**Case Study Title:**
**Competition, Innovation, and Human Capital**

**Article Information:**
Community colleges welcome Obama's challenge
Mary Beth Marklein
January 27, 2012
News
A3

Community colleges fill skills gap: Programs push shift to workforce
Mary Beth Marklein
April 10, 2012
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Schools focus on science slump
Greg Toppo
May 11, 2012
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Energy powers employment
Tim Mullaney
October 1, 2012
Money
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Steering more girls to science
Mary Beth Marklein
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**Summary Statement:**

Competition can lead to societal advances if that competition leads to improved productivity, which creates jobs and wealth. Competition drives the innovation necessary to develop new products and processes required to compete. Innovation requires investment in human capital.

A great Chinese civilization flourished before 200 BCE. Technological inventions included iron melting furnaces and the oldest known iron suspension bridge. In 1086 Su Song created the world's first mechanical clock that told the time and charted movements of the sun, moon, and planets. Raw and manufactured goods were transported by more than 500 miles of canals using boats with compasses and rudders. Many historians feel this civilization ended because leaders developed a provincial philosophy that viewed competition and trade as harmful.

The Roman Empire (27 BCE-476 CE) was a sophisticated system in which agriculture and medicine flourished. However, the upper classes squandered human capital as they became self-indulgent and less concerned about the welfare of the population. Disenfranchised working-class people could not withstand barbarian invasions.

Science and technology flourished in the Middle East from 750 CE to 1258 CE with innovations in mathematics and navigation. Ibn al-Haytham discovered that light travels in straight lines and described the first pinhole camera in the 11$^{th}$ century. However, innovation and education languished after Western books were forbidden.

Each of these civilizations failed to invest in human capital and compete, which meant that with population growth, incomes fell, and so did nutrition and productivity. The results were catastrophic when crops failed or invaders disrupted their cultivation.

The Industrial Revolution started in England around 1733 and spread throughout Europe. As new inventions were being created, factories followed, increasing the availability of goods and food. Unlike previous civilizations, European countries competed with small neighboring countries and each country benefited. The average life span increased steadily with technological advances.

To compete, Americans offered a significant reward to anyone who could build a cotton-spinning machine in the United States. Samuel Slater, who had been an apprentice in an English cotton factory, reconstructed a cotton-spinning machine and proceeded to build an American factory. Thus, the Industrial Revolution arrived in the United States in 1793.

What happened to the economic reign of Europe? Over half of the world's most important modern inventions were British but the British stopped investing in the training and small businesses necessary to manufacture products.

The United States experienced this in the race for space. After the Soviets launched the world's first satellite, the United States began re-investing in human capital by improving science education. This led humans to the moon and made numerous tools including cordless appliances, smoke detectors, and UV-blocking sunglasses possible.

Historically, the rise of civilizations depended on innovations that made food and goods available, thus improving the standard of living and quality of life for citizens. These innovations were made when science and math were used to understand the world and to use the Earth's resources. Competition was the motivation for these technological and business innovations; the primary resource was human capital.

**Discussion Questions:**

1. Colleges are recruiting foreign nationals, often because these students can pay full tuition. These students usually major in mathematics or science. Will this behavior reduce the trained American workforce?

2. To compete in a global economy and maintain a high standard of living, which type of jobs should a country try to stimulate?
   a. Tradable jobs (factory jobs making things like cars and clothing that can be made somewhere else).
   b. Non-tradable jobs (such as nurses and auto mechanics, who provide services that are consumed where they are produced).

3. Companies pay $1,500 to $5,500 to apply for H-1 Visas for foreigners with bachelor's degrees in a specialty field such as nursing or computer science.
   a. Are foreign nationals taking jobs from Americans?
   b. How can Americans compete for these jobs?

4. Copernicus, Kepler, and Galileo were in conflict with religious doctrine because they published their evidence to support heliocentrism—that the Earth revolves around the sun. The commonly held idea at the time was that the Earth was the center of the universe. Use this example to discuss whether the competition between commonly held beliefs and new evidence inhibits advancements?

5. With which of the following statements do you agree? Give reasons for your answer.
   a. Science is a luxury that we can't afford to invest in.
   b. Science is more essential for our quality of life than it has ever been before.

**Future Implications:**

Innovation requires change, risk, and investment in human capital—things discouraged by leaders of early civilizations. Modern technological innovations led to the personal computer, lifesaving biotechnologies, and medicines and have driven the U.S. economy. One technology company added 0.25 percentage points to the U.S. economy's growth in the third quarter 2012.

The U.S. Bureau of Labor Statistics reports that 12.1 million Americans are unemployed while there are 3.7 million unfilled jobs. Why are companies hiring foreign workers on H1 visas to fill these jobs? (H1 visas allow U.S. companies to employ foreign workers in specialty occupations.) Over 50% of the unfilled jobs are in technology and healthcare and require postsecondary science and mathematics education. The unemployment rate for healthcare occupations is 2.7% and 3.3% for math and computer occupations compared to 7.8% for all occupations.

An additional 20 million workers with postsecondary math and science education will be needed by 2020. Unfortunately, among 34 countries participating in international testing, U.S. students ranked 17th in science and 23rd in mathematics. Will the U.S. invest in the math and science education, that is the human capital, needed to remain competitive in the global economy?

**Additional Resources:**

Crow, Michael and Mariko Silver. "American education systems in a global context." *Technology in Society* 39: 279-291, 2008. Discusses the importance of national education and science policy decisions to enhancing the well-being of citizens.

Ferguson, Niall. *Civilization: The West and the Rest*. New York: Penguin Group, 2011. The author introduces six factors important for prosperity.

*Job Openings and Labor Turnover*. U.S. Department of Labor Statistics, Bureau of Labor Statistics. http://www.bls.gov/jlt/. A valuable source of data on labor market activity and working conditions.

Langdon, David et al. *STEM: Good Jobs Now and for the Future*. Washington, D.C.: U.S. Department of Commerce, Economics and Statistics Administration, July 2011. http://www.esa.doc.gov/Reports/stem-good-jobs-now-and-future. An analysis of employment, education, and salaries in science and technology jobs.

Marks, Robert. *The Origins of the Modern World: A Global and Ecological Narrative from the Fifteenth to the Twenty-first Century*, 2d ed. New York: Roman & Littlefield, 2002. Provides a global perspective of historical events.

Raju, P. K. and Ashley Clayson. "The Future of STEM Education: An Analysis of Two National Reports." *Journal of STEM Education* 11 (5 & 6): 25-28, 2010. http://ojs.jstem.org/index.php?journal=JSTEM&page=article&op=view&path[]=1645&path[]=1339. A discussion of the decline in U.S. competitiveness in the "global knowledge economy."