Why Manufacturing and the infrastructure are central to the economy:
A global vision of peace, prosperity, democracy, and ecological sustainability

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In this time of globalization, global warming, and U.S. unilateralism, it might seem overly optimistic to propose an ambitious progressive global agenda. There are several efforts, such as the World Social Forum, International Forum on Globalization , the writings of David Korten[1], and others, that have proposed alternatives to our present global political economy. This essay is an attempt to provide a useful theoretical foundation for these efforts. The global corporations have great wealth and power on their side, which is imposing enough, and they also have a web of think tanks and intellectuals that provide them with the apparatus to create a monopoly of ideas. This domination of popular discussion is based on the field of neoclassical economics, a body of work extending back over 100 years. This framework provides the core of a body of political and economic thought. Margaret Thatcher tried to sum up the inevitability position of this world view with the term, "There is no alternative".

During the Cold War, the neoclassical economic center of this "ideology of the powerful" even provided the basis for its political ideology, which was the fight against Communism. The political implication of neoclassical economics is that government intervention in the economy should be as limited as possible (or even as not possible). Communism was an alternative that advocated as much intervention as possible, so both ideologies were perfect foils for each other, presenting the enemy as the opposite of the good society. Most importantly, the huge military and corresponding military-industrial complex could be justified as needed for the defense of the free market system against the Communists. In the United States, at least, democracy has always been the core political idea, if often more in principle than in reality. The ideology of the powerful, however, always used *neoclassical economics* instead of democracy as their core political principal. Since the free market is more important than democracy, in their view, and the Soviet Union threatened the free market, the resulting logic led to their support of anti-Communist dictatorships because protecting the free market was more important than someone else's democracy.

This neoclassical core has been useful for advancing the entire conservative agenda. If has portrayed the protection of ecosystems, support of unions, affirmative action for minorities and women and any programs of the welfare state that alleviate poverty or sickness as intrusive governmental interventions in the free market, and therefore, bad for the economy and bad for growth . Free trade and less taxes for the rich retract the government from the market, and so are pro-growth, according to the neoclassical paradigm. Economic growth is equated with the decline of government's control over the economy, even though there is nothing within the work of neoclassical economists that shows that such policies lead to long-term economic growth. In short, the conservatives have the ideal ideological framework for advocating policies that are really designed to make the most powerful in society even more powerful.

In order to counter this ideology of the powerful it is necessary to replace the core of the entire framework, neoclassical economics, with a different view of how the economy works. This might seem to be an impossibly ambitious task, but at one time neoclassical economics was basically a discussion among a fairly small number of proponents, most of whom had no formal connection to the field. I believe that the time is right for just such an effort.

Instead of putting the market at the center of an understanding of the economy, I propose to place first, manufacturing, and second, the physical infrastructure, at the center of a progressive view of economics, and to put democracy at the center of a view of the good political society. I wish to show that the following global economic system would flow from such a view: The global economy would grow economically in a long-term, sustained way, with an equitable distribution of wealth among the world's people; such development would be environmentally benign, and would start to reverse the effects of environmental destruction; the conditions for a peaceful world would be set, with minimal military establishments; and mankind would be weaned away from its addiction to oil and other nonrenewable resources. At the national or regional level, a new core framework would be helpful for justifying the following policies: cities would be provided with advanced transportation, water, energy, and communications infrastructures; full employment would result from a focus on constructing a world-class infrastructure, which would create a social environment conducive to fighting racism,

sexism, and poverty; and national health insurance and inexpensive, high-quality education at all levels would be needed to support the manufacturing effort. All of these elements of the program would reinforce each other. They can all be shown to be pro-growth and pro-security, instead of the opposite, as is now argued by conservatives.

In order to create a powerful intellectual challenge to the status quo, it is necessary to construct a system of ideas, that is, a set of ideas that are logically consistent, that reinforce each other, and that provide the foundation for an expansion of the original set of ideas. Most progressive agendas are composed of a list of very laudable proposals, but they lack a unifying framework. The Right possesses such a unifying framework, neoclassical economics. The Left needs one as well.

Manufacturing and the physical infrastructure might seem to be rather strange candidates for providing a foundation for a wide-ranging progressive agenda. After all, manufacturing is often a major source of pollution, and multinational manufacturers are some of the most powerful forces for globalization. Industrial unions have often tolerated racism, sexism, and militarism. Most of the public seems to have bought the idea that we are now a service economy, and manufacturing doesn't matter. Except for spectacular failures like the levees in New Orleans, infrastructure is very much below the radar (which is one reason the levees broke). It doesn't look like a very promising start.

For the people who grew up in the first half of the 20th century, the production base was very exciting, because the benefits of modern industrial technology were becoming very evident to most citizens – electricity, radio and then TV, cars and then airplanes, household appliances, not to mention the cornucopia of goods made possible by modern manufacturing machinery, as well as the great infrastructure projects, including the interstate highway system. To move from a world without these technologies to one possessing them can be eye-opening, as we see in China today, but to grow up in a world that has always had them is to take them for granted.

Personally, I became interested in computers, the most important technological force of the last 30 years; but as I was growing up, I was always frustrated by the phenomenon, from the 1960s until now, that every attempt at a progressive change was met with the same response: "It sounds nice, but it's bad for growth". In the early 1980's I was fortunate to meet the late Professor Seymour Melman, who had as great an

understanding of economic realities as any scholar I have known or read. Melman's intellectual work was based on the assumption that if he could show that some aspect of the political economy, whether managerial hierarchy or military production, is bad for manufacturing, then the public would conclude that such a feature of the economic system should be banished. As time went on, fewer and fewer potential readers made the logical connection. Melman, like many important thinkers who grew up in the shadow of America's industrialization, never constructed a framework for explaining to the skeptical public why it's bad for the economy if something is bad for manufacturing. After reviewing and finding wanting the various theories of rise and decline of nations, which I undertook in order to write my dissertation, it became clear to me, at least, that manufacturing underlay the largest shifts in political and economic power in the 20th century[2]. The case for manufacturing is not based on aesthetics, academic fashion, or policy trends; it is based on a close reading of history, the present environment, and what seems to be the logic of the functioning of the economy.

The argument in favor of the centrality of manufacturing starts with a look at its alleged replacement, services. If, as I argue, services cannot be substituted for manufacturing, then manufacturing is essential. I trace the disastrous consequences to the U.S. economy that will occur without a strong manufacturing base. But manufacturing is not simply a constraint on what an economy can consist of, producing manufactured goods also creates the opportunity for the explosive and long-term nature of economic growth that has occurred because of the existence, in particular, of manufacturing equipment and machinery. Because people and machines must interact in close proximity in order to maximize the technological change that underlies economic growth, I argue, economies are not global in nature, as the advocates of globalization would have it, but economies are continental or subcontinental. The infrastructure serves to bind together these continental economies, which are based on the givens of geology and geography. If every region contained a complete set of manufacturing industries along with a well-built infrastructure, we would live in a world with no poor regions and with no powerless regions that entice would-be conquerors. Democracy and ecologically sustainable societies, based on trains and buses, would create the conditions for a long-term environment of peace and prosperity.

1) The myth of the service economy

The first step in understanding the economy is to debunk the myth that an economy can be a service economy and still be wealthy in the long-term. The myth of the service economy is exactly the kind of idea that serves to prevent the population from understanding how the economy works, and thus prevents the electorate from pressuring the government to move the economy in a constructive direction. The more accurate statement is that a wealthy economy must be both a service economy *and* a manufacturing economy. In fact, as I shall argue, the manufacturing sector is more important than the service sector.

There is a creation myth associated with the service economy myth: In the beginning people engaged in agriculture; then nations became more advanced and manufacturing was born; finally, the most advanced society, the U.S., pioneered the age of the service economy. Services allegedly require more "knowledge" than manufacturing and services are not involved in the grime of a manufacturing factory. People allegedly have to think and interact with other people in services, not strain to the rhythm of the factory floor.

Like all myths, this creation myth serves a political purpose. The myth that services are more advanced than manufacturing is used to justify the hollowing out of industry. The myth of manufacturing as a temporary stage of human history is wrong. Humans have always manufactured. We use our "hands to make things", which is the actual meaning of the word "manufacture" (We should probably use the word "machinofacture" now, but I will stick with "manufacture"). Our hands are constructed the way they are, our brains are as big as they are, and we walk upright to free our hands, so that we can use tools – of which machines are a recent variety. Agriculture actually came after tool-making, for the very good reason that agriculture has always been dependent on tool making. Since various "services" had to be performed on and with manufactured goods, we have always had services as well. Manufacturing always has been, first and foremost, a "knowledge"-intensive part of the economy. In fact, the most important reason for speech may have been to discuss and pass along the knowledge

necessary to design, make, and use tools.

So why is manufacturing considered less advanced than services? First of all, the people who saw the difference that manufacturing made in everyday life, those that were alive in the 1920s and 1930s, are either passing away or forgetting that they saw how machinery turned an agricultural society into a rich, powerful, industrial society. This problem interacts with the second one, which is that the majority of economic activity does not involve manufacturing, because the rest of the economy uses the output of a very productive manufacturing sector. If manufacturing was as labor-intensive as preindustrial agriculture, which involved about 90% of most populations, there would be few services to talk about. But if most people are not involved in manufacturing, they do not understand it, because people usually have to have some personal experience with something in order to understand it.

Since most of the public never saw the difference that machinery makes and most people never see how machinery is used to make manufactured goods, the third factor became relatively easy: the relentless portrayal of manufacturing as consisting of huge assembly lines full of people doing deadening, physical work. As far as most people are concerned, manufacturing work is dull, dirty, and dreary. Actually, the most important physical work in manufacturing is done by highly sophisticated, skilled production workers outside of the assembly line, most of which involves great craftsmanship and intelligence. In partnership with skilled production workers, engineers must design the machinery that is used to create goods and must organize how humans will use the machines to create goods. Managers on the factory floor must monitor this entire process. The considerable and important technological progress that takes place in manufacturing comes out of the heads and experience of engineers and skilled production workers who are intimately involved with the manufacturing process. But the public almost never sees this because – the fourth factor in the dismissal of manufacturing – engineering and making things is considered – egad – geeky.

Now contrast these American factors with China. The current Chinese generation is witnessing the transformative power of manufacturing, probably has either done some manufacturing work or knows people who do, lives with a media and government that are supportive of manufacturing, and is not the least bit worried about being geeky.

Thus, it is necessary to very carefully, and in some detail, show what the role of manufacturing is in the economy. But before doing so, it is best to understand why services can not, by themselves, sustain an economy. Services are actually dependent on the manufacturing sectors.

To really understand the role of the service economy, we have to examine it in some detail. Just as we cannot understand the functioning of an ecosystem, or human body, or machine, without examining their parts, we must get beyond the simple label "services", and look beneath the label. The service economy, which makes up about 2/3rds of the U.S. economy, is very diverse. It is made up of three main kinds of services. First, most services are dependent on the goods they use, without which there would be no need for the service; an example is retail. These are goods-servicing services. Second, there are services that are close to being purely services, if by service, we mean some economic activity that involves mainly humans, not goods. These two kinds of services I count as part of the "production" side of the economy. Third, there is a class of services are dependent *indirectly* on goods, because some services, such as finance, "service" both the goods and services industries. These I call part of the "distribution" side of the economy. Thus, manufactured goods, and the services that use those goods, are part of the production system, and the rest of the economy is involved in the distribution of the goods and services that the production system generates. Together, the production system and the distribution system make up the economic system.

In virtually all cases services need to take place on the territory in which they occur; that is, they are tied to a particular country, and cannot be traded. 80% of world trade is in goods, and only 20% is in services, even though service industries always constitute the majority of economic activity of a country or region[3]. Manufactured goods are the main "stuff" of the economy, the material manifestation of wealth that can be produced and traded. For the most part, services are the activities of people using the "stuff" of the economy. Since people spend the vast majority of their time within their own country, most of the activity involved with this "stuff" takes place in their country, and so cannot be traded. The service must take place at the same point in space as the manufactured good.

Let us take a quick stroll through the particular services (see Table 1 on the next page for more detail). First, there are the services that service goods, or use mainly manufactured goods. The wholesale and retail sector (12.9% of the economy) is responsible for distributing goods that the manufacturing sector creates. Transportation services (2.9%) use planes, trains, trucks, ships, and taxis to move people and things, and use transportation infrastructure such as airports, roads, rail and ports. Hotels and restaurants (2.6%) use hotel buildings and food preparation equipment, respectively. Health care (6.3%) is an enormous repair process on the machinery known as the human body. Repair of machinery, including cars, (1%) is really a form of manufacturing. Software, computer and data services (1.9%) are the activity of people using computing machinery. Telecommunications (1.8%) are completely dependent on very complex equipment, as are miscellaneous services such as travel (.5%).

Engineering services (1%) are directly related to manufacturing, as is, indirectly, scientific R&D (.5%). Education (.9%) is also part of the service sector that is necessary for manufacturing, as education and training are vital aspects of producing goods. Engineers, skilled production workers, scientists and operational managers must all be educated and trained.

The second type of services are those that are made up, to a great extent, of industries that involve people doing most of the activity without machinery (for a total of about 6.4% of the economy), although even these services also use technology extensively. Arts, entertainment and recreation, which only adds 1% of the value of the GDP, personal and laundry services, at .5%, organizations and social assistance at 1.5%, and legal services, at 1.5%, perhaps need less machinery, or depend less on machinery than other services. TV, radio and publishing (1.5%), and movies and music (.4%) actually are totally dependent on machinery, but one could perhaps make the argument that people are more central to these activities than other services. At any rate, the media certainly rely on the communication infrastructure.

	GDP	Percentage of GDP	Trade balance (billions)
Wholesale and Retail	1,415,845	12.87%	N/A
Transportation Services	319,284	2.90%	-18
TV, Radio & Publishing	169,357	1.54%	0
Movies and music	41,195	0.37%	10
Telecommunications	200,879	1.83%	0.8
Legal	160,587	1.46%	2.5
Accounting	69,450	0.63%	0
Engineering services	106,458	0.97%	1.9
Software, Computer & data services	208,958	1.90%	5.9
Management services	267,927	2.43%	0.5
Scientific R&D	51,422	0.47%	4
Advertising	57,435	0.52%	-0.4
Other professional	94,736	0.86%	N/A
Health Care	689,342	6.26%	2.1
Educational services	94,511	0.86%	11
Arts, entertainment & recreation	106,597	0.97%	-0.05
Hotels and restaurants	383,057	3.48%	8
Employment services	84,491	0.77%	N/A
Building services (e.g.,janitors)	38,725	0.35%	N/A
Business Support (e.g., call centers)	107,412	0.98%	N/A
Travel, Security, other admin	54,276	0.49%	N/A
Repair and maintenance	106,389	0.97%	4.3
Personal and laundry services	57,474	0.52%	N/A
Organizations & social assistance	166,527	1.51%	N/A
Finance	626,886	5.70%	13
Insurance	256,010	2.33%	-21
Real Estate and leasing	1,367,399	12.43%	5.4
Other services trade			7
NonSoftware Royalties			24
Total services	**7,302,630**	**66.36%**	**61**

Table 1 – Service industries in the U.S., 2003[4]

Note that in all of these production-oriented services, most of the technological advances emanate from technological change in the manufactured goods that they use. Retailers always want "new and improved" goods to sell, while services involved with transportation or communication are sensitive to advances in transportation or communications equipment. Computer services, of course, are at the mercy of advances

in semiconductor and other technologies, all of which made the Internet possible. Health care advances are mainly technological. Even if we look at the history of movie-making, we see that technological progress came from advances in machinery, in the progression from silent movies to talkies, from black-and-white to color, and for special effects.

The third type of services are those that indirectly service all of the other goods and services industries. Under this heading we have noninsurance finance (5.7%), insurance (2.3%), real estate (12.4%), management services (2.4%), accounting (.6%), advertising (.5%), business support services (1%) and employment services (.8%). These industries are involved with the distribution side of the economy, the part that serves to take the goods and services made by the production side of the economy and distribute them within the economy. In the U.S., these industries add up to about 25% of the economy. One quarter of the economic activity of the U.S. is involved with distributing the output received from the production side of the economy. Governments at all levels constitute 12.7% of the economy, so production – manufacturing, construction, mining, agriculture, and production services -- constitutes about 62%. The distributive part of the economy depends on the production side of the economy, and the *services* that are in the production side of the economy depend, overwhelmingly, on manufactured goods.

Neither services used for production nor services used for distribution can be traded for the goods that the economy depends on. In 2003, of the nearly $2 trillion worth of manufactured goods consumed in the U.S., 54% was imported. If current trends continued, or if the myth of the service economy was to come to complete fruition, and we had no manufacturing, then we would have $2,000 billion worth of goods that would have to be paid for with services. Private services, however, only totaled $294 in exports for 2003, but were almost useless for solving the imported goods problem, because we imported $228 billion in private services that same year (see Table 1 for a breakdown of services trade balances). The resulting $66 billion surplus in services can do little to pay for $1,079 billion of imported manufactured goods. Most of the outsourcing hysteria involves the possibility that we will be outsourcing services to other countries, so the services surplus could easily turn into a deficit. Ironically, our manufactured goods sector was much more important for filling the imported goods gap, exporting $507 billion. But this still leaves more than $568 billion in goods to make up for[5].

2) The collapse of the Dollar

Services can not make up for a huge goods import bill. In order to bring the trade deficit down, there are three main processes that can occur: first, we can import less goods by replacing them with manufactured goods that we make here (called import substitution); second, we can export more goods, which would require a revitalized manufacturing competitiveness; or third, we can import less goods if we become so poor that we can't afford the imports, which will put us on the road to long-term decline. At the rate things are going, the third outcome will occur. Instead of producing more of our own manufactured goods, the trade deficit is getting worse, mainly because we are importing more.

Let us follow the possible process whereby the U.S. becomes much poorer. The basic manifestation of this process will be the declining value of the dollar, but the cause of our decline will be the inability to make enough goods to supply either our own market or markets in other countries.

When the value of the dollar goes down, the prices of exported goods go down and the prices of imported goods go up. If we use a lot of imported goods and the value of the dollar goes down, the inflation rate goes up, because prices of imported goods go up. In such a situation, American goods should be more competitive because the imported goods would be more expensive, but since we are busy destroying our capacity to make more American goods, this self-corrective behavior probably would not happen.

The trade deficit will lead to a dollar with a significantly lower value because that is what chronic trade deficits always do. When there is a trade deficit, instead of exchanging goods or services for goods or services, a country has to exchange its currency for some goods and services. So over the past 20 years foreigners have been accumulating over two and one/half trillion dollars as the trade deficit has grown and grown. If foreigners decide that they don't want dollars because they already have too many and there isn't enough that they can do with the dollars to justify holding more, they will dump the dollars, and drive the price of dollars down. There are three main reasons why this has not happened so far. They are like three ropes holding up an actor on stage; as each rope unravels, the possibility increases that the actor will fall to floor.

The first "rope" holding up the value of the dollar is the use of the dollar as a medium of international exchange, in particular, as a "reserve" currency that foreign banks use to keep a dependable pile of cash on hand in order to uphold their own currency. This is often done by buying parts of the U.S. federal deficit, and so foreigners now own about $2,000 billion in U.S. Treasury bonds, of which the top ten countries own $1,513. Japan, Hong Kong and China together hold $971 billion[6]. When several countries recently floated the idea of using other currencies instead of the dollar as a reserve currency, the value of the dollar plunged until the statements were "corrected"[7].

The second "rope" is the decision of the oil-producing countries to accept only dollars for oil. So even if you are, say, Japan, and you have a huge trade surplus with the U.S. and so you have a pile of extra dollars, you can at least turn around and buy oil with the dollars, even if you can't buy American goods. The problem for the U.S. is that as other currencies appreciate against the dollar, the oil producers may get tired of only using dollars as a medium of exchange. For example, even though the price of oil has gone up for Americans, the Europeans are hardly paying any extra money for oil because the value of the Euro has also gone up, relative to the dollar.

The third "rope" holding up the dollar is the purchase by foreigners of American assets inside the U.S. In 2004, foreigners added $1,078 billion in American assets[8]. Thus, instead of buying American goods, foreigners are buying America. There is a lot of ruin in a nation, as Adam Smith asserted, and there is more ruin in the U.S. than any country in history. But at some point the best pickings will be gone.

It is probably most likely that foreigners will stop buying U.S. assets before oil producing countries switch to Euros or central banks stop using dollars, because these two "ropes" can be affected by political pressure from the U.S. At some point, as the dollar drops, the central banks and oil producing countries will come under pressure to stop using dollars, which will bring the dollar down lower still.

Because of the deterioration in manufacturing, the value of the dollar will have to go very low in order to close the trade deficit. The reason is that we will have a limited ability to "export" our way out of a falling dollar. The trade deficit should improve because we should buy less of the more expensive imported goods, and foreigners should buy more of our cheaper goods. Unfortunately, exactly the opposite has been occurring.

Between 2001 and 2004, the value of the Japanese yen has increased 12%, but instead of going down, our trade deficit with Japan has increased by 9%. The value of the Euro increased by 39%, but the trade deficit with Europe actually *increased by 37%* [9]. How to explain? We are outsourcing our manufacturing capability; instead of exporting goods, we are exporting our manufacturing base. With a smaller manufacturing base, we have a smaller capability to increase exports in order to close the trade deficit. Our manufacturers may also have problems keeping up with technological advances in what are now more advanced countries, such as in Europe and Japan. Therefore, the only way the trade deficit will close will be for Americans to buy many less goods from abroad, which will lead to a drastically lower standard of living.

The myth of the service economy is a very misleading tale. Services are almost completely dependent on goods for their very existence. Even though most economic activity within a country or region is in the realm of services, most of the trade is in the realm of goods. Services cannot be traded for even a significant part of the goods that an economy needs. Therefore, manufactured goods are a necessary and critical part of a wealthy economy, no matter how advanced or service-oriented. Manufactures are necessary if the economic system is to function properly. I will now show why understanding manufacturing is the key to understanding sustained economic growth.

3) Why manufacturing is the central part of the economy

In order to rebuild the manufacturing system, it is necessary to know how the manufacturing system works. Just as biologists study an ecosystem in order to know how to maintain or restore it, we must know how a manufacturing system works.

The manufacturing system is similar to an ecosystem for a couple of reasons. First, there are a number of functional units, or roles, or niches, within both systems. In other words, each part serves a particular, necessary purpose. Both systems also have levels, or stages. For instance, in a land-based ecosystem, plants form what is called the primary producer level; the plant-eating animals feed off of the plants, forming a primary consumer level; and animals that eat the plant-eating animals form the next, or secondary consumer level.

A manufacturing system also has levels, or stages. Consumers buy goods, and these goods must be produced in consumer goods factories. In order to make the goods in the consumer goods factories, we need what I will call production machinery, the equipment that is used to make the consumer goods. In addition, this production machinery is used, outside of factories, to produce consumer services. So at the *consumer* stage of the manufacturing system, we have factories using production machinery that create consumer goods, and offices and commercial spaces using production machinery to create consumer services. I will call this the *consumer goods and services stage of production*.

Now we move to a stage previous to the consumer goods and services stage of production, the stage at which the production machinery is produced. This sector of the economy is so foreign to most people that it might as well be in the deepest part of the ocean (indeed, viewers of science channels may now more about the deep than about the factory). It is exactly as we move into this part of the economy, however, that we find the technologies that are most responsible for holding the manufacturing system together and encouraging technological advances. This is were the construction machinery is made that is used to make buildings and roads, the textile machinery is made that is used to make the clothes we wear, and where we see the production of the the food processing machinery, the paper-making machinery, the furniture wood-working machinery, and

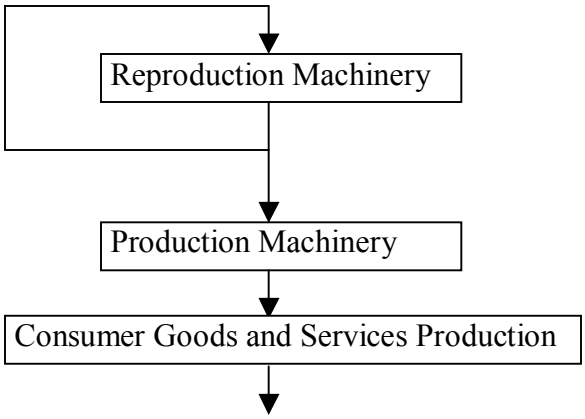
other machinery used to make the multitudes of diverse goods and services that people use.

Production machinery production constituted only 1% of GDP in 2003, but only half of the production machinery purchased in the U.S. was made in the U.S.A. If the U.S. made all of its production machinery, one could assume that 2% of the GDP would be devoted to making production machinery. Since half of domestic consumption of manufactured goods is imported, one can assume that if the U.S. rebuilt its manufacturing base and relied exclusively on American machinery, the U.S. would again double the percentage devoted to machinery, to reach about 4% of GDP. This small piece of the U.S. economy is its most crucial part. Either directly or indirectly, virtually all goods and services throughout the world, except in undeveloped areas where people use preindustrial tools, owe their existence to production machinery. The start of the Industrial Revolution, which occurred between the late 1700s and the early 1800s, was a phenomenon of new kinds of machinery. The complex system known as the modern world would collapse as a result of the biggest disaster in human history if, for some bizarre reason, all production machinery were to disappear. Since world population at the start of the Industrial Revolution was about one billion, and is now over six billion, then approximately five billion people owe their existence to production machinery. Production machinery is in the most strategic position within the economy; it is absolutely essential for its functioning and well-being, more so than any other sector.

But how is production machinery made? There exists a subset of production machinery that is collectively capable of producing *any* kind of machinery. These are the core technologies of the modern age, and changes in these technologies are of an epochal nature. For example, historians of technology have written of machine tools as the master machine of manufacturing. Machine tools are kinds of machinery that cut and shape metal, and most importantly, cut and shape steel. All machines contain metal pieces. Since machine tools are also machines, machine tools can make parts for more machine tools. In other words, machine tools can reproduce themselves. As in an ecosystem, the capability to reproduce translates into the capability to grow in an exponential, or explosive, manner. Economic growth in the industrial era has been of this sort, continuing at a constant pace of increase, yielding the greatest economic growth in

history. It is the reproductive nature of machinery such as machine tools that has provided the foundation of this unprecedented growth. I therefore refer to these technologies as *reproduction machinery*. The most critical part of the modern economy is the manufacturing sector; the most critical part of the manufacturing sector is the production machinery sector; and the most important part of the production machinery sector, or stage, is the reproduction machinery sector, or stage.

Within the reproduction machinery stage, reproduction machinery makes more reproduction machinery. Within the production machinery stage, reproduction machinery is used to make production machinery. At the consumer goods and services stage, production machinery is used to produce consumer goods and services. The process is shown in the diagram below.

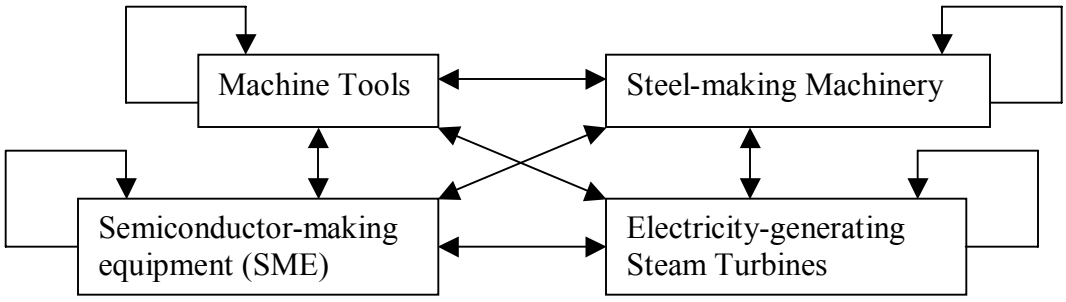


Machine tools are only one kind of reproduction machinery. Machine tools help to create form out of a material; let's call them a *structure-forming* type of production. There are other types, or categories of production. By distinguishing among different categories, we can get a better idea of the multiplicity of functions that exist within the manufacturing system, and we can see that each function is necessary -- this complex manufacturing system will break down without all of these functions. That is the negative aspect of having many functions. The positive characteristic is that these many pieces interact in mutually reinforcing ways and help to create the phenomenon of growth. So there is a potential for both disaster and growth in the economic system because it is divided into various functions that are all interrelated.

It is the function of *material-making* production to create the material to which the structure-forming machinery adds form. Steel-making machinery is the most important material-making reproduction machinery. These are some of the biggest and most spectacular pieces of machinery; most people have seen images of huge buckets of molten steel being poured out during news reports about manufacturing. Steel-making machinery also produces the steel that is used to make machine tools, and these machine tools are used to make the pieces used to make steel-making machinery. There exists what is called a *positive feedback loop* between machine tools and steel-making machinery; that is, a technological innovation in one has a positive, or additional, technological effect on the other, which in turn has yet more effects on the original type of machinery, and so on.

Now that we know how to create the material and form of manufactured goods, we need to explore two more categories of production. Production requires the *conversion of energy* in order to undertake other processes, and production requires the *processing of information* in order to guarantee that the original design of the manufactured good, whether a machine or anything else, matches the final output. The premiere form of energy used for manufacturing is electricity, and the central technology used for electrical generation is steam turbine machinery. The premiere machinery for information-processing is the computer, and the central technology in the computer age is semiconductor-making equipment (SME), machines which make the semiconductor chips that power computers and more and more of other kinds of machinery.

The following diagram illustrates the positive feedback loops among these four reproduction machinery technologies:



When a technological advance occurs in one of these industries, all industries, including the originating one, are affected. When SMEs can put more transistors on one chip, this

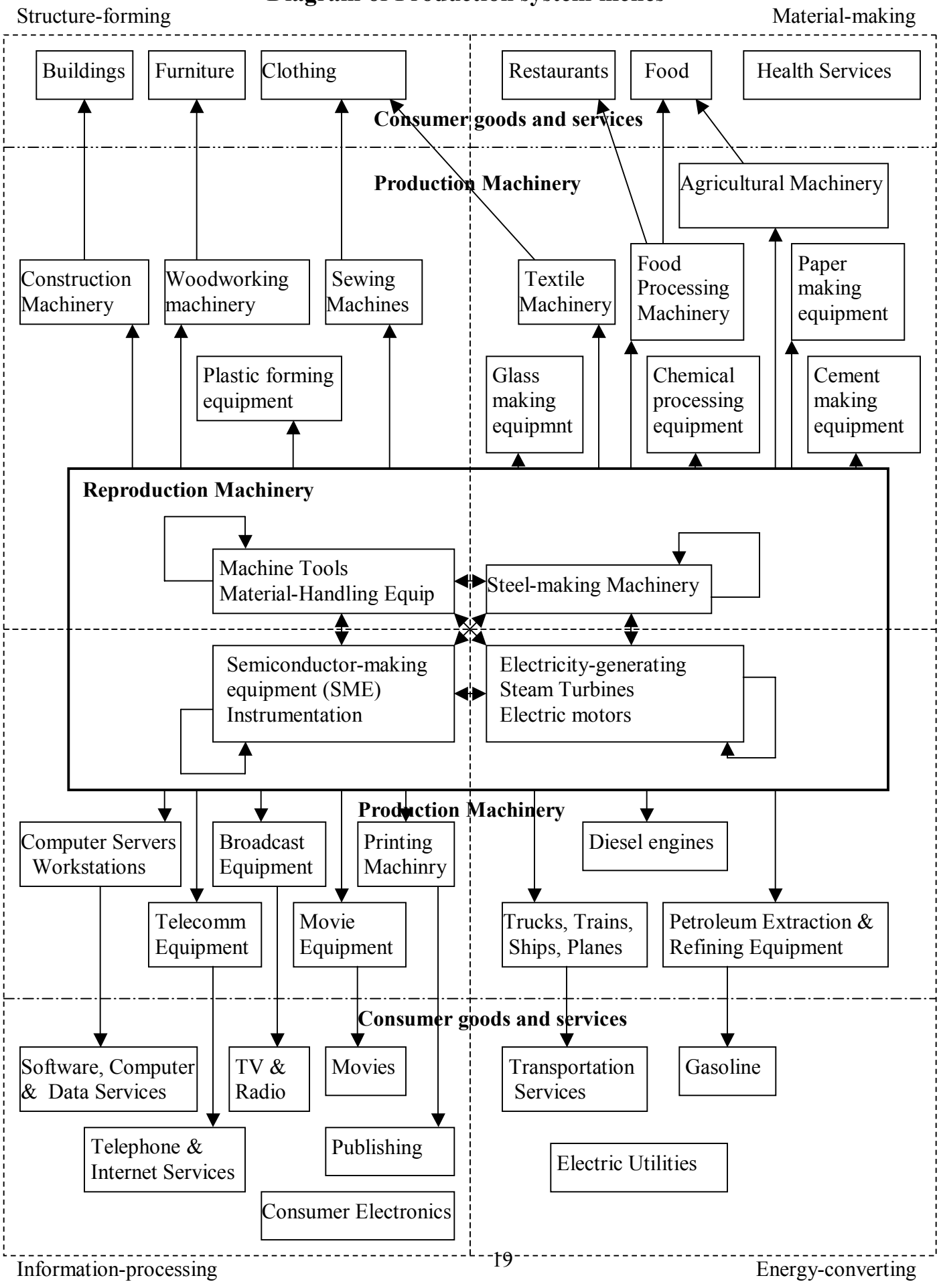
improves the semiconductors used in the machinery making the SMEs and so the SME has helped itself to be a better SME. Better semiconductors are used in machine tools to produce computer-controlled machine tools, which create parts of greater and greater precision, or to stock the instrumentation used to generate steel or electricity. When a better machine tool appears, it can create more precise parts for electricity-generating steam turbines, and it can help grind better lenses for the SME lithographic equipment that is most critical for making better semiconductors. Better steel, and other metals, means better machinery of all kinds, and better steam turbines lead to cheaper electricity and less costly machinery.

The U.S. is losing its 20th century leadership in reproduction machinery technologies. We no longer make steel-making machinery (made by only Japan, Germany, Austria, and Italy), our machine tool industry has declined precipitously, and what is left is mainly controlled by foreign companies. Most of the most important types of SMEs are made by Japan.

The most important consequences of the complex of positive feedback loops among reproduction machinery industries is that these machineries are then used to create better and better production machinery, and this constantly improving production machinery is then available to make the new and improved products that we see throughout our lives. Production machinery may also be divided into four categories of production, and their output, consumer goods and services, can also be divided into four. We thus arrive at a structure of the *production system*, which is defined by three stages of production and four categories of production; this yields twelve separate, necessary, and mutually reinforcing parts, or *production niches*, as illustrated in the diagram on the next page.

The arrows in the diagram show those sets of machinery that are responsible for producing what machinery or type of goods. Boxes without arrows indicate that there are many industries that the industry labeled by the box connect to; the diagram shows only selected industries and selected relationships. This is intended to give a feel for how the different parts of the economic system fit together, how the production part of the economy works, as a step in acquiring "industrial literacy".

Diagram of Production system niches

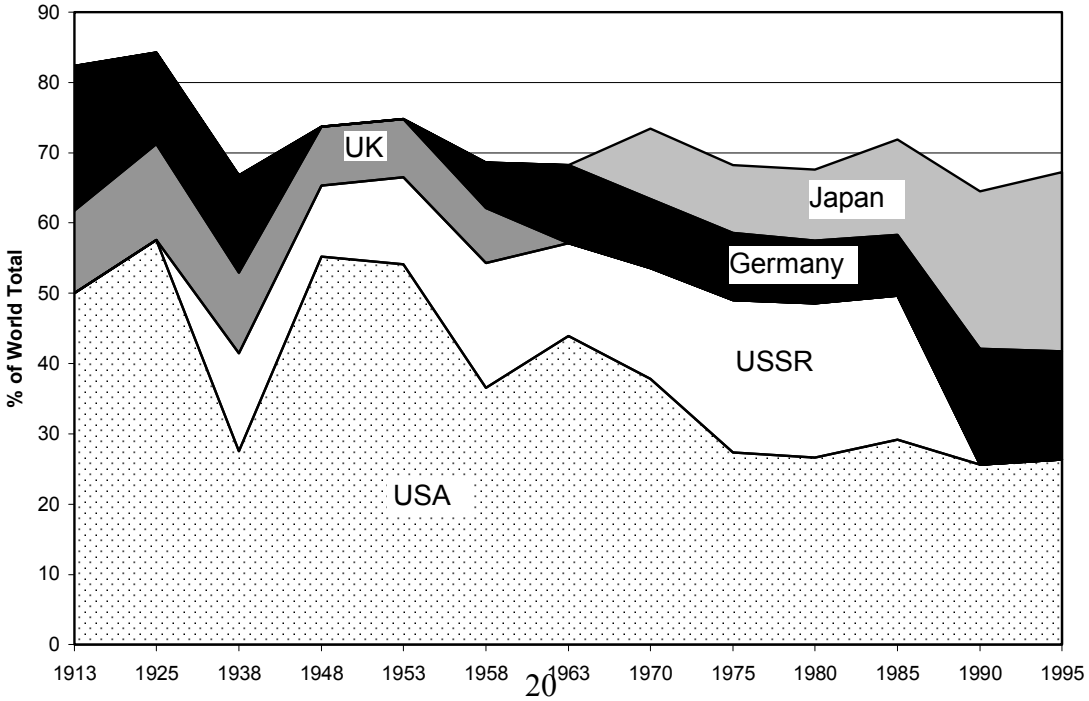


Knowledge and skill are at the core of this system. The people who are responsible for researching, designing, and creating these goods, particularly in the machinery niches, are highly educated and/or highly trained. They must be well-paid and well-motivated. The people who participate in the technical aspects of this system themselves constitute a *human capital system* of scientists, engineers, and skilled production workers.

The human capital system is reproductive: Scientists train scientists, engineers train engineers, and skilled production workers train skilled production workers. The combination of human capital training more human capital, and machinery being used to create more machinery, yields the technologically advanced modern industrial society.

In the long-term, nations and regions compete on the basis of the quality of their human capital system, not on the cheapness of their labor force. The Chinese will become a major power because they have world-class scientists, engineers, and skilled production workers. This is why they are flooding science and engineering departments within U.S. universities.

Nations and regions that incorporate fully integrated and high-skill production systems are wealthy and powerful, and regions that do not incorporate these systems are poor and become the victims of the aggression of the wealthy and powerful. We can see how power follows machinery in the following graph of the percentage of machinery output of the most powerful countries during the 20th century[10]



The richest, most powerful nations of the last two hundred years have been those countries that have had the best manufacturing systems. Economic growth follows manufacturing innovation, in the long-term. The British invented industrial and manufacturing techniques; this advantage brought them to the top of world power for almost 100 years, despite their small size. The French were not far behind, and had actually had the most advanced pre-industrial machinery in the 18th century. By the late nineteenth century, the U.S. and Germany had caught up to the U.K. in manufacturing technology. Germany became the most powerful country in Europe, which it is to this day, as the U.S. became the most important manufacturing nation in the world. The U.S.S.R. leaped to superpower status by building a massive means of manufacturing production, and declined as its manufacturing base deteriorated. As can be seen in the previous chart, those countries that have the greatest capacity to create the machineries that make manufactured goods are the countries that are usually considered the major, or "Great", powers of their day. In fact, the major machinery producers form an oligopoly, that is, only a few countries control most of the market. Three or four countries have produced between three quarters or four fifths of the world's machinery for the last one hundred years. The reason that manufacturing power translates into political power is that military equipment and supplies are just as dependent on a thriving manufacturing system as services are.

Here lies an opportunity to creating an international political system that is as peaceful as possible. If every country was contained within an integrated region, such as the European Union, and if every region had a fully functioning manufacturing system, then every region would contain the capability to produce a military that would provide a defense that would be difficult, if not impossible, to overcome. Conquest would become obsolete.

Manufacturing is therefore not only the key to long-term, sustainable economic growth and wealth, it is also the key to global and political power. The rise of China is unthinkable without the rise of its manufacturing base.

4) Why economies are regional, not global

Great Powers contain within their territory most, if not all, of the production niches of a production system. A production system is a regional phenomenon, not a global one. The global production system is the sum of the regional production systems, and the global economy is the sum of the regional economies. The idea of globalization, if it is to mean something more than the rise of China and India, implies that the world is moving towards one economy which is global in nature. I will argue that a production system that extends over several continents and oceans is not optimal. We must look at the nature of technological change in machinery industries in order to see why this is so.

The central act of technological innovation in an economic system is the creation of an innovation, usually small in nature, that an engineer or set of engineers, often in cooperation with skilled production workers, creates for a piece of machinery that is used to produce goods and/or services. The most important innovations occur in the reproduction machinery industries, followed in importance by innovations in production machinery industries, and followed in importance by innovations in consumer goods and services industries. A reproduction machinery innovation reverberates among the reproduction machinery niches, as explained earlier. The physically closer the various firms in these industries are to each other, the faster these innovations will move among the industries. Technology moves when engineers and skilled production workers are *physically present* at the site of an innovation, so that the people can understand how the innovation works by talking to fellow engineers and workers, looking at the working machinery, and fiddling with the machinery if possible. While the Internet and phone conversations are useful in communicating technological innovations, there is no substitute for being physically present. The same principle applies in office work; while conference calls have their place, businesses go to considerable trouble to fly and move people around so that they can have face-to-face meetings. In manufacturing, engineers need face-to-face-to-machine meetings.

Engineers need to be near the factory floor in order for technological change to be optimal. When an engineer proposes a change, he or she needs to see how the proposed

change actually works on the factory floor. Is the change impractical when actually put on the factory floor, or does viewing the change suggest another, even better change? Engineers get an intuitive "feel" for how their systems work when they can actually look at it. A disembodied global production system, in which engineers throw their designs from Detroit to a factory in China, for instance, will be a global production system that will experience less technological change, and therefore less economic growth, than one in which the engineers and factory floor workers are in close proximity. Global economic growth will be greater if the Chinese engineers are designing machinery and production in Chinese factories and American engineers are doing the same in the U.S.

Because the reproduction machinery industries are all so intimately related to each other, they need to be physically close to each other. Just so, the production machinery industries need to be close to the reproduction machinery industries because reproduction machinery is used to produce production machinery. The engineers and workers in the construction machinery industry, for example, need to be in close touch with the firms that are providing them with machine tools. The machines that go in factories are usually custom-made, which means that the people doing the custom work must understand the needs of their customers at a very detailed level. The faster each one responds to the other, the better. So the people in the reproduction machinery industries need to be close to each other, and the people in the reproduction machinery industries need to be close to the people in the production machinery industries.

The customers of the production machinery industries, the consumer goods and services industries, need to be close to their machinery providers, if they hope to create the most productive factories and service sites possible. The same applies to providers of infrastructure, who also use production machinery. So the niches in a production system need to be in close proximity for three main reasons: first, engineers and workers need to see technological innovations first-hand; second, engineers need to be close to the factory floor; and third, the interconnections among reproduction and production machinery sectors and among production machinery and consumer production sectors are optimized when people are close to each other. The entire manufacturing system needs to be in the same physical region.

The implication of this argument is that the theory of comparative advantage, which is used to justify free trade, leads to exactly the wrong policy prescriptions. Comparative advantage argues that each country should concentrate on that industry, or perhaps industries, in which it has the best relative advantage among countries, and by implication, each country should *drop* those industries in which it does not have a comparative advantage. According my theory of manufacturing centrality, a country or region should retain as many production niches as possible and it should not specialize. The theory of comparative advantage is totally inappropriate in an environment where technological change is the most important economic process. Ricardo, who originated the theory of comparative advantage in the early 1800s, concluded his arguments by explaining that the U.S. and Poland should produce grain, and the U.K. should make manufactured goods. His breathtaking lack of predictive ability occurred because he did not consider technological change. If technological change in production machinery is the most important cause of economic growth, then it is sheer folly to freeze "comparative advantage" by dropping most industries.

Every continental region should contain a complete suite of manufacturing industries in order to sustain a wealthy society. No region is constrained by its natural resources or its current educational level or current comparative advantage. Japan, with few natural resources, was able to become one of the wealthiest societies in history, while Africa and the Middle East, with vast reserves of oil and resources, are the poorest regions in the world. The Japanese make high-quality machinery, the peoples of Africa and the Middle East don't, and the difference has nothing to do with ethnic predispositions. There are historical and ecological explanations for the relative economic power of various regions[11], but the resources of Africa and the Middle East probably were a great disadvantage because when the Industrial Revolution started in Europe two centuries ago, the Europeans used their advantages in machinery production to subjugate and destroy the production base of every other society, particularly those with exploitable resources. The message for the present time is clear: continental or sub-continental regions should be economically integrated, and should create, maintain, or rebuild their manufacturing base, depending on whether they are poor, rich, or declining, respectively.

As an example of the developmental implications of this argument, let us look at a quick sketch of the case of subSaharan Africa. This region, which in 2003 had a population of 651 million, only had a GDP of about $400 billion, while Europe had a population of 727 million and a GDP of $12,177 billion[12]. Now suppose we wanted to plan for Africa to have one-third of the GDP per person of Europe, which would lead to an approximately 10-fold increase in African living standards. After creating an African free-trade zone, the goal would be the construction of the equivalent of almost one-third of Europe's manufacturing capacity. The first task would be to train enough scientists, engineers, and skilled production workers to start work on such a project, and then to have these skilled people become teachers so that they could turn out a steady stream of human capital to work on the entire program of economic construction. A revamped World Bank would have to provide credit for the construction of the physical and human capital, but preferably, the loans would *not* be paid back from the proceeds of resource exploitation, but from the proceeds of the emerging manufacturing base. Resource exploitation leads to environmental destruction and a reliance on destroying ecosystems, as opposed to creating manufacturing systems. A vital part of such a program would be to construct a network of rail systems across Africa, to enable the creation of a continent-wide production base; the construction of the rail equipment and lines could be done by Africans, which would give a boost to manufacturing firms. With a base of scientific and technical teachers, production machinery, and infrastructure, Africa would possess a production base that would make economically and ecologically sustainable growth possible.

5) The infrastructure and economic reconstruction

The best way to create, maintain, or rebuild a manufacturing base is to constantly expand the physical infrastructure. The physical infrastructure is made up of man-made networks that serve to fundamentally reconfigure the ecosystems in which human production systems take place. There are four main networks. First, water systems are the most fundamental, as we saw in New Orleans, because they provide clean water, remove waste water and control floods, thus making the human ecosystem habitable. Second, transportation systems are the most expensive, because they require huge investments in equipment and physical structures, in order to make movement relatively easy throughout the production system. This movement makes possible the construction of a manufacturing system that contains all major production niches. Third, the energy system known as the electrical grid is the premiere energy system of the modern era. Finally, the communications system makes modern day communications such as the telephone and internet possible.

One of the reasons that particular parts of the world become centers of continental economies is because they are conducive to the construction of physical infrastructure. The Chinese coastal provinces possess a long sea coast, great rivers, and broad plains. The centers of Indian population are large plains as well, and the great civilizations of the Middle East were racked by war because they were so easy to crisscross with opposing armies (and merchants), who were after the great wealth of the region. A deforested Europe became one fairly contiguous area, within easy reach of water, as was the United States. As Jared Diamond showed, geography can have a very profound effect on the relative power of different civilizations. Physical infrastructure systems provide the glue that holds these civilizations, or more recently, regions, together.

A manufacturing system is absolutely dependent on the smooth functioning of the infrastructure. In turn, the technological sophistication of the infrastructure depends on the machinery used to construct it; note the difference between the dikes and levees in Holland and those in New Orleans.

Since the infrastructure is built and maintained using machinery, infrastructure spending provides a very important market for the machinery sectors. In the U.S., local,

state, and Federal agencies all engage in infrastructure spending. Why not use their combined spending power to award contracts to American manufacturing firms, and if the appropriate firms don't exist, why not create new firms? For instance, there are no subway firms in the U.S., so when New York City recently asked for bids for a multibillion dollar subway contract, not one American company submitted a bid.

If governments coordinated their spending, they could build infrastructure for less cost, because they could achieve economies of scale. If they could coordinate *and* engage in long-term planning, they could provide a stable market for American manufacturing firms that would allow those firms to ride out the ups and downs of the business cycle. Historically, reproduction and production machinery firms have too many orders when the economy is booming because everybody wants to expand at once, and have too few orders when the economy stagnates or recession sets in, worsening the business cycle because the machinery industries hover near collapse. If infrastructure spending was always providing a market to these firms, the worst effects of recessions could be averted.

The government, at all levels, would be managing the economy in such a scenario, but in an unobtrusive way. The local governments would provide most of the initiative and implementation, and the Federal government would provide most of the funding for an expansion of the infrastructure. Besides the $1.6 trillion price tag for infrastructure revitalization advocated by civil engineers[13], in New York City alone, former comptroller Alan Hevesi estimated in a report that $92 billion is needed to bring the city's infrastructure up to adequate levels. This is not central planning, nor is it a completely free market, but something in between: managing the economy like an ecosystem. When an ecosystem is well-managed, its basic functioning is left alone. In a market-based system, the market should be left to its own processes when possible. In a managed ecosystem, the authorities step in to protect particular species or physical systems, or even reintroduce species or rebuild pieces of the physical landscape, if it is determined that not doing so will lead to a disastrous degradation of the ecosystem. In the same way, governments at all levels can intervene in the economy when something disastrous is about to happen, such as the collapse of the manufacturing system

We need to replace the military-industrial complex with an infrastructure-industrial complex. The trillions of dollars spent on the military in the past 50 years have turned the military-industrial complex into an inefficient, low-productivity, bloated, government bureaucracy and political machine. When engineers and scientists who work for the Defense Department contractors are showered with money and perks, and those in the civilian sector are threatened with the loss of a career because manufacturing is going down the tubes, then the military winds up weakening the country more than any terrorist cell or foreign mad dictator[14]. Part of the process of avoiding the traps of the military-industrial complex would be to make all parts of the infrastructure-industrial open to public scrutiny, as opposed to the secrecy and corruption of the Bush Administration.

The greatest concentration of infrastructure development and manufacturing expertise are concentrated, historically, in cities. Cities are the cradles of manufacturing innovation, because the closer firms and people are to each other, the faster innovations are created and spread, and cities are the best way to enable people to work in close proximity[15]. Close, concentrated environments require massive investments in infrastructure, which provides a market to the manufacturers. American planning has weakened cities at the expense of the suburbs, which has contributed to the decline of American manufacturing. We need to rebuild the infrastructure of the cities in order to build up the best possible environment for manufacturing excellence.

We also need to rebuild the infrastructure of the cities because an expansion of the mass transit systems of the cities and their surrounding suburbs will be the only way to avoid the disruptions that expensive gasoline is going to create in this country. Not only will the price of oil rise because the value of the dollar will decline, the price of oil will rise because greater demand from countries like China and India will drive the price higher. We are also probably in a global situation in which the supply of oil will start to decline[16]. The U.S. suburbs, exurbs, and even many cities, such as L.A., Houston, and Phoenix, were built on the assumption of cheap oil. Expensive oil will make them all unusable in their current forms. Carbon emissions will also create huge disruptions as a result of global warming, and oil will become a source of war tensions[17]. It is hard to overestimate the terrible damage that oil has done and will continue to do to the economies and ecologies of this planet. The logical course of action would be to create a

very reliable electrical grid, one powered by clean coal, natural gas, and renewable technologies, with rail and buses as the foundation of the transit system.

Ideally, the cities should be made more attractive to live in, so that people move to their superior transit systems. After World War II, many large-scale government funded housing projects were undertaken for returning G.I.'s. Cities with affordable housing stock and excellent transit systems would be very attractive if integrated with a core part of a reconstruction effort, the revitalization of the education system. If urban schools were brought up to world-class levels, there could be a mass migration back into the cities on the part of families.

A rebuilt educational system would do more than bring people into cities, it would create a new class of engineers, skilled production workers, scientists and other professionals that would be needed in order to build a better manufacturing and infrastructure system. The educational system of Germany may a good one to emulate, since they have an apprenticeship program for all skilled workers, a set of technical institutes for engineering research, and a university system for scientists that are the basis for the world-leading level of the German machinery industries. We could also make public universities tuition-free, as they were for soldiers returning from World War II, creating the human capital base for the post-War boom. On the other end of the age spectrum, we could have a universal preschool program, such as in France, with public childcare for working parents, which would also help to give a head start to a generation of students. For elementary school through high school, the Federal government could offer to match the salaries of teachers, effectively doubling their salaries. We had the best manufacturing in the world when teachers were very highly paid professionals. It is time to rejoin the rest of the industrial world, and provide high-quality education.

Manufacturing and infrastructure systems are always vulnerable, partly because they constitute a small portion of the economy, and partly because they are not in the business of controlling the surplus resources of a society, as the financial and governmental sectors are. In other words, the production base creates, and finance and government controls; this dynamic puts the production base in a weaker position in the short-term, even though *in the long-term*, the production base is the most powerful instrument developed by humans, since it determines the relative level of power of

particular societies at particular points in time. So human society is constructed in such a way that its source of wealth is at the mercy of short-term calculations by people in finance and government who may or may not sacrifice their own short-term power accumulation in order to prevent the strangulation of the production base. History is littered with the remains of countries in which the elites destroyed the society by enriching themselves. Most recently, for example, the Soviets built up a very impressive means of production, only to have the Soviet military suck it dry like a spider with a fly. The U.S. possesses the double challenge of a growing financial sector and a huge, expansionist military. The very conditions that lead to the rise of a Great Power, the rise of the production base, gives rise to a large and powerful financial/governmental apparatus that depletes the source of its power. Rise leads to decline…unless people in a democracy elect governments that rebuild the production base.

Democracy is thus a critical political factor in the long-term performance of an industrial economy. Japan, Germany, and the Soviet Union were able to create powerful manufacturing systems under the auspices of a dictatorship. But none of them were able to survive with their political systems intact. As they became wealthy, their elites used the wealth of the country to build their power at the expense of their people and their production base, mostly by military means. The U.S. can reverse its decline by throwing the bums out and installing leaders who understand the importance of the production base. But first, the people must understand how important manufacturing and the infrastructure are. We need something like a political party, that educates its members, and maintains a network of think tanks and political and media operations. The success of a program of economic reconstruction will depend on the education of the public, and in particular, on a deep understanding on the part of those who vote and are elected.

Conclusion

Economies are based on continental or subcontinental-sized economies that encompass a complete set of manufacturing sectors. In particular, economies need production and reproduction machinery industries that possess high-quality human capital in the form of scientists, engineers, and skilled production workers. In turn, human capital is only as good as the educational system that produces it. Cities and infrastructure networks are critical because they enable the easy interaction of people and machines that is so necessary for the technological progress that underlies economic growth. Governments at all levels are responsible for maintaining the integrity of the production base, by using investment in the infrastructure as a way to insure that the manufacturing base has the resources it needs to survive and thrive.

Democracy and an ecologically-sustainable manufacturing system, based on efficient infrastructure such as mass transit, are necessary for the very long-term success of an economy. Only the efforts of a large majority of the public can prevent the natural tendency of elites to strangle the economy. Only by keeping the ecosystems stable can manufacturing and infrastructure be kept stable enough to allow for the time needed to build up the physical and human capital of a modern manufacturing system.

As the founders of the American republic saw, inequality in power tends to be self-reinforcing and leads to the domination of the many and powerless by the few and powerful. In a production system, positive feedback loops are the source of a benign result, economic growth. In a system of control, such as a domestic or international political system, positive feedback is manifested by the powerful becoming more powerful and the weak becoming weaker. Political democracy within a country is one way to enable the citizenry to stop this process. A domestic economic constraint on the ever-increasing accumulation of power is the institution of employee-ownership and operation of firms. An international constraint on ever-expanding empire and conquest is the balance of power, the ganging up of weaker powers against the stronger one. The ultimate balance of power system would be one in which each participant was powerful enough to make conquest too costly. If each continent or subcontinent constituted a complete production base, the balance of power would be hard to break, and peace would be the easy choice. Since democracies don't seem to fight each other, a world of

continental, complete economies and democratic polities would maximize the possibility of sustained global peace and prosperity. Wealth increases the resources available to educate the public, and so manufacturing, the source of wealth, and democracy, the means for an educated public to control the government, reinforce each other.

There are many articulate advocates of manufacturing who have argued for the importance of manufacturing[18]. They often quote studies that show, for example, that manufacturing creates more jobs outside of its own sector than do most sectors, or that many of our best-paid jobs are in manufacturing. In this essay, I am attempting something much more ambitious: to build a case that virtually *all* jobs are based on manufacturing and the infrastructure; to argue that manufacturing is not simply an important part of a diverse economy, but is the *central* component of a wealthy economy; that a strong production base and democracy can bring a peaceful and prosperous world into being, one that is ecologically sustainable. This framework can be used to strengthen the arguments of those who are concerned about manufacturing's decline, and hopefully, to convince much of the public that the decline is something that needs to be reversed.

Unfortunately, it is not possible to use mainstream economics to support the arguments advanced in this essay. Neoclassical economics, as practiced by thousands of economists throughout this country, is dedicated to the idea that the market makes the best decisions possible. In the world of neoclassical economics, there are no critical sectors, such as manufacturing. The market will decide which industries should live and which should die, and the less the government interferes, the better. Fortunately for the U.S., the government has been constantly interfering in the economy ever since the U.S. was born, or we would never have become the world's wealthiest country. But the current ideological monopoly of neoclassical economics prevents people from seeing the importance of the manufacturing sectors or of the physical infrastructure. That is why it is necessary, now more than ever, to construct a new framework for thinking about the economy and the world.

Jonathan Rynn received his doctorate in Political Science from the City University of New York in 2001. He was a research associate for many years for the late Professor Seymour Melman of Columbia University, and has been Adjunct Professor at Baruch College in NYC. He can be reached at jonathanrynn@yahoo.com

Footnotes

[1] See http://www.bostonsocialforum.org/news.php, http://www.ifg.org/index.htm, or http://www.pcdf.org/

[2] Jon Rynn, "The Power to Create Wealth: A systems-based theory of the rise and decline of the Great Powers in the 20th Century", 2001, Department of Political Science, City University of New York

[3] WTO publication, "International Trade Statistics, 2004", at http://www.wto.org/english/res_e/statis_e/its2004_e/its04_toc_e.htm, "World Trade in 2003 – Overview", page 23, Table 1.9

[4] Percentages are from Survey of Current Business, January 2005, "Annual Industry Accounts", Table 1, and trade figures are from Survey of Current Business, October 2004, "U.S. International Services", Table 1. In order to calculate the value-added percentages for several small service subsectors, I used the data on revenue to calculate the percentage that a certain sub-subsector was of a subsector, and applied that percentage to the subsector's value-added.

[5] Data for manufacturing for 2003 for imports and total consumption taken from http://www.bea.gov/bea/industry/iotables/prod/options_list.cfm?aggregations_id=0&get_results=show&goto=go_to_options&anon=448&CFID=14992&CFTOKEN=43573192, which is the BEA interactive website for I/O data, The Use of Commodities by Industries before Redefinitions (1997 to 2003). Data for services trade from Survey of Current Business, "U.S. International Transactions", April 2005, Table 1.

[6] Data from http://www.treas.gov/tic/mfh.txt, part of the Treasury International Capital System, Securities Holdings and Transactions

[7] See, for instance, New York Times, Editorial, "Before The Fall", April 2, 2005

[8] From "International Transactions, 2004", Survey of Current Business", April 2005, Table A, line 17, 2004 column

[9] Exchange rates from Federal Reserve Bank Release G.5A, trade data from Bureau of Economic Analysis, U.S. International Transactions Accounts Data, Table 2

[10] Jonathan Rynn, "The Power to Create Wealth: A Systems-based Theory of the Rise and Decline of Great Powers in the 20th century", Ph.D. Dissertation, Department of Political Science, City University of New York, 2001, from "Statistical Appendix".

[11] See, for example, "Guns, Germs, and Steel: The fate of human societies", Jared Diamond, 1999

[12] Population figures form UN Demographic Yearbook, Table 1, UN Statistical Database, 2002; GDP figures from UN Department of Economic and Social Affairs, 2003,Economic and Social Development

[13] http://www.asce.org/reportcard/2005/index.cfm

[14] See the works of Seymour Melman, at http://www.aftercapitalism.com

[15] For a good argument as to the economic importance of cities, see Jane Jacobs, "Cities and the Wealth of Nations", 1985

[16] See the work of Colin Campbell, for instance http://www.oilcrisis.com/campbell/

[17] See the recent work of Michael T. Klare, for example, http://www.tomdispatch.com/index.mhtml?pid=1888

[18] Perhaps the best at the moment is http://www.jpcecon.com/NAM_PopkinPaper.pdf