Suppliers indicated that increasing complexity of the industry, lack of appropriately skilled workers, and rising minimum wage standards have been causing their phones to ring off their hooks as food service and restaurant operators seek to automate.

Experience tells us that automation drives up the skill requirements of the workforce. Lower skilled tasks are often taken over by machines and software, and people in those jobs often have the opportunity to move up by acquiring new skills. The workers that remain perform higher value-added tasks such as data analysis, problem solving, troubleshooting and maintenance. As food service automates, workers will need to be upgrading their skills. Our high schools will need to be turning out graduates with different and better skills, as lower skilled jobs of the past disappear. I would caution, that this should NOT imply sending more to college! Career paths will be altered. Career pathways between manufacturing and food service may also converge.

My mind isn't made up if this will exacerbate or reduce the skilled worker shortfall for both manufacturing and food service.

Smart Manufacturing & The Internet of Things

written by Lauri Moon | July 5, 2016
(IW — Andrew Waycott: 6-3-16) There's a rumor going around, centered in Germany, that we're now in our fourth Industrial Revolution. According to this rumor (in which I believe):

The first Industrial Revolution started in England in the 18th century. Think: mechanical looms.

- The second centered on electrically-powered mass production, near the start of the 20th century. Think: Henry Ford and assembly lines.
- The third is electronics and robotics and IT. Think: computers enter the office and manufacturing space.
- The fourth is about harnessing, finally, the power of data. It's about big data and predictive analytics and artificial intelligence, and it includes Smart Manufacturing. Early computers did what humans could do, but faster and better. Smart Manufacturing puts machines in the business of real decision-making—through calculations outside the range of human capabilities. Think: the data tells us what to do.

With Smart Manufacturing, the Data Tells us What to do.

Or to state it more dramatically, the computers control the process! While the smartest person in the room is still human (depending on how we define 'smart'), machines can tell us things we don't know and could not figure out on our own.

Say we're talking about maintaining aircraft engines. In the old days, all we could do as humans was:

Analyze how frequently they failed, and work to a preventative maintenance schedule cycle slightly shorter than the average of that period.

- Wait for it to fail.
- Fix it.

It's not optimal. But now, with sensors providing considerably more data about the engine, and software that is able to analyze that data in a highly sophisticated manner, we can have a much more precise idea of when each engine needs maintenance, and what type.

Better data and better analytics give us considerably more insight into the root cause of any specific shop floor event or process. And the root cause makes all the difference, in terms of increasing efficiency and quality, while decreasing cost.

The Industrial Internet of Things (IIoT) applies Internet of Things technology to manufacturing. IIoT incorporates machine learning and big data, harnessing sensor data and automation. The big idea behind IIoT is that smart machines are better than humans at capturing, analyzing and communicating [some types of] data. Manufacturers can pick up on inefficiencies and issues sooner, and find answers faster.

A major part of the story is the drop in technology costs. The emergence of cheap connected devices, coupled with the availability and affordability of mass computing power, has been the biggest driver of Smart Manufacturing.

It All Hinges on Visibility

Visibility is the driver of ROI, in manufacturing efficiency. And Big Data and Smart Manufacturing have taken visibility to a whole new more granular level. In real time.

With greater visibility of the real workings, your shift supervisors and operators can make better, more informed decisions, all day long. There are all kinds of possibilities: messages on their phones; displays on a monitor; an overhead

dashboard that highlights your six key processes. It's all about visibility.

One Last Point About Smart Manufacturing

Just to clarify—you can, in theory, run a Smart Manufacturing plant that has no connection to the Internet. Essentially, Smart Manufacturing is about using analytics and Big Data to run your plant better (think: the data tells you what to do!).

So Smart Manufacturing isn't really about the Internet. It's about collecting and crunching data to make more informed decisions.

(Andrew Waycott is Chief Operating Officer and Chief Technology Officer, Factora)

The M4.0 Tidal Wave is Coming-Are You Ready?

written by Lauri Moon | July 5, 2016

(Manufacturing Leadership — Paul Tate: 6-7-16) "Industry is about to experience more change, across more aspects of the business of manufacturing, and in a shorter time than perhaps any period of transition in the history of manufacturing", predicted David Brousell, Co-Founder and Global Vice President of the Manufacturing Leadership Council in his opening address at the *2016 Manufacturing Leadership Summit* earlier today.

Hosted by international research and consultancy company Frost & Sullivan at the Omni La Costa Resort in Carlsbad, CA, the theme of this year's 12th Annual Summit focuses on ***Manufacturing 4.0****: The New Rules of Leadership,* and has brought together over 200 senior industry leaders from across multiple sectors of the global manufacturing sector.

Citing the results of the Manufacturing Leadership Council's recent research study

on *Factories of the Future*, Brousell continued that over the next five years the research suggests that a "tidal wave of digital change is coming" for manufacturing. This will engulf production and assembly processes, the devices and equipment on plant and factory floors, how design relates to production, how companies interact with customers and suppliers, and, perhaps most importantly, how and where leadership teams will pilot their companies in the years ahead.

On a broader scale, the impact of this digital transformation across society will be profound, he added. For example, until about 1900 observers suggest that human knowledge doubled around every 100 years. But today, he noted, IBM estimates that the build out of the Internet of Things alone will cause human knowledge to double every 12 hours!

Yet the digital transformation that is inherently part of M4.0 for the manufacturing sector, is still in its early stages in most companies, he explained. What's more, any manufacturing company that believes M4.0 is simply about investing in new digital technologies alone is missing the point.

Digital tools are critically important, of course, but M4.0 is also about "cultural change and organizing differently – understanding and successfully implementing such things as flatter organizational structures and a collaborative innovation model – as well as re-tooling leadership teams with non-traditional skills sets," he added.

The problem is that many manufacturers appear to be struggling today to fully absorb and get into position to drive and lead this new industrial revolution.

Citing another recent Council research project on *Next-Generation Manufacturing Leadership,* Brousell reports that, "While manufacturers expect to receive significant benefits from digitization, they also say their leaders have not yet fully adjusted their mind-sets, behaviors, and skills in ways that will be necessary to take advantage of the possibilities of digitization."

Perhaps that's where the biggest challenge along the journey to M4.0 may lie for many manufacturing organizations in the years ahead. Time, however, is not on the side of those who delay.

“You will not have 25 years to get on board with M4.0,” advised Brousell. “You are going to have to act fast – and with as much precision as possible.”

(Paul Tate is Research Director and Executive Editor with Frost & Sullivan’s Manufacturing Leadership Council. He also directs the Manufacturing Leadership Council’s Board of Governors, the Council’s annual Critical Issues Agenda, and the Manufacturing Leadership Research Panel.)

The Rise of Manufacturing Marks the Fall of Globalization

written by Lauri Moon | July 5, 2016

(Geopolitical Weekly – Rebecca Keller: 6-7-16) Whether you’re reading this article on a smartphone, tablet or laptop, chances are the device in front of you contains components from at least six countries spanning three or more continents. Its sleek exterior belies the complicated and intricate set of internal parts that only a global supply chain can provide. Over the past century, finished products made in a single country have become increasingly hard to find as globalization — weighted a term as it is — has stretched supply chains to the ends of the Earth. Now, anything from planes, trains and automobiles to computers, cellphones and appliances can trace its hundreds of pieces to nearly as many companies around the world. And its assembly might take place in a different country still. Opportunities for producing and assembling products and their components have spread worldwide, making it is easier for countries to climb the production value ladder. States at the bottom, extracting raw materials, can gradually move up, first making low-value components and then progressing to higher-value ones or basic assembly.

But just as technology spurred globalization and the shifts in international trade that followed, so, too, will it revolutionize how countries again do business with one another. Compounded by the economic and demographic changes taking place today, automation, advanced robotics and software-driven technologies are ushering in a new era — one of shorter supply chains that will

provide fewer opportunities for the developing world. Regions once labeled “emerging economies” may instead stagnate, and the divide between the haves and have-nots within and among nations could widen further.