

The Work World Is Changing and Society Needs To Change As Well

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We live in a time of great paradox. Technologies such as low cost renewable energy and automated production tools promise a world of abundance in which global poverty is abolished and human drudgery is eliminated. Yet even a casual glance at the daily news confronts us with a sense of dread that, far from Utopia, we are instead headed toward a dystopian future in which the benefits of technological advance will be reserved for a privileged few.



The disquieting consequence is that the bulk of humanity is relegated to scraping out a meager existence in a mean-spirited world where jobs (and the prosperity they bring) are reserved for a global elite trained to read the sacred texts of a new religion of technology.

Is the social contract of Western civilization, promising fair treatment and opportunity for all, which took root in 18th century England and France and flowered in the post WWII democracies, destined to fail? Just how will the world adapt to the current wave of technological advance which threatens the jobs of today's middle class much as Mr. McCormick's reaper drove earlier generations from the farms and into the factories of a prior era?

Econintersect has asked two contributors, John Slater and Steven Hansen, to discuss some aspects of this conundrum concerning how and where automation and robotics will impact the new economy and how social institutions, specifically education, can address these challenges.

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Steven Hansen, co-founder and Publisher of *Econintersect*, has had a career in international engineering management and is now an international business and industrial consultant specializing in turning around troubled business units; consults to governments to optimize process flows; and provides economic indicator analysis based on unadjusted data and process limitations. Graduated 1971 California State Polytechnic University at San Luis Obispo.

Questions addressed by the two panelists were presented by *Econintersect* co-founder and Managing Editor John Lounsbury.

Question 1: What is driving the increase in automation?

JS: Automation is not a new story, but we are clearly in a period of accelerated adoption. We're digitizing the physical world and applying digital intelligence to replace the human beings in managing our assets and interactions. Robots, which are all the rage, are only a small part of that.

There are multiple drivers behind this trend. To name a few:

- Tremendous computing power is now available in very small devices at low cost.
- Cheap sensors and digital vision systems enable computers and robots to see the world
- Tasks formerly reserved for humans can increasingly be accomplished by intelligent systems

At the same time shortages of skilled workers has created increased demand for more efficient tools. Often these digitally driven machines enable suppliers to deliver a quality of goods and services not possible with human workers alone. And in the case of additive manufacturing, they can generate objects in configurations not even possible with traditional tools.

SH: There is only one driver of automation - profits. The goal is to sell a product at a lower cost with better quality and durability than competition. This is not a static situation but is very dynamic as businesses react to what is happening in the marketplace. Sometimes a product is created in another field that makes your product less necessary or redundant.

Question 2: Is the "*glut of labor*" described by Derek Thompson in his *Atlantic* piece, [The Next Industrial Revolution](#), an insurmountable problem?

SH: In the past increased automation has created as many jobs as it destroyed. The difference this time is that robotics and artificial intelligence are beginning to be designed to completely automate a strata of employment without offering many jobs to maintain or build. Take self-driving trucks - what jobs are being created? Add to this the possibility that AI may become "aware" and be able to automatically optimize and improve.

An insurmountable problem? Maybe and maybe not. But it certainly it is a problem much greater than we have faced before.

JS: The jobs issue is ultimately not technological. Walk out your front door and you will find things that can/need to be done. Fix the potholes, clean the parks, create the art. Roosevelt understood this when he created the WPA and CCC. The issue we're facing is that much of what needs to be done constitutes public goods and we don't seem to have the political will to pay for them. If we did the first item on the administration's agenda would have been infrastructure, not tax cuts.

Question 3: How do China and the U.S. compare when it comes to automation?

JS: Robotics is relatively old tech. Industrial robots were invented in the U.S. and first introduced in the 1960s and wide scale adoption of robots in the auto industry began in the 1980s. The global leaders in the manufacture of robots and automated production equipment are Germany and Japan. Traditionally, the U.S. auto manufacturers have been among the leaders in the deployment of automated production processes. U.S. industry purchased a record number of robots in Q1 2017, up 28% from the same quarter in 2016. For now the auto industry still predominates, but other industries are catching up fast.

Much of the underlying technology for the next phase of robots and artificial intelligence is being developed in the U.S. China, however, has made a national commitment to become the global leader in adoption of industrial robots in its manufacturing industries and is aggressively pursuing humanoid robot development so that it can deal with a rapidly aging population.

SH: Faster growing economies always have the automation edge as a growing economy expands its goods and services infrastructure. Expansion usually pushes state-of-the-art so that the investment will produce the most profit into the foreseeable future. A slower growing economy delays automation usually until it is obvious that they have to make additional investment to maintain or improve profit margins.

Question 4: Can Germany be a model for U.S. (and others) for manufacturing systems?

SH: Getting into a measuring contest on what country does the best job of manufacturing is a waste of effort. I have learned automation techniques even watching how things are done in undeveloped countries. Every country is different. I have brought technology into developing countries - but I never imposed the "American Way" of using that technology. Think of it this way - most tools are designed for right hand use - and to impose a right hand tool in a left hand country spells "f-a-i-l". Try putting beer vending machines (Germany) or serving wine for lunch (France) into the design of USA factories. There are good ideas everywhere - and one picks and chooses what to incorporate.

JS: Germany is a critical industrial partner. Automation is a global effort in which various countries have various comparative advantage, such as Germany's strength in building automated production tools and Japan's strength in industrial robot manufacture. The U.S. retains its lead in many aspects of software and particularly in artificial intelligence, as well as in developing technologies such as additive manufacturing and autonomous vehicles and drones. A primary driver of the U.S. technology lead in those fields has been its ability to attract many of the world's best and brightest as immigrants to the U.S. Success in rebuilding American manufacturing depends on global cooperation, not isolation.

Question 5: Is education a major problem for U.S. manufacturing compared to competitor nations?

JS: The U.S. still leads the world by a large margin in University level education. Unfortunately the emphasis in the U.S. educational system on college for all has led to a system that fails to train a large portion of our youth in employable skills. High school or junior college grads with hands on

training in skilled trades such as welding can jump straight from school into jobs that pay well above U.S. median income levels. Yet liberal arts college grads often find themselves relegated to positions as baristas at Starbucks.

SH: It is NOT education but SKILLS that are important in business. Education creates a framework for learning - but it does not in itself create the skills.

ALL of my career was spent running union labor. UNIONS were the driver of apprenticeship programs - not business or education sectors. Without Unions, the USA would not have had an apprenticeship programs, and the difference is night and day when you do non-Union work vs Union. Running non-Union labor requires a hands-on management which must have better SKILLS than the workers. Although Unions are not good on several levels, they were a positive force in the building of 20th century America. Now America has marginalized Unions, and business believes the task of properly training skilled labor is still by others [watch the commercials on TV where you can learn skills].

There is prejudice against blue collar skills [thinking it is inferior to university education] - and we are now reaping the rewards of this prejudice. We talk about racial segregation, but there is also blue and white segregation. Please prove me wrong by having a Ph.D. comment on this post saying not only does he / she live next door to a blue collar worker - but feels their education is equally valuable to blue collar skills.

This prejudice is pervasive in all advanced and developing economies.

Question 6: Are sectors other than manufacturing at risk of disruption by automation?

SH: ALL sectors (including manufacturing) are ripe for automation. Automation is not an explosion but a slow process which attacks the lowest hanging fruit (easiest and cheapest to automate). I remain mystified that there are still cashiers as technology beyond scanning is available (but requires products to have rfid instead of bar codes).

JS: Manufacturing in the U.S. is likely to witness a rebirth as production is reshored to reduce the logistical costs and inefficiencies of a global supply chain. We've already seen that in some formerly challenged industries. From 2009 to 2015, U.S. exports of fiber, yarns, fabrics and apparel were up 38 percent, reaching almost \$27.8 billion in 2015.

Automation's biggest impact in terms of jobs will not be in manufacturing, but in the white collar industries that have been the bastion of middle class America for the past fifty years. Robotic Process Automation (RPA) is one of the fastest growing sectors of the IT industry. The goal of RPA is to automate every business activity that is routine and can be more efficiently accomplished with an online system. We're seeing this throughout the financial services industry, where FinTech firms have raised tens of billions of dollars, with the goal of automating every aspect of banking and finance. Since 2001 [Goldman Sachs has eliminated the jobs of 598 of its 600 equity traders](#) (each formerly a member of the storied 1%) through implementation of RPA. In the coming years tens of millions of service and retail jobs will be replaced by automation, including many jobs previously outsourced to places like India and the Philippines.

Question 7: Are traditional engineering disciplines out of step with automation changes? How will engineering change in the future?

JS: (I'll leave this one to Steven. My son dropped out of engineering school to start his own manufacturing firm when he realized that U.S. engineering grads were competing directly with Indian engineers at a fraction of U.S. wage scales.)

SH: Education is out of step with automation changes. The elementary, middle and high schools are generally no longer providing students skills - but think their role is to prepare students for college / university.

JS: (Let me jump back in.) Yet the high school and college robotics and STEM challenge competitions are booming. The kids love to show what they can do and the brightest members of the new generation are rediscovering the real world. Not sure I'm that comfortable with high schoolers inventing new life forms, but the brightest kids are certainly not waiting for their teachers to tell them what they should explore. We need to offer opportunities for similar creativity up and down the educational spectrum.

Question 8: Will manufacturing ever again become the biggest sector in the U.S. economy? Would that be good for America?

SH: Goods production is the easiest sector to automate as time and motion is predictable. Services and your home environment have more varied time and motion and therefore are more difficult.

JS: Farming was once the largest industry in the U.S. Since 1970 farming has dropped from about 4.5% of U.S. employment to about 1.5%. Yet the total output of U.S. farms had grown dramatically, increasingly in real terms from under \$300 billion in 2000 to around \$450 billion by 2013. Manufacturing employment in the U.S. has followed a similar pattern, peaking at just under 20 million jobs in 1979 and declining to a trough of about 11.5 million in 2010. Since then manufacturing employment has actually rebounded to about 12.4 million jobs today, notwithstanding the trend toward more automation.

Notwithstanding the steady decline in manufacturing employment, real output of U.S. manufacturers grew approximately 85% from 1987 to 2008. While U.S. output witnessed a precipitous drop during the great recession, it has come back strong, hitting an all-time high in Q1 2017. The real growth in the U.S. economy has been in knowledge based industries like healthcare and education. Clearly continued growth in manufacturing has been good for the economy, but the growth in consumer demand for physical possessions has been eclipsed by the growing demand for services such as healthcare and experiences such as digital gaming, media and entertainment, sports performances, etc. and job growth has followed that trend.

Question 9: Is automation suitable for all types of work? What about remedial work? Troubleshooting?

JS: In the near term automation is most suitable for repetitive tasks and tasks that are dangerous or difficult for humans. As computing power becomes more powerful and "intelligent" it will continue to assume increasingly complex tasks. For the foreseeable future humans will remain critical to the production process. The remaining tasks reserved for humans will, however, require more judgement and specialized skills that will demand an appropriately educated workforce.

SH: Automation can be applied to all types of work - but if it does not improve profits there is no driver to make it happen. Remedial work is difficult (but not impossible) to automated as it required too many decision steps. Having said that, what happens to home remodeling if a technology evolves where a house can simply be torn down and rebuilt cheaper than simply to a remodel. My

prediction is basic design and manufacture will evolve to simple component or complete replacement vs. repair.

Question 10: How should education be changed for the "new world economy"?

SH: Teach skills. White collar education is NO substitute for blue collar skills. I have witnessed the trend in the USA (and many of the advanced economies) where senior management believes it can directly manage labor. One cannot manage well something that the manager cannot do. Just watching (or even being taught how to be) an auto mechanic does not give you the techniques or touch necessary to be an effective or efficient auto mechanic. Skill sets take practice to develop.

JS: When I was in college, little attention was paid to training student in practical skills. Today when I read the Alumni Weekly, I see more and more examples of engineering students building practical tools (yes, including robots) and even liberal arts majors learning practical skills through global outreach programs. We need to encourage a similar transformation throughout the educational system to assure that we are training our youth in the skills needed to function in an increasingly automated and digital world. That doesn't mean that everyone needs to learn to be a coder. Much of what passes as technical education is training students in yesterday's technologies. It's far more important that our young people (and our older workers who have been replaced by automation) learn the core disciplines needed (math, reading, writing and a core understanding of both the hard and social sciences) to equip them to pursue a lifetime of continuous learning.

Econintersect thanks our two panelists for a personal and insightful discussion of the challenges facing the "working world" of the 21st century.