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Strengthening Industry & Academia Partnerships *in Manufacturing*

DEVELOPING THE 21ST CENTURY WORKFORCE

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Introduction/ Summary

Industry and academia collaboration has become a subject of great interest to industry, academics and policy makers. It is now acknowledged by noted industry advisors that such relationships are valuable for innovation. In today's global economy, disruptive innovation and disruptive technology may well be the catalysts that determine whether a manufacturing or service organization even exists. Two-year and four-year public institutions of higher education face dwindling state and federal financial support creating a perfect storm for average higher education institutions to eventually reach zero state funding. Thomas Mortenson (2012), a senior scholar at The Pell Institute for the Study of Opportunity in Higher Education in Washington, D.C., wrote an article in the Winter 2012 Edition of American Council on Education (ACE) entitled "State Funding: A Race to the Bottom". The article states, "Based on the trends since 1980, average state fiscal support for higher education will reach zero by 2059, although it could happen much sooner in some states and later in others. [Eventually] public higher education [will] gradually [become] privatized" (p. 27).

Background/ Problems

With an undetermined future for state funding, higher education administrators are working in the unknown territory of a skill set (collaboration with business) that could come to be commonly used in industry.

Mortenson (2012) further states that,

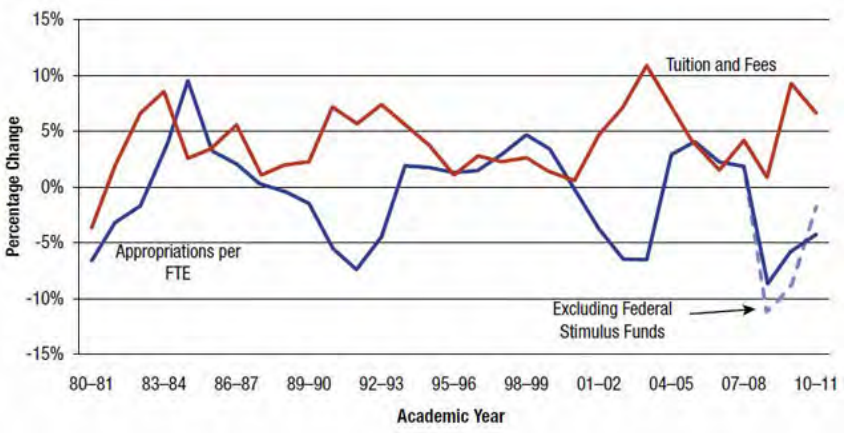
> The longer-term issues are being addressed in some states and at some public institutions. If these public institutions are no longer state supported who owns them? Who should govern them? Who should they serve? Should states be contracting for quite specified outcomes? The defunding of public higher education by the states inevitably inaugurates a new conversation about who controls them and whose interests are to be served. The states will play a diminished role in finding answers to these questions if public higher education is to survive and thrive (p. 29).

The College Board's annual *Trends in College Pricing 2011* report graph below concurs with Mortenson's findings and illustrates dwindling state funding for higher education since its peak of almost +10

percent of appropriations per Full Time Equivalent (FTE) (student) in the mid 1980's to a drastic low of approximately -10 percent in 2009, back up to approximately -5 percent in 2011. See figure 1.

The 2011 funding effort was down by 40.2 percent compared with fiscal 1980. Extrapolating that trend, the national average state investment in higher education will reach zero in fiscal 2059. In other words, states are already 40 percent of the way to zero. At this rate of decline, it will take another 48 years to finish off the remaining state support for higher education. Mortenson (2012) elaborated on dwindling state funding and stressed, "Based on the trends since 1980, average state fiscal support for higher education will reach zero by 2059, although it could happen much sooner in some states and later in others. Public higher education is gradually being privatized (p. 27). So, where will the funding for institutions come from?

***Figure 1*. 2011 The College Board's annual *Trends in College Pricing 2011* report**



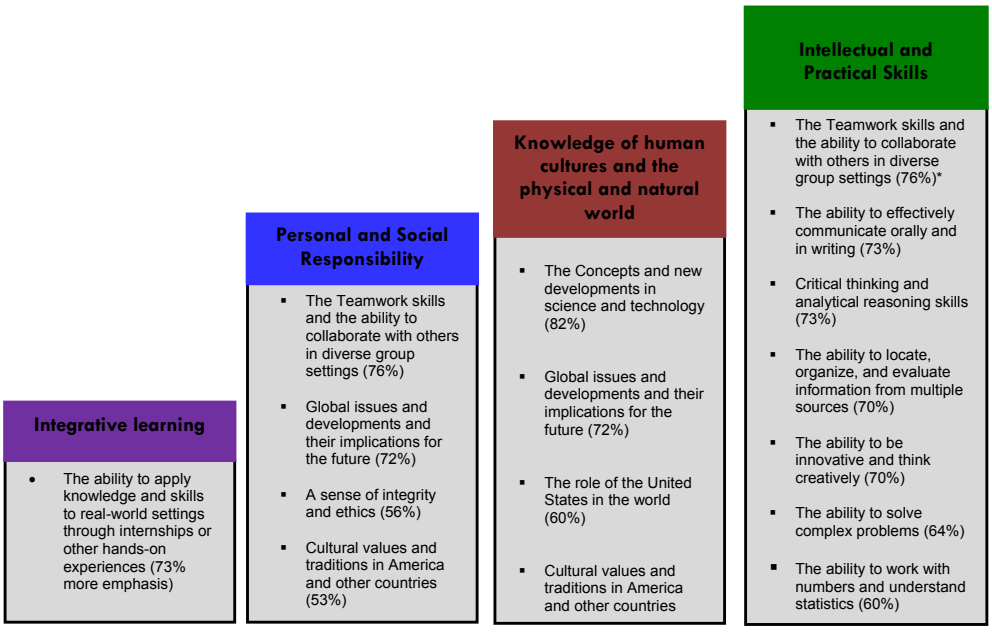
Two-year higher education institutions face the same challenges as traditional four-year institutions, dwindling government support. The federal government's stimulus money temporarily delayed the inevitable end, or great decrease, in government funding for higher education. In June 2012 the Center for American Progress released an article by Stephen Steigleder and Louis Soares entitled, *Let's Get Serious About Our Nation's Human Capital-A Plan to Reform the U.S. Workforce Training System.* In the article the writers proposed a plan to overhaul and reform the workforce training and counseling system. Steigleder and Louis Soares (2012) emphasized, "Programs would be implemented with private-sector partners and linked to projected job openings in high-growth regional industries. Participants would earn associate degrees, technical certificates, and industry-recognized credentials"

(p. 5). This may suggest there is a paradigm shift from higher education for general purposes, or liberal arts education, at least in part, to education for specific jobs and career occupations.

Four-year institutions of higher education and industry employers may favor a two-pronged approach to a college education, according to a December 28, 2006 study by Peter D. Hart Research Associates, Inc. entitled, *How Should Colleges Prepare Students to Succeed in Today's Global Economy?* Hart (2006).The study was prepared for The Association of American Colleges and Universities, which includes community colleges. As evidenced by the results of this study (see Figure 2 below), a majority of employers and a majority of recent college graduates reject a higher education approach that focuses narrowly on providing knowledge and skills in a specific field; the Hart study indicates that majorities of employers and recent college graduates believe that an undergraduate college education should provide a balance of a well-rounded education and knowledge and skills in a specific field (p. 4).

In presenting the employers' point of view on the responsibility of a college education, the study concluded that the majority of employers think that colleges and universities should place more emphasis in the areas listed in the categories below. See figure 2.

***Figure 2*. Adapted from information in a 2006 study by Peter D. Hart Research Associates, Inc., findings of the four areas of need to be taught by colleges and universities.**



The Hart study article further explains,

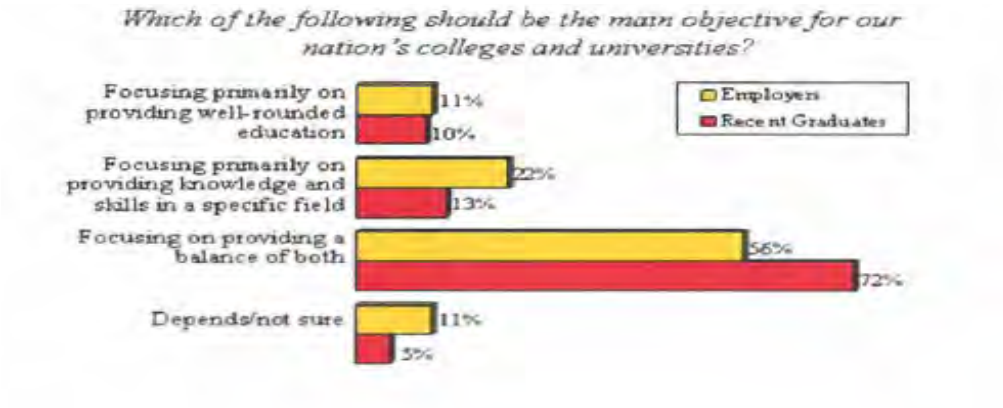
> A key area of concern for both employers and recent college graduates is the degree to which college students are given the opportunity to put learning outcomes into practice. They believe that higher education should give students more experience with real-world applications of their knowledge and skills through hands-on learning (p.3).

Upon hearing a description of liberal education, large majorities of employers and recent graduates endorse it as important for colleges and universities to provide this type of education.

Key Findings of Peter D. Hart Research Associates, Inc.

Majorities of employers and recent college graduates believe that an undergraduate college education should provide a balance of a well-rounded education and knowledge and skills in a specific field. Both audiences reject a higher education approach that focuses narrowly on providing knowledge and skills in a specific field. Fifty-six percent of business executives think that our nation's colleges and universities should focus on providing all students a balance of both a well- rounded education with broad knowledge and skills that apply to a variety of fields and knowledge and skills in a specific field and 11 percent favor a focus primarily on providing a well-rounded education. Just 22 percent of employers endorse a narrow focus on providing skills and knowledge in a specific field (Peter D. Hart Research Associates, 2006). See figure 3.

***Figure 3*. Illustration of the Balance of Broad Knowledge and Specific Skills Preferred: by Peter D. Hart Research Associates, Inc., published December 28, 2006.**



Solution

Based on the evidence contained in this white paper, it is the authors' opinion that academic institutions, industries, and policy makers/governments should collaborate and strengthen their relationships by soliciting feedback from consumers/customers of their products and services and use that combined feedback to shape academic programs that meet the needs and desires of all constituents.

Industry and academia partnerships could well be the vehicle that propels an industrial organization to the front of its field, or, the lack of such a partnership may well doom the organization to oblivion. The same could be said of such partnerships for the rescue of higher education funding. The primary goal of this white paper is to explore the dichotomy between the strong motivations of both industry and academia to conduct research that promotes new product development and scholarly productivity. Of equal importance, there is a need to make the collaborative effort effective.

In support of the manufacturing inclusion of this white paper, the authors used the Manufacturing Institute, the 501 (c) 3, non-partisan affiliate of the National Association of Manufacturers whose mantra is, *Making Manufacturing Strong Through Education, Innovation, and Research.* A Manufacturing Institute article entitled, *2011 Public Perception of Manufacturing,* concluded the following concerning American Manufacturing,

> Hungry for a strong manufacturing sector, Americans are nervous about its future. Our third annual survey of the American public indicates that nearly three-fourths (72%) of those surveyed do not believe that the economy has been improving or is in better shape since 2008. Over two-thirds (67%) of those surveyed believe the economy remains weak and could fall back into recession. And Americans are nearly evenly split, 50-50, on whether the economy will show significant signs of improvement by 2015. Additionally, the public is not confident that business leaders and policy makers necessarily understand how to effectively grow and strengthen the economy. So it is noteworthy that our recent survey of the American public's opinion on manufacturing reveals that throughout one of the most turbulent periods in U.S economic history, they have maintained remarkably consistent views, year after year, on the importance of manufacturing (p.16).

Furthermore, Generation Y's work ethic, world view and their perception of the *working man* makes restoring American manufacturing difficult and a challenge for the United States to regain the top global position.

Conclusion

Strengthening industry and academia partnerships in manufacturing, the backbone of most developed nations, means industry personnel in the classroom and academic students in the industrial workplace. Greg Galdabini is Senior Director of Editorial Communications, U.S. Chamber of Commerce and Editor-in-Chief of FreeEnterprise.com and Free Enterprise magazine. In a Feb 12, 2013 FreeEnterprise.com article entitled, *U.S. Manufacturing: The World's Third Largest Economy*, Mr. Galdabini states, "During the recent recession, many observers wrote American manufacturing's obituary, claiming that it could no longer be a world leader because of intense competition from low-cost competitors" (¶ 1). In addition, the blog created by Galdabini added the opinion of ESPN College Gameday host Lee Corso. Corso,

> Not so fast, my friend The U.S. manufacturing sector generates $1.7 trillion in value each year—equivalent to nearly 12% of GDP. It supports over 17 million U.S. jobs. About 12 million Americans—or 9% of the workforce—are directly employed in the manufacturing industry (¶ 1).

In comparing U.S. manufacturing to some other nations, based upon a study of U.S. Manufacturing by Dr. Mark J. Perry, Professor of Economics at the Flint campus of The University of Michigan, Dr. Perry emphasized the following three points in American manufacturing (¶ 1):

1. The combined sales revenue (including global sales) of (only) the top 500 US-based manufacturing firms in 2012 was $6.01 trillion, which was a 17.2% increase over 2011 sales of $5.13 trillion. To put those sales in perspective, if those 500 US manufacturers were considered as a separate country, their revenue last year of $6.01 trillion would have ranked as the world's third's largest economy behind No. 1 US and No. 2 China, and slightly ahead of No. 4 Japan's entire GDP of $5.98 trillion in 2012.

2. The sales revenue from the top ten US manufacturing industries totaled $4.83 trillion in 2012 (see figure 4.), which was 44% more than Germany's entire GDP of $3.36 trillion last year.

3. Annual sales of $1.62 billion in 2012 for America's single largest manufacturing industry – petroleum and coal products – was larger than the GDP of Australia last year of $1.54 trillion, and almost as much as Canada's $1.77 trillion in GDP in 2012.

Figure 4. Mark Perry published -*Top 500 U.S. Manufacturing Firms in 2012.*
From: http://www.aei-ideas.org/2013/02/if-top-500-us-manufacturing-firms-were-a-separate-country-they-would-have-been-the-third-largest-country-last-year/

RANK	10 LARGEST MANUFACTURING INDUSTRIES, 2012	REVENUE (MILLIONS)	EXAMPLES
1	Petroleum & Coal Products	$1,629,494	Exxon, Chevron, Conoco
2	Computers & Other Electronic Products	$814,172	HP, IBM, Apple
3	Chemicals	$441,233	P&G, Dow, DuPont
4	Food	$387,855	General Mills, Kellogg, Campbell
5	Motor Vehicles	$333,693	Ford, GM, Harley-Davidson
6	Pharmaceuticals	$317,763	J&J, Pfizer, Merck
7	Machinery	$263,840	Caterpillar, Deere, Xerox
8	Aerospace & Defense	$260,360	Boeing, Lockheed Martin
9	Electrical Equipment & Appliances	$248,864	GE, Emerson, Whirlpool
10	Motor Vehicle Parts	$137,552	Johnson Controls, Cummins, TRW
	Total	**$4,834,826**	

In the same article above, at the Greater Elkhart (IN) Chamber of Commerce, U.S. Chamber of Commerce Chief Operating Officer David Chavern expressed in a blog:

> Manufacturing jobs have dropped – a lot. U.S. manufacturing jobs peaked at 19.5 million in 1979. But by 2010, the number of Americans directly employed in manufacturing fell to a new low of 11.4 million. Where did those jobs go? Mostly to a country called "productivity." Technological change, automation, and widespread use of information technologies have enabled firms to boost output even as some have cut payrolls. These advancements are also allowing us to make high-value-added products that drive growth, innovation, and competitiveness (¶ 1).

Two-year and four-year public institutions of higher education face dwindling state and federal financial support creating a perfect storm for average higher education institutions to eventually reach zero state funding.

To develop cutting-edge products and services in a manufacturing industry at the pace that current global innovation demands and to increase U.S. productivity, academia and industry must change the way we think about education and industrial relationships. In addition to liberally educating students, educators and students must be engaged in hands-on activities so that students can contribute immediately to innovate at faster and faster levels. Concepts such as active learning, where students take ownership in the design and implementation of their own learning, must be encouraged. More focused manufacturing learning may involve newer concepts such as early childhood education intervention for the sake of manufacturing. Nurturing post-secondary schools with STEM programs where students who have a propensity for the STEM disciplines, are encouraged to pursue career paths in these disciplines early in the education process. New manufacturing programs such as Advanced Manufacturing and Manufacturing Execution Systems (MES) can be taught along with more mature manufacturing concepts such as Six Sigma, Lean Manufacturing, Supply Chain Management and Enterprise Resource Planning (ERP). A joint industry-academic comprehensive approach to this very complex problem of educating the workforce will most likely yield the best results.

References

Galdabini, G. (2013, February 12). Re: FreeEnterprise.com, "*U.S. Manufacturing: The World's Third Largest Economy*" [Electronic mailing message]. Retrieved from: http://www.freeenterprise.com/economy-taxes/us-manufacturing-worlds-third-largest-economy

Mortenson, T. G. (2012). *State Funding: A Race to the Bottom and Presidency*, (Vol 15, Issue 1). Retrieved from: http://0 ehis.ebscohost.com.sheba.ncat.edu/ehost/pdfviewer/ pdfviewer?sid= 655cfa93-26d5-4d43-b684-82d0af468cd0%40sessionmgr104&vid= 4&hid=102

Peter D. Hart Research Associates, Inc., (2006). Conducted On Behalf Of: The Association Of American Colleges And Universities, *How Should Colleges Prepare Students to Succeed in Today's Global Economy?* http://www.americanprogress.org/wp-content/uploads/issues /2012/06/pdf/workforce_training.pdf,

Stephen Steigleder and Louis Soares (2012) . The Center for American Progress, Let's Get Serious *About Our Nation's Human Capital-A Plan to Reform the U.S. Workforce Training System*, Retrieved from: http://www.americanprogress.org/wp-content/uploads/ issues/2012/06 /pdf/ workforce_training.pdf

The National Association of Manufacturers (2011). *2011 Public Perception of Manufacturing* Retrieved from: http://www.deloitte.com/assets/Dcom-UnitedStates/Local%20Assets /Documents /us%20cip%202011PublicViewonManufacturingReport%20090811.pdf

Figures

Figure 1. The College Board's annual Trends in College Pricing 2011 report, Retrieved from: http://trends.collegeboard.org/sites/default/files/college-pricing-2012-full-report-121203.pdf

Figure 2. Adapted from a 2006 study by Peter D. Hart Research Associates, Inc., findings of the four categories need to be taught by colleges and universities, Retrieved from: http://www.aacu.org/leap/documents/Re8097abcombined.pdf

Figure 3. How Should Colleges Prepare Students to Succeed in Today's Global Economy? Retrieved from: http://www.americanprogress.org/wp-content/uploads/issues/2012/06/pdf/workforce_training.pdf

Figure 4. Retrieved from: http://www.aei-ideas.org/2013/02/if-top-500-us-manufacturing-firms-were-a-separate-country-they-would-have-been-the-third-largest-country-last-year/.

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