

# The Role of Universities in a Knowledge Economy



Farideh Farazmand  
Lynn University



# OBJECTIVES



- To explore the characteristics of the knowledge economy.
- To investigate the impacts on future jobs and skills.
- To study the roles of universities in a knowledge economy.
- To discuss the implications for national economic, education and research and development policies.

# Knowledge Economy

The knowledge economy is characterized by intensive use of human knowledge and its transformation into innovation, technology, machines, decision support systems and products to generate economic value.



# CHARACTERISTICS OF A KNOWLEDGE ECONOMY

- It is a knowledge-intensive production method (relies on intellectual capabilities rather than on physical inputs).
- Production is codified, digitized and automated.
- Workers are highly skilled with a college degree, labor productivity is high, consequently wages are high.



# CHARACTERISTICS OF A KNOWLEDGE ECONOMY

- Knowledge sector is another sector producing knowledge.
- Human capital and talents are the producers of new knowledge that are transformed to innovations and new superior products.
- New Knowledge is short live and continuously changes edge.
- Research universities and technology hubs are where new knowledge is produced.



# EVIDENCE



- Between 1986 and 2007, The world's technological capacity of computing and processing information grew at 61% annually.
- Politico reports that 85 percent of the world's innovation comes from research and talent clusters.
- United Nations estimates that the knowledge economy's contribution to the world GDP is 7% with an annual growth rate of 10%.

# Changing Jobs and Skills in a Knowledge Economy

- A high percentage of workers (2/3) are replaced by robots and machines.
- The need for fewer workers, and for workers with computer and data processing skills.
- The cost-saving impact of the new technology is expected to be 25% in the United States by 2025.
- The new technology also creates new jobs that were not existed previously, e.g., hardware engineers, app creation, and information systems management.



# Changing Jobs and Skills in a Knowledge Economy

- The Internet had destroyed 500,000 jobs in France in the previous 15 years, but at the same time had created 1.2 million others, a net addition of 700,000, or 2.4 jobs created for one destroyed.





# Changing Jobs and Skills in a Knowledge Economy

- Demand for computer scientists, engineers, data analysts, chemists, biologists, mathematicians, and scientific inventors will grow.
- The supply of these workers falls short of the demand.
- The U.S. educational institutions do not provide enough of graduates in the STEM area.
- McKinsey predicts shortages of 250,000 statisticians and data analysts in the United States.
- The shortages of STEM-related skilled workers in the U.S. requires the change in the U.S. national educational policies in the direction of STEM education.

# Manufacturing Sector in a Knowledge Economy

- Digitization, automation, and robotics is an ongoing trend in the manufacturing sectors for the higher productivity and efficiency advantages associated with the new technology.
- There are fewer workers on the floor of manufacturing plants, what 25 workers produced in 1980, it needs only 6.5 workers in 2018.



# MANUFACTURING SECTOR IN U.S.



- The manufacturing output of the United States is 12% of its total GDP.
- With the average of 48.8 hours of weekly work, the manufacturing workers still earn more among all workers without a college degree in the other sectors.
- The U.S. manufacturing plants' exodus for off-shoring in low wage and tax and fewer regulations countries started 1978 and continued in later years.
- The result was low employment and slow economic growth in America's industrial cities.

# RESHORING OF MANUFACTURING TO U.S.

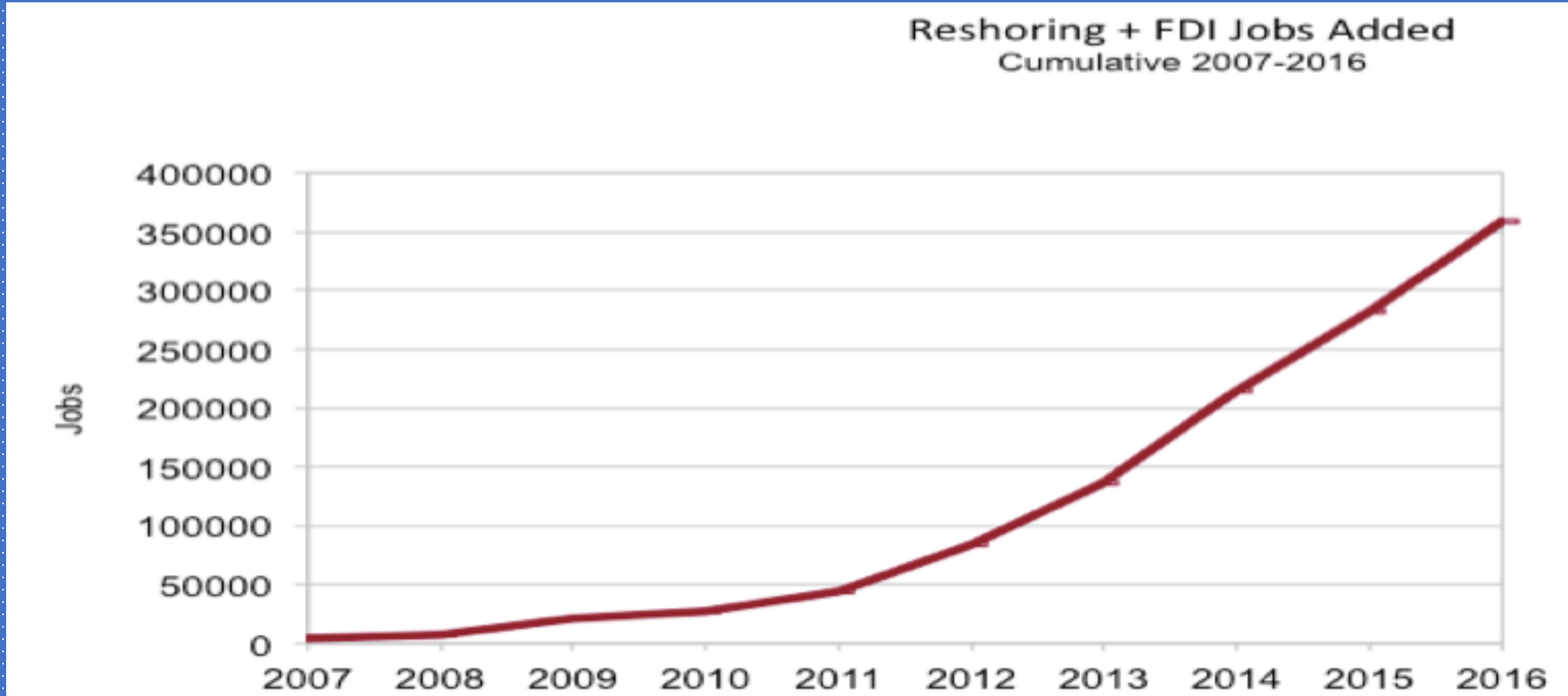
- Bringing manufacturing and jobs back to America have been on both the previous and new administration's agendas.
- Since 2009-2010, there has been a reversal trend and some of the companies that left America in the previous years are coming back to America.
- The reshoring back to America includes more than 200 companies, creating 50,000 new factory jobs in the U.S.



# U.S. MANUFACTURING 1940-2017



# RESHORING OF MANUFACTURING TO U.S.



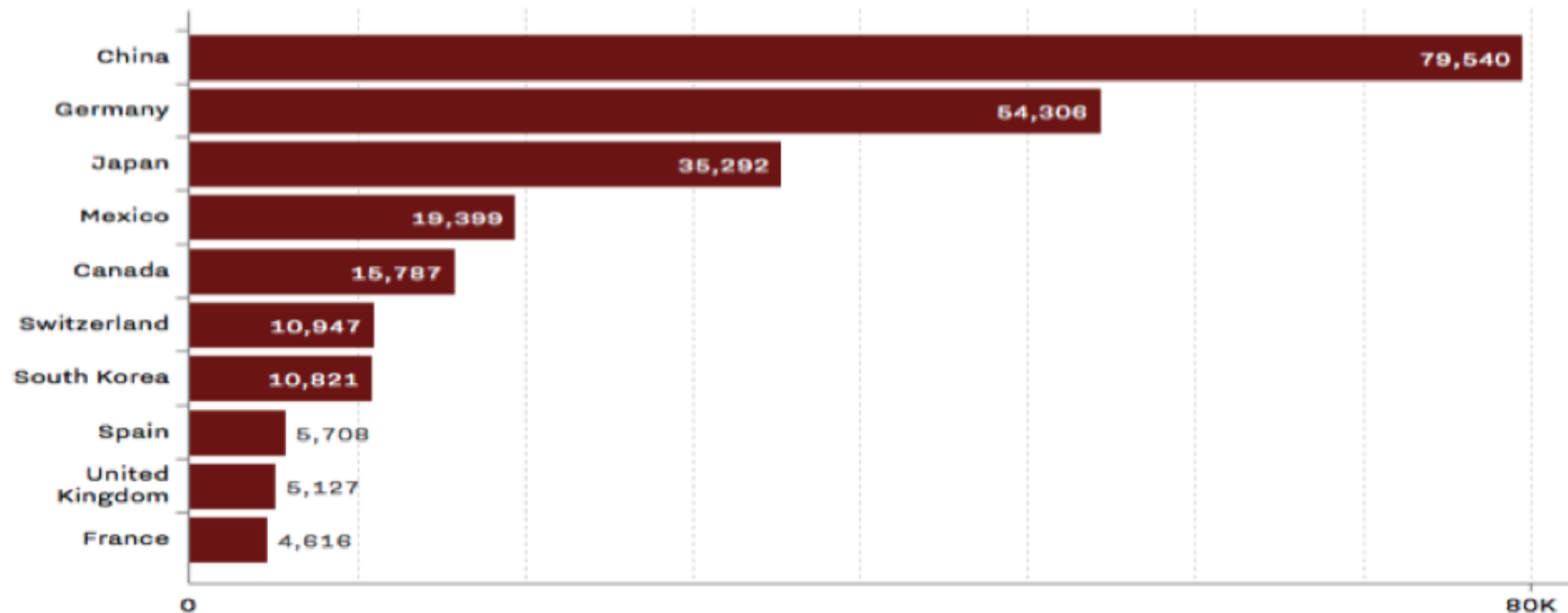
# REINSTATED COMPETITIVE ADVANTAGE OF U.S.

- The recent on-shoring includes General Electric, Whirlpool, Intel, Caterpillar, DuPont, and Apple.
- The majority of reshoring or on-shoring manufacturing companies are coming back from China.
- Rising production costs in China and diminishing role of unskilled workers in robotic manufacturing, lessening the competitive advantage of China.
- Automation, innovations, and demand for talent workers; plus less expensive energy in the U.S. add to the competitive advantages of U.S.

# WHERE RESHORING U.S. JOBS ARE COMING FROM

## Where 'reshored' U.S. jobs are coming from, 2010-2016

Reflects reshored jobs and direct foreign investment





# THE RETURNING INDUSTRIES

Reshoring + FDI by Industry, 2010-2016				
Ranking by job #s	Industry	NAICS Code(s)	Jobs	Companies
1	Transportation Equipment	336	133963	444
2	Electrical Equipment, Appliances, Components	335	35340	201
3	Plastic/Rubber Products	326	29220	218
4	Fabricated Metal Products	332	18725	245
5	Computer/Electronic Products	334	18393	137
6	Apparel/Textiles	313, 314, 315, 316	17166	287
7	Chemicals	325	16257	136
8	Machinery	333	15619	141
9	Wood & Paper Products	321, 322	10723	64
10	Furniture & Related Products	337	7170	55
11	Food & Beverage	311, 312	6968	64
12	Non-Metallic Mineral Products	327	6132	33
13	Primary Metal Products	331	5381	36
14	Medical Equipment	33911	4525	63
15	Energy, Petroleum & Coal Products	324	3828	19
16	Miscellaneous	339 3315	3805	43
17	Castings & Foundries		3248	30
18	Hobbies, Toys & Sporting Goods	33992, 33993	3222	106

# RETURNING AND SUSTAINING THE MANUFACTURING INDUSTRIES

- Bringing back the manufacturing and sustaining them in the U.S. require:
  - Availability of **trained workers** for knowledge-based manufacturing.
  - A modern **infrastructure**.
  - A technologically advanced **suppliers**.
  - Promotion and investment in **R&D** to stimulate **innovations**.



# TRAINING WORKERS FOR A KNOWLEDGE ECONOMY

- In the next ten years, there will be as many as 2 million shortages of workers for positions such as operators of computer-controlled machine tools and industrial mechanics demanded by manufacturing industries.
- Three out of five Americans who are between ages of 25 to 64 have no more than a high school degree.
- U.S. students' math skills score 481, below the average of 494, close to the bottom six: Sweden (478), Turkey (448), Mexico (413), Brazil (391), Indonesia (375) and Peru (368).

# TRAINING WORKERS FOR A KNOWLEDGE ECONOMY

- American students are also weak in science ranking 24th in the world.
- A national plan for the American educational system is needed to put more emphasis on math and science.
- Reforms at K-12 level are required in STEM areas to prepare students for the future employment opportunities in manufacturing.
- A technologically advanced economy with a high-quality labor force will bring sustained economic growth, jobs and higher per-capita income for all.

# MAINTAINING A MODERN INFRA-STRUCTURE

Another factor for sustaining a competitive manufacturing industry is a modern and efficient transportation system and infrastructure.

The American Society of Civil Engineers 2017 report has rated American Infrastructure as D+.

Government's active role in investing in and management of modern and efficient transportation, energy, utilities, water, communications and other infrastructure and social support services is important for U.S. manufacturing competitiveness.

# CUTTING-EDGE SUPPLIERS

- Finally, availability of cutting-edge suppliers for the technologically knowledge-intensive manufacturing is essential.
- Industrial linkages and clusters of related and supporting firms and industries lead to efficiency, higher productivity and global competitiveness.



# CLUSTER OF SUPPLIERS

- The research shows that clustering of related industries results in the efficient supply of intermediate products in the city, resulting in cost reduction and efficiency for all firms and industries in that city.
- Another study tested the cost and productivity impacts of external economies of the industrial size of a city on production function of manufacturing industries for 19 two digits SIC level industries in 47 SMSAs in 2007 in the United States.
- The result showed that clustering still is a significant factor for most manufacturing firms.

# CLUSTER OF SUPPLIERS

- Availability of competitive suppliers in close proximity leads to in-shore out-sourcing as opposed to off shore out sourcing, reduces the transportation costs and creates more jobs in America.
- Century Foundation Report (2017) highlights the need for a modern logistics and suppliers to attract and sustain manufacturing in America. The Century Report explains that how manufacturing production involves “a diverse array of suppliers” that results in the cluster of related companies in a location.
- Politico (2017) specifies the role of knowledge and talent clusters such as Silicon Valley in high tech industries such as computer industry.



# THE ROLE OF UNIVERSITIES IN A KNOWLEDGE ECONOMY

- In a knowledge economy, the role of educational institutions can be summarized in two capacities:
  - Training the workforce and supply of graduates in technical skills, such as engineering, data analysts, and IT specialties.
  - Research, Production of new knowledge, innovation and commercialization of research results.



# THE ROLE OF UNIVERSITIES IN A KNOWLEDGE ECONOMY

- In a knowledge economy, the life cycle of new technology and products are short.
- The research universities along with technology hubs and incubators and Research Parks are producers of knowledge and innovations.
- The United States has some of the best research universities in the world that can have a significant role in reinstating the American global competitiveness in a knowledge-based economy.

# THE ROLE OF UNIVERSITIES IN A KNOWLEDGE ECONOMY

- Research universities bring Federal funds from National Science Foundation, U.S. Department of Defense, and the National Institutes of Health.
- Corporations play a role not only by endowing university chairs and sponsoring collaborative R&D but also by participating in entrepreneurial activities and funding technology-based initiatives in the community.



# THE ROLE OF UNIVERSITIES IN A KNOWLEDGE ECONOMY

For example in St. Louis, the Danforth Foundation, Monsanto, and the McDonnell Family have funded research initiatives at the University of Washington.

In Pittsburgh, the Heinz Endowments and other corporate contributors have provided the majority of funding for the Pittsburgh Life Sciences Greenhouse.



# THE ROLE OF UNIVERSITIES IN A KNOWLEDGE ECONOMY

- The recent model for urban and regional development is partnership between research universities, businesses and government.
- The link between the research universities, innovation, entrepreneurship, and economic and job growth shows the role of universities in a knowledge economy.
- Businesses are the sector that commercialize the innovations and create jobs and income.
- Government role is providing funds for R&D to the highly research oriented educational institutions.

# THE ROLE OF UNIVERSITIES IN A KNOWLEDGE ECONOMY

- There is no doubt that university technology transfer and commercialization activities are impacting local, state, and national economies.
- There are many examples of universities whose research and innovations played a significant role in the growth of their local economies.



# THE ROLE OF UNIVERSITIES IN A KNOWLEDGE ECONOMY

- In 2003, 300 patents filed by Stanford and companies such as Google, Sun Microsystems, Silicon Graphics, Netscape, Cisco Systems, and Yahoo spun off from the University.
- Many new companies are directly resulted from MIT technology transfers.
- Washington University in St. Louis, Georgia Institute of Technology in Atlanta, the University of Wisconsin in Madison, and Carnegie Mellon and the University of Pittsburgh have played significant roles in the economic development of their regions.

# THE ROLE OF UNIVERSITIES IN A KNOWLEDGE ECONOMY

Innovation Associates Inc. identified ten universities as exemplary in using their R&D resources and transferring their technology for state economic development initiations in 2004, as follows:

Carnegie Mellon, Georgia Tech, MIT, Purdue, Stanford, University of California, University of California San Diego, University of Pennsylvania, University of Wisconsin-Madison, Washington University, and Cambridge University.



# THE ROLE OF UNIVERSITIES IN A KNOWLEDGE ECONOMY

- Carnegie Mellon University and the University of Pittsburgh in association with automotive, biomedical and tech industries attracted Uber, Ford, and Meds and Eds companies to Pittsburgh area, resulted in the creation of many new jobs and income.
- Arizona State University built a new biomedical complex in Phoenix in collaboration with the city's economic development plans.

# THE ROLE OF UNIVERSITIES IN A KNOWLEDGE ECONOMY

The University of Buffalo with more than \$348.2 million in research spending and pipelining the new technology to the private sector and entrepreneurial firms, not only contributes to the creation of jobs and income in the region, it also creates employment for its graduates who were involved in the research.

# IMPLICATIONS

The examples found throughout this report represent the experiences of some of the nation's most successful university technology transfer and commercialization programs.

The examples presented the academic, corporate, and government collaborated models in R&D for technology-based economic development.

They showed the university R&D, and entrepreneurial initiations in working with businesses created new opportunities for both academic excellence and economic growth.

# IMPLICATIONS

- Knowledge, innovation, and technology are now recognized as the drivers of productivity and economic growth.
- To enhance the environment for university-public-private partnerships in research, innovation, entrepreneurship, jobs and economic growth.
- To promote Federal grants to support R&D and provide funding opportunities for research projects at higher education institutions.

# IMPLICATIONS

- To add emphasize on STEM education for increasing youth engagement in STEM education.
- To enhance the environment for the university-public-private partnership to develop workforce training programs to increase early and rapid adoption of new technological changes.
- To invest in education, infrastructure, and research and innovation for creating high-value jobs.

# THANK YOU!

Questions?

