

EFFECTS OF ECONOMIC GLOBALIZATION ON THE UNITED STATES' DEFENSE INDUSTRIAL BASE

BY

LIEUTENANT COLONEL JOHN M. LAZAR
United States Army

DISTRIBUTION STATEMENT A:

Approved for Public Release.

USAWC CLASS OF 2007

This SRP is submitted in partial fulfillment of the requirements of the Master of Strategic Studies Degree. The views expressed in this student academic research paper are those of the author and do not reflect the official policy or position of



U.S. Army War College, Carlisle Barracks, PA 17013-

Report Documentation Page				Form Approved OMB No. 0704-0188	
Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.					
1. REPORT DATE 30 MAR 2007		2. REPORT TYPE Student Research Project		3. DATES COVERED 00-00-2006 to 00-00-2007	
4. TITLE AND SUBTITLE Effects of Economic Globalization on the United States' Defense Industrial Base				5a. CONTRACT NUMBER	
				5b. GRANT NUMBER	
				5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S) John Lazar				5d. PROJECT NUMBER	
				5e. TASK NUMBER	
				5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) U.S. Army War College, Carlisle Barracks, Carlisle, PA, 17013-5050				8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)				10. SPONSOR/MONITOR'S ACRONYM(S)	
				11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
12. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release; distribution unlimited					
13. SUPPLEMENTARY NOTES					
14. ABSTRACT See attached.					
15. SUBJECT TERMS					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT Same as Report (SAR)	18. NUMBER OF PAGES 20	19a. NAME OF RESPONSIBLE PERSON
a. REPORT unclassified	b. ABSTRACT unclassified	c. THIS PAGE unclassified			

The U.S. Army War College is accredited by the Commission on Higher Education of the Middle State Association of Colleges and Schools, 3624 Market Street, Philadelphia, PA 19104, (215) 662-5606. The Commission on Higher Education is an institutional accrediting agency recognized by the U.S. Secretary of Education and the Council for Higher Education Accreditation.

USAWC STRATEGY RESEARCH PROJECT

**EFFECTS OF ECONOMIC GLOBALIZATION ON THE UNITED STATES' DEFENSE
INDUSTRIAL BASE**

by

Lieutenant Colonel John M. Lazar
United States Army

Dr. Clayton Chun
Project Adviser

This SRP is submitted in partial fulfillment of the requirements of the Master of Strategic Studies Degree. The U.S. Army War College is accredited by the Commission on Higher Education of the Middle States Association of Colleges and Schools, 3624 Market Street, Philadelphia, PA 19104, (215) 662-5606. The Commission on Higher Education is an institutional accrediting agency recognized by the U.S. Secretary of Education and the Council for Higher Education Accreditation.

The views expressed in this student academic research paper are those of the author and do not reflect the official policy or position of the Department of the Army, Department of Defense, or the U.S. Government.

U.S. Army War College
CARLISLE BARRACKS, PENNSYLVANIA 17013

ABSTRACT

AUTHOR: Lieutenant Colonel John M. Lazar

TITLE: Effects of Economic Globalization on the United States' Defense Industrial Base

FORMAT: Strategy Research Project

DATE: 12 March 2007 WORD COUNT: 5416 PAGES: 20

KEY TERMS: Operational Net Assessment, Center of Gravity, Intellectual Capital

CLASSIFICATION: Unclassified

This paper examines the effects of globalization on the United States' Defense Industrial Base (DIB). It provides an operational net assessment and offers an analysis of the center of gravity of the US DIB in terms of globalization. The critical vulnerability determined by the center of gravity analysis is education. Further review of this vulnerability determined that intellectual capital is the key component of education. Several recommendations are offered to mitigate and maintain domestic intellectual capital superiority.

EFFECTS OF ECONOMIC GLOBALIZATION ON THE UNITED STATES' DEFENSE INDUSTRIAL BASE

The product of mental labor - science - always stands far below its value, because the labor-time necessary to reproduce it has no relation at all to the labor-time required for its original production.

—Karl Marx

This paper examines the effects of globalization on the United States' Defense Industrial Base (DIB). It provides an operational net assessment and offers an analysis of the center of gravity of the US DIB in terms of globalization. This paper is limited to economic globalization, although globalization has many other aspects. These include political, cultural, religious, social, technological and military impacts. Space and time dictate my concentration on the economic impact. Many of these warrant analysis on their effect on the US elements of national power, but further research is left for the future.

The paper takes a systematic approach to the affect of globalization and the center of gravity. A base definition is offered. An anti-globalization viewpoint is offered to provide an additional perspective and comparison. Next, a review of the globalization of the DIB is offered. This includes a historical review, global elements, and the current effect of globalization of the DIB. The US defense industry has many strategic aspects. In order to narrow this discussion, elements that conform to an operational net assessment are addressed. These elements form the basis of the center of gravity analysis review. Once the elements of the globalized DIB are determined, a formal strategic center of gravity analysis is conducted. The friendly strategic center of gravity analysis yields recommended areas to consider protecting. Finally, the paper offers recommendations to enhance the friendly strategic center of gravity against any critical vulnerabilities. The paper lays the foundation for follow on studies.

Economic Globalization

There are several definitions of economic globalization. This paper does not attempt to account for all the permutations and combinations of economic globalization. Understanding the leading terms of art and the counter perspective is essential to laying the foundation of this paper. Perhaps no one has brought to the forefront of public consideration a basic understanding of globalization more than Thomas L. Friedman. In his two books, *The Lexus and the Olive Tree* and *The World is Flat*, he has raised the general consciousness of the concept of globalization and its impact.¹ In very concise terms, Friedman believes, "Globalization means the spread of free-market capitalism to virtually every country in the

world.”² This translates to an opening of trade, services, and assets that has a profound impact on nations, markets, and industries.

Specifically, he outlines globalization as having ten flattening forces. These forces are worth a review, keeping in mind the DIB. First, the fall of the Berlin Wall marks the dominance of free-market capitalism and the end of communist state driven command economies. Second, the Internet browser brought worldwide access to information to anyone with the appropriate equipment. Third, workflow software brought standardization of the process that allowed industry to seek the cheapest source. Fourth, open sourcing and freeware expanded availability. Fifth, outsourcing between the United States and other leading software developers increased relationships. The sixth flattener was offshoring. Offshoring allows companies to seek more efficient markets for executing sub-processes through competition. Seventh, horizontal supply chains have created standard practices that increase flow of goods. Eighth, insourcing allows shipping companies to handle minor goods repair and reduces the turn-around time to the customer. Ninth, informing addresses the worldwide access to a body of knowledge never before available. Tenth, the expansions of digitized and mobile information processors are the steroids of flatteners. Although he is recognized for his contributions to the body of knowledge on globalization, he is only a journalist, albeit a very perceptive one.

Others take a more academic approach to economic globalization. The Washington has determined multiple definitions for globalization. The National Security Strategy of 1999 and the Defense Science Board defines globalization in terms of economic integration.³ Two additional perspectives from respected academics are also provided. Kenneth Arrow and Martin Wolf, renowned economists, have identified are several key aspects to economic globalization. The economics of globalization are based on transborder trade and movement of capital, the new international order, the diffusion and homogenization of economic institutions, labor markets, and governance.⁴ Wolf defines globalization as, “ the integration of economics through markets across frontiers.”⁵ Advanced to primitive economics have been integrated into one, willing or not.

There is a general and economic anti-globalization viewpoint that is worthy of review. For example, general anti-globalization activists met in Nairobi in 2007. They blamed this phenomena for destabilizing the world. Additionally they believe that globalization is responsible for the widespread of diseases, drug trade, human trafficking, environmental damage, unregulated hazardous materials, and greater accessibility to deadly weapons.⁶ Not all of the leading economist accept the globalization perspective. Others claim that globalization has reach its zenith and fallen.

Friedman and the anti-globalists provide a very broad definition. For this paper, economic globalization is defined in its most essential form. Simon Reich perhaps provides a useful approach when he defined it as “the worldwide spread of sales, production facilities, and manufacturing processes, all of which reconstitute the international division of labor”.⁷ To fully understand and apply economic globalization one must also understand the functional characteristics. Again, Reich provides an insight,

These include the liberalization and deregulation of markets, privatization of assets, retreat of state functions (particularly welfare ones), diffusion of technology, cross-national distribution of manufacturing production (foreign direct investment), and the integration of capital markets.

His concise definition and functional characteristics serve as the working definition for this paper. His definition captures the general concepts of Friedman, Arrow, and Wolf.

US Defense Industry Globalization

A general review of economic globalization on the US defense industry is useful in understanding the historical context of the current impact. Many argue that the US defense industry has been a product of economic globalization since the time of the American Revolutionary War. The global systems have been in place all along. The functional and geographic characteristics have just been refined over the years.

The industrialization of the world and the US prior to World War I (WWI) marked an era similar to today. The characteristics of economic globalization were present then. Worldwide mobility of commodities increased.⁸ Capital and labor exchange also increased and broadened. Trafficable and safe sea-lanes decreased political and geographic barriers. The trans-Atlantic telegraph increased the flow of information from the US to Europe at unimaginable speeds. The clear stamp of globalization through ease of transportation and communication along economic liberalization was present. WW I combat operations stopped this expansion. Later global and regional economic depression and disruption kept globalization from flourishing for decades. The Second World War revitalized the global expansion that was present before WW I, but it concentrated on mostly materials and basic products, not key consumer products. The vast post-war domestic economic expansion was fueled by the enabled elements of globalization through satisfying pent-up consumer demands.

The Cold War saw a large number of US defense contractors vying for a portion of a healthy defense budget. The Regan defense initiatives provided a prosperous environment for the US DIB for domestic and international markets. Numerous redundancies existed with the DIB within each sector. Firms wanted to sell products to allies and other nations. However

these multinational companies (MNC) were limited to specified trading partners. A large number of US defense contractors were loosely aligned with MNC of our Cold War partners.⁹ Although labor and capital flowed between Free World MNCs, there was a restricted flow of technology and knowledge capital to these partners. Off-shoring was restricted based on the complexity and security of the item. There was however an increased economic liberalization with partners.

There is evidence that economic globalization effects are clearly noticeable in post-Cold War US defense industry. The political and economic barriers of the Cold War largely disappeared. The start of the post-Cold War era begins with one of Friedman's flatteners, the fall of the Berlin Wall. With the fall of the Wall came an overwhelming American demand for a peace dividend.¹⁰ The drive for a peace dividend reduced defense dollars for procurement. In response the defense corporations consolidated to survive. Most of the companies that did not consolidate suffered from the peace dividend and left the market. Cost reduction efforts were the norm. The aircraft industry is the best example of this case. A juxtapose from a decrease of defense dollars and the relief of economic globalization inhibitors forced the DIB to search for new markets and strive to become more competitive.

Economic globalization affects the US DIB that support the Global War on Terrorism (GWOT). Since 9-11, the US defense budget increased significantly more than the Cold War at least in normative terms. At the same time the US federal debt increased significantly. There are more borrowed dollars than ever before to spend on defense. There has been an increase in liberalization and deregulation of the market. Unlike the Cold War era, MNCs' national allegiances can be ambiguous at best. Strategic competitors have used legitimate business activities to unlawfully transfer U.S. technology.¹¹ This diffusion of technology is increasing with globalization. Countries are working through MNCs to the benefit of their stockholders to determine their support for GWOT. Some of our traditional allies are benefiting from globalization at the expense of our efforts to win the GWOT. Cross-national distribution of manufacturing production blurs the national identity of MNCs. Some of the functional characteristics of globalization are operating with decreased security but increased efficiencies. The security implications of off-shoring production of technologies are grave. Replacement or substitution of simplistic offshore produced goods is easily achieved. In total the US government and primarily the US DIB is not adequately postured for this new era. Janes Defense Weekly identified of the USG's inability to address the effects of globalization on the Department of Defense.¹² Now that a brief historical context of the globalization of the DIB has been examined, a review of the strategic aspects of the DIB is necessary.

Strategic Aspects of the DIB

The strategic aspects of the DIB must be reviewed to form the basis of understanding for the center of gravity analysis. A Systems of Systems Analysis (SoSA) technique provides structure to the process. A disciplined approach to this review is found in the Operational Net Assessment (ONA).¹³ The ONA takes a SoSA approach by categorizing major systems. This disciplined approach is used to assess friendly, enemy and neutral organizations or states capabilities and weakness as a precursor to a structured center of gravity analysis.

ONA includes the political, military, economic, social, infrastructure, and information systems.¹⁴ Each of these systems has systems nodes that represent a person, place or thing. The nodes in the systems are generally link thus forming an interconnected system. Not all of these have application to economic globalization or the DIB. The systems that have systems nodes that are relevant are military, economic, infrastructure, and social systems. Each of these systems has at least one systems node that is pertinent to the review. Each system and its applicable systems node will be discussed.

Military Systems of the ONA consists of five systems nodes. They are leadership, armed forces, internal security, military industrial complex, and sustainment. The applicable systems node in this system is the military industrial complex. The military industrial complex is comprised of three applicable sub-systems nodes. The three applicable sub-systems nodes are national arms production, foreign arms production, and research and development.

The US national arms production in terms of systems and dollars has declined from the Cold War era. The greatest limitation to US arms production is its capacity to surge both complex and mass production.¹⁵ Economic globalization would lead one to believe that fitting substitutes could be easily found through horizontal supply chains. This is not always the case as arms become more technologically advanced and specialized. Recent examples of the limitations of key wartime surge requirements are body armor and blast and ballistic steel for light wheeled vehicles. Both armor and armor upgrades have made headlines and drawn the attention of Congress.

Foreign arms production is the second pertinent sub-system node. The end of the Cold War has seen a reduction in the production and distribution of arms in many markets. There has been a worldwide decline in requirements for military equipment over the past thirteen years.¹⁶ The US remains as the leader in total arms sales amongst the West European Organization for Economic Cooperation and Development (OECD) countries, other OECD countries, and non-OECD countries. The US leads the second group by over \$30 billion. The

US has a solid foundation in foreign arms production and sales, but the market has become more competitive.

Research and development is the last sub-system node of the military industrial complex. There has been a decline in worldwide research and development expenditures since 1993.¹⁷ The decline amongst the major leaders has only varied between one to five percent. The United States continues to lead all nations in research and development in total funds expended and percentage of military funding. These trends fair well for continued US dominance. It is imperative that research and development efforts continue to surpass our adversaries and allies.

The second applicable ONA is economic systems. There are two system nodes that are applicable. These nodes are production and distribution. Each of these has several sub-system nodes. Production consists of industrial and services. The United States' recent industrial production rose at an annual rate of 4.6 percent.¹⁸ This appears to confirm a trend. Compared to the other members of the G-7, only Japan performed better at 5.6 percent. Industrial production does not appear to be at risk.

Services are the second sub-system of economic system of production. This node by far is the US strongest area of development. The US economy is more focused on services than manufacturing.¹⁹ This trend has been consistent over time. Not only does it surpass manufacturing it is credited with positively contributing to U.S. economic growth. The Brookings Institute credits service industries for 73 percent of post-1995 labor productivity growth.²⁰ This sector is continues to thrive and contribute to our economic health.

Distribution as a system has two sub-system nodes. International trade consists of exports and imports. The US experienced in 2006 a total goods and services deficit of \$763 billion.²¹ This is an increase of \$46.9 billion from 2005. This would lead to a great concern until it is reviewed as a percentage of GDP. As a percentage of GDP the deficit is unchanged from 2005. Although the US service sector has been strong, the imports of services were up in 2006 from 2005 by \$27 billion. Standardization of processes and intigration of capital markets could account of the poor results. The sub-system node of international trade is of grave concern.

Infrastructure systems are comprised of heavy and light manufacturing, petroleum, and nuclear. Although there are 23 sub-system nodes in infrastructure, these are the most applicable. First, heavy and light manufacturing are addressed. The US produces a quarter of the world's output of manufacturers.²² The US total manufacturing production increased from 1972 to 2003 by more than 270 percent.²³ Given the effects of economic globalization these are incredible achievements. One would expect cross-national distribution of manufacturing

processes would decrease the national manufacturing output. Manufacturing employment in the U.S. has decreased since 1998. This would indicate a more efficient process. The U.S. is not at risk in this node.

The petroleum sub-system node is a known US concern. US petroleum dependency has dictated much of recent political actions. The US imports a majority of its petroleum from non-OPEC countries as compared to OPEC. There is, however, other indicators concerning this node. Recently, the US had a 0.4 percent decline in oil demand. It was the first decline since 2001. World growth rates stand at 1.4 percent per year.²⁴ China position concerning petroleum dependency is far graver than the US.

Nuclear power is the final applicable sub-systems node of the of infrastructure system. Nuclear power provides 20 percent of the total electricity power in the US. Not all of the power from the plants is used economically. At the height of utilization of nuclear power in 2004 eight percent of power generated was unexploited. Nuclear power expenditures have increased from 2003 to 2004 by 4.1 percent.²⁵ Along with the increased production of nuclear power comes an increased threat. Nuclear security under the supervision of the Department of Energy and Department of Homeland Security has been increased since 9/11. The risk of failure in this node is catastrophic.

The final ONA is social systems. The pertinent sub-system is enabling systems where the applicable sub-system node is education. Although the US leads in undergraduate and graduate education institutions, the performance of its students is falling behind. The US students who are entering these institutions are not competitive with their international peers. An OECD survey ranked the US basic math and science skills 24th out of 29 country members.²⁶ It is not surprising that poor math and science students are not entering these fields. Asian and European universities far exceed the US in the number of science and engineering undergraduates. The trend continues for science and engineering doctorates. Both Asia and Europe have a larger percentage than the U.S. The total ratio of degrees in science and engineering in US colleges is only 5.7 degrees per 100.²⁷ As a point of reference European countries award between 8 and 13 degrees per 100. The trend continues to spiral. Foreign students pursuing graduate degrees in the US outnumber US students.²⁸ Education is a very troubling node.

The review of the eleven subsystems nodes reveals a number of concerns. The next step is to subject the systems of systems approach to a center of gravity analysis. This process, like the SoSA, is subjective in nature. Although this is not a quantitative process, it does provide a structured process to review the nodes.

Strategic Center of Gravity Analysis of the DIB

There are several accepted definitions of the center of gravity. Karl Clausewitz is recognized as coining the concept: "What the theorists has to say here is this: one must keep the dominant characteristics of both belligerents in mind. Out of these characteristics a certain center of gravity develops, the hub of all power and movement, on which everything depends. That is the point against which all our energies should be directed."²⁹ Others have added to his concept. Current US doctrine defines center of gravity as the source of power that provides moral or physical strength, freedom of action, or will to act.³⁰ Here we will only consider the friendly economic element of power. Specifically the US defense industrial base as an economic element of national power is the focus. This paper will not argue that the strategic center of gravity of the US is the defense industrial base. Instead it points to that aspect of the economic center of gravity within the defense industrial based that is the critical vulnerability.

A process has been developed to conduct a systematic approach to center of gravity analysis. Dr. Joseph Strange's Center of Gravity - Critical Capability - Critical Requirement-Critical Vulnerability concept is the most widely accepted process within the US Department of Defense.³¹ Each critical element flows to the subordinate element creating a hierarchical chain. The center of gravity consists of several critical capabilities. The critical capabilities show the way to a number of critical requirements. Critical requirements direct the final element of critical vulnerabilities. A basic understanding of each of the definitions is required in concert with the analysis. These are defined in order of the process flow.

The centers of gravity (CG) are the primary source of moral or physical strength, power and resistance.³² There can be several centers of gravity. In this case the single CG is presumed to be the elements of the defense industrial base that are subject to globalization. A simplified CG is named the defense industrial base globalization. This facilitates the process to determine the primary critical vulnerability.

The critical capabilities (CC) are the primary abilities that merits a center of gravity to be identified as such in the context of a given scenario, situation, or mission.³³ There are four CCs in this analysis. They are the major systems of the SoSA. The military, economic, infrastructure, and social systems are the primary abilities in terms of a defense industrial base globalization. The scenario or situation is the continued economic globalization of the US.

The critical requirements (CR) are the essential conditions, resources and means for a critical capability to be fully operative.³⁴ There are five CRs in total. They are the military industrial complex, economic production, economic distribution, infrastructure industry, and social enabling sub-systems. Each of these must be operational in order for the respective

military, economic, infrastructure, and social systems to function. Arguably, there are several other components of these systems but these CR are the only ones that are applicable to defense industrial base globalization.

The critical vulnerabilities (CV) are the critical requirements or components that are deficient or vulnerable to neutralization, interdiction or attack (moral/physical harm) in a manner achieving decisive results – the smaller the resources and effort applied and the smaller the risk and cost better.³⁵ There are eleven CVs that comprise the same sub-system nodes previously reviewed. Each of the sub-system nodes will be reviewed in terms of their deficiencies and vulnerabilities. The previous ONA provided the quantitative review of each sub-system node. The sub-system nodes are address by their CR grouping.

The CR of military industrial complex consists the CVs of arms production, foreign arms production, and research and development. Arms production and foreign arms production are vulnerable to interdiction and influence. Research and development is susceptible to influence, disruption, and co-option. None of these nodes are currently deficient. Of these three nodes, research and development is the most critical vulnerability.

The CR of production and distribution has four CVs. These are industrial, services, exports, and imports. All four are vulnerable to influence. Industrial, exports, and imports are disposed to interdiction. Imports and exports significantly are deficient and therefore the most critical vulnerability within production and distribution.

The CR of industry is comprised of three CVs. They are manufacturing, petroleum, and nuclear. All three are subject to foreign interdiction. Manufacturing and nuclear are vulnerable to domestic and foreign influence. Foreign suppliers expose petroleum to disruption. Petroleum and nuclear sub-system nodes are vulnerable to attack. Petroleum is the most CV of the industry CR.

Social enabling sub-systems is the final CR. Education is the only CV in this system. Education is evaluated as deficient. This is particularly evident in the area of science and engineering. It is vulnerable to influence, disruption, dissuasion, and co-option by foreign and domestic elements.

There are four sub-system nodes that are most vulnerable within their respective CR. These nodes are research and development, exports/imports, petroleum and education. Reviewing these CV nodes will lead to the primary focal point of this analysis. The most critical vulnerability of the four will offer a possible concentration of resources in order to protect and improve. The key to establishing the most critical is determining a link between the CVs.

The US leads in funding research and development. Funding is not the only aspect of research and development. The nation must have the intellectual capital behind the financial capital to maintain its supremacy. Education is the foundation to the intellectual capital. We cannot depend on foreign students as a source of our research and development workforce. Security restrictions require US citizens with advanced degrees to fill these positions. This subsystem CV node is linked directly to education.

Imports, exports, and education are the only three nodes that are rated deficient. Imports and exports can be directly manipulated in the short term to remedy their vulnerability. The government can through regulatory and protectionist laws address this issue. Markets can be flooded with under-valued goods with government subsidies drive down up exports. Subsidies can also lower prices of domestic goods to decrease import requirements. Fiscal manipulation of the currency can also affect the trade imbalance. Immediately the cost of imports and export can raise or lowered. This area is of serious concern but it can be artificially influenced.

Education is the final deficient sub-system node. The education system is a less controllable and responsive node. Shortcomings in fundamental science and math knowledge at the elementary level take years to overcome. Early indications of this disaster are foretold in the decrease in undergraduate degrees in the science and engineering areas. There are formidable forces who co-op the warning signs in fear that it may effect their livelihood. Strong domestic teacher unions and weakened administrations fight against basic minimum competencies in these areas. Foreign students are taking advantage of the domestic institutions only to export their new intellectual capital back to their county of origin. China is a clear example of this process. China aggressively places students in North American and European universities for this purpose. Education is a link to several other nodes in the systems of systems environment. Education is the most critical vulnerability in the center of gravity analysis of the US defense industrial base globalization.

What is to be Done?

Outcome of the center of gravity analysis leads one to believe that education is the critical vulnerability. The center of gravity analysis is a tool to help provide insights. Perhaps it is not really education, but what education provides. The process of education supplies a domestic workforce and citizenry that are able to meet the demands of society. A more definitive view of the education product has already been conceived.

The critical vulnerability is really domestic intellectual capital. The largest share of knowledge output using scientific papers as a measurement comes from Western Europe and

the United States.³⁶ More revealing is the disproportional ratio between a countries' standard of living and its production of knowledge. East Asian countries with high standards of living have had some of the lowest knowledge production.³⁷ Some believe that our economic strength depends on moving from a production-based economy to a knowledge-based economy. A leader in the US defense industry since 1958, Mr. Norman Augustine believes that as technology evolves you will have a much more limited population to meet the needs of the defense industry.³⁸ This places a premium on knowledge workers and intellectual capital.

A historical example may serve to illustrate impedance for change and institutional reaction. *Sputnik* was launched on October 4, 1957 by the opposing super power, the Union of Soviet Socialist Republics. The American public was outraged by the perceived technological advancement and strategic offensive capability of the Soviet Union. President Dwight D. Eisenhower developed several strategic policies to address the situation. One of the pillars of his policy addressed education reform. Eisenhower's education reform focused on three fronts. First, Eisenhower began a series of public speeches and radio broadcasts to increase public awareness of math and science education in terms of its effect on national defense.³⁹ This provided the public with a clear indication of the national importance of the education gap. Second, he solicited the top business executives to support his program.⁴⁰ Finally, he enacted the National Defense Education Act (NDEA) of 1958.

The NDEA took a broad approach to education reform in light of a second sputnik launch. The NDEA looked to improve or reform six areas. These areas focused on improvements in graduate schools, scholarships, fellowships, high school testing, improved equipment for teaching math and science, and improved teaching in foreign languages. These six areas combined with presidential attention provide an historical example to a perceived intellectual capital shortcoming.

There are several economic perspectives that may provide further insights. Karl Marx brought the duality of capital and labor. With the addition of knowledge a new trinity is formed. This trinity has been named capital, labor, and knowledge. The value chain of industry does not account for intellectual capital unless one includes integration.⁴¹ Integration passively assumes a certain amount of intellectual capital in order to complete the action. The resource-based view does not adequately address intellectual capital either. Transaction cost economics is void of it as well.⁴² There is another possible avenue to pursue.

Globalization has brought us to this nexus. Globalization is where to look for solutions. There are several thoughts on the matter from a economic globalization perspective.

Friedman's writings are a good place to start. He also offers others works as well. Friedman claims that Joseph Schumpeter is one of the defining economists of the globalization system.⁴³

Freidman approaches the idea of intellectual capital superiority through adaptability. The individual adapts to continue to add value to the enterprise. He believes we need to be untouchable. "Being Untouchable" according to Freidman is the ability to "learn how to learn".⁴⁴ The US can establish itself as a leader in intellectual capital by ensuring that the workforce adapts to the changing requirements by continuing to learn. Learning to learn requires motivation on the part of the individual, the corporation, and the government. The government and industry can significantly contribute to this effort.

Joseph Schmpeter's most significant contribution was the theory of creative destruction. Schumpeter stated,

The opening up of new markets, foreign or domestic, and the organizational development from the craft shop and factory to such concerns as U.S. Steel illustrate the same process of industrial mutation—if I may use that biological term—that incessantly revolutionizes the economic structure from within, incessantly destroying the old one, incessantly creating a new one. This process of Creative Destruction is the essential fact about capitalism.⁴⁵

An innovative change makes a business more competitive. This competitive edge replaces the old business. The cycle continues as new innovations prevail over the outdated processes. Intellectual capital is the driving factor in this incessant process. Schumpeter realized this long before the term globalization was fashionable.

There are several approaches to ensuring intellectual capital. The first method is to improve domestic capability. The US could establish standards for elementary skills that serve as the foundations for hard the sciences. An increase in incentives for students to pursue science and engineering undergraduate and graduate degrees would improve capability. University grants that promote scholarly advances in the sciences are another method. The government should decrease education costs for working professionals who pursue learning for a lifetime. US corporations should receive government incentives to fund advance degrees for employees.

The second method is to decrease foreign capability that is provided domestically. The primary focus of these programs should be placed on the foreign student from counties who aggressively seek to undermine our national interests. The increase in US students should decrease opportunities for foreign student enrollment in hard sciences. Significantly higher tuition rates for foreign student should be enacted. Foreign student pursuing targeted degrees should be encouraged to seek US citizenship or permanent resident alien status. Several

countries already have expedited naturalization processes for immigrants who bring needed intellectual skills. A follow-on study should take a closer look at defending and over time improving our intellectual capital through positive domestic policies.

Conclusion

This paper examined economic globalization in terms of the US defense industrial base. The purpose was not to provide a standard definition with a short review of historical globalization. It did stop at providing evidence that globalization effects our defense industrial base. The purpose was to provide an analysis of strategic significance that demands action.

A systematic review of applicable systems in the systems of systems approach presented structure to the review. The Operational Net Assessment Approach provided a standardized list of systems. These systems are the military, economic, infrastructure, and social systems. After a careful review of the eleven applicable sub-system nodes, a center of gravity analysis was employed to determine critical vulnerabilities. The center of gravity analysis is a process that assists in defining the critical vulnerability. The process identified education as this vulnerability.

Education is the critical vulnerability of the center of gravity and systems of systems analysis. A closer review reveals that intellectual capital is the focal point of this critical vulnerability. Globalization points to the impact of intellectual capital. Two leading experts warn us of its importance. The protection our domestic intellectual capital capability is of strategic significance. The deterioration of the US education system is a slow process that provides few undeniable indicators. Policies that ensure the US dominates the global market in intellectual capital must be enacted. Even Karl Marx understood the value of intellectual capital.

Endnotes

¹ Thomas L. Friedman, *The Lexus and The Olive Tree* (New York: Farrar, Straus, and Giroux, 2000), 7.

² Thomas Friedman, "Globalization," *New York Times*, 28 March 1999.

³ The White House, *A National Security Strategy for a New Century* (Washington, DC.: U.S. Government Printing Office, December 1999), 1.

⁴ Kenneth J. Arrow, "Globalization and Its Implications for International Security," in *Economics of Globalization*, ed. Partha Gangopadhyay and Manas Chatterji (Burlington: Ashgate Publishing, 2005), xi.

⁵ Martin Wolf, "Will Globalization Survive?," in *Why Globalization Works*, (New Haven and Connecticut: Yale University Press, 2004). 2.

⁶ Steven Weber and Ely Ratner, "Who Screwed up globalization?," *Los Angeles Times*, 21 January 2007, sec. M, p. 1.

⁷ Simon Reich, "What is Globalization? Four Possible Answers," *The Helen Kellogg Institute for International Studies*, no. CIAO2/00 (1998): 4.

⁸ Niall Ferguson, "Sinking Globalization," *Foreign Affairs*, (March/April 2005): 62.

⁹ Industrial College of the Armed Forces, *US Defense Industrial Base National Security Implications of a global World* (Washington, D.C.: National Defense University Press, April 2006), 1.

¹⁰ *Ibid.* 12.

¹¹ Bill Gertz, "Foreign Spies Activity Surges to Fill Technology Gap," *The Washington Times*, 3 January 2007.

¹² Bryan Bender, "DoD Struggles with Globalization," *Jane's Defense Weekly*, 4 August 99, 32.

¹³ U.S. Department of Defense, *Commander's Handbook for an Effects-Based Approach to Joint Operations*, Joint Warfighting Center, Standing Joint Force Headquarters (Washington D.C.: U.S. Department of Defense, 24 February 2006), II-2.

¹⁴ *Ibid.* S-3.

¹⁵ James W. Canan, "The Changing Industrial Base," *American Institute of Aeronautics and Astronautics* (August 2006): 36.

¹⁶ Deba R. Mohanty, "Defense Industries in a Changing World: Trends and Options, Strategic Analysis," *A Monthly Journal of the ISDA*, (January 2000): 3.

¹⁷ *Ibid.* 2.

¹⁸ Michael Youssef, "International Economic Comparisons," *International Economic Review* (July/August 2002): 17.

¹⁹ Industrial College of the Armed Forces, *US Defense Industrial Base National Security Implications of a global World* (Washington, D.C.: National Defense University Press, April 2006), 26.

²⁰ Jack E. Triplett and Barry P. Bosworth, *Productivity in the U.S. Services Sector, New Sources of Economic Growth* (Washington, D.C.: Brookings Institution Press 2004), 2.

²¹ U.S. Department of Commerce, *US Bureau of Economic Analysis News*, (Washington, D.C.: U.S. Government Printing Office, February 2007), 3.

²² Industrial College of the Armed Forces, *US Defense Industrial Base National Security Implications of a global World* (Washington, D.C.: National Defense University Press, April 2006), 26.

²³ Ibid.

²⁴ Energy Information Administration, "International Energy Outlook," available from <http://www.eia.doe.gov/>; Internet; accessed 5 February 2007.

²⁵ Country Watch, United States, "Energy Forecast Overview," available from <http://www.countrywatch.com/>; Internet; accessed 5 February 2007.

²⁶ Industrial College of the Armed Forces, *US Defense Industrial Base National Security Implications of a global World* (Washington, D.C.: National Defense University Press, April 2006), 48.

²⁷ The Task Force on the Future of American Innovation, "The Knowledge Economy: Is the United States Losing its Competitive Edge?," available from <http://www.futureofinnovation.org/>; Internet; accessed 5 February 2007.

²⁸ Ibid.

²⁹ Carl von Clausewitz, *On War*, edited and trans. Michael Howard and Peter Paret (Princeton: Princeton University Press, 1989), 595.

³⁰ U.S. Department of Defense, *Joint Publication 5-0, Joint Operations Planning, Signature Draft*, (Washington, D.C.: U.S. Department of Defense, 24 August 2006), GL-6.

³¹ Joseph Strange, *Centers of Gravity & Critical Vulnerabilities, Perspectives on Warfighting*, (Quantico, VA.: Marine Corps University Foundation, 1996), 3.

³² Ibid.

³³ Ibid.

³⁴ Ibid.

³⁵ Ibid.

³⁶ Arrow, 86.

³⁷ Ibid.

³⁸ Nora Macaluso, "Profile: Norman Augustine, Augustine reflects on a changed industry; Globalization is the new challenge for companies," *Washington Technology*, 4 September 2006.

³⁹ Douglas C. Folye, *Counting the Public In: Presidents, Public Opinion, and Foreign Policy* (New York: Columbia University Press, , 2003), 131.

⁴⁰ Ibid. 141.

⁴¹ The value chain is a concept from business management that was first described and popularized by Michael Porter in his 1985 best-seller, *Competitive Advantage: Creating and Sustaining Superior Performance*.

⁴² Transaction cost economics (TCE) is most associated with the work of Oliver Williamson, *The Economic Institutions of Capitalism*.

⁴³ Thomas L. Friedman, "Dueling Globalizations," *Foreign Policy* 116 (Fall 1999): 112.

⁴⁴ Friedman, *The World is Flat*, 238.

⁴⁵ Joseph A. Schumpeter, *Capitalism, Socialism and Democracy* (New York: Harper, 1975), 82.