Chapter 4 - Producing in the United States: Beyond War Economy

At this writing more than 800 American firms have transferred parts of their production operations to low wage countries, especially China and Mexico. *Business Week* of May 24, 2004 reports that "Some 3 million factory jobs—one in every six—have been lost since the last peak in mid-2000." The characteristic explanation that managers have offered for these moves is that only by discarding the high wage labor force of the U.S. will they be sufficiently profitable to be assured of ability to continue as managers of industrial enterprise.

The immediate effect of these moves is the creation of a mass of unemployed American workers and the transformation of many communities into "ghost towns". Is all this inevitable? Is it true that industrial production of consumer goods and machines—including capital goods—is no longer feasible in the U.S., paying U.S. wages?

Must U.S. Firms Move Manufacturing Outside the United States in Order to Compete?

What factors can make U.S. based producers cost competitive vs. production "offshore"? Such questions typically raise another issue: can U.S. productivity offset Chinese wages? However, by examining the cost structure we find that a great portion of the costs borne by U.S. industrial firms are incurred outside the realm of production in the form of salaries to administrative workers. In 1996 within U.S. manufacturing firms, for every hundred *production* workers there were 53 salaried, *administrative* (and technical) employees. This Administrative : Production ratio as measured here in terms of people is also reflected in terms of cost. By 1996, for every dollar paid to production workers an equal sum was paid to the salaried employees. This equality of payments tells you immediately that the conventional method of slashing the costs of industrial products by lowering production worker wages is not the only option available. However, in most U.S. manufacturing firms the idea of reducing the salaries of administrative employees is almost unheard of.[*] (Recall that Chapter 3 shows U.S. corporate chiefs being paid 531 times the employee average.)

Apart from administrative costs and materials, the main body of expense in manufacturing production is controlled by the productivity of labor and the productivity of capital. The degree of mechanization of work has a controlling effect on the average output per production worker, (i.e. the productivity of labor). But for every work task there are alternative production methods and equipments that can be graded on the basis of intensity of mechanization – in essence, the size of the capital outlay per particular piece of equipment.

In the centuries-long history of manufacturing industry, managers and their engineers have responded to the rising wages of production workers by developing means of production by which the average output per production worker man-hour could be progressively increased. At any given time and for any given task, a manufacturer confronts an array of possible production equipments ranked in terms of the capital outlay required for each one: the higher the wages of production workers, the greater the capital outlay that can

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[*] For the long-term record of administrative overhead in U.S. firms see: S. Melman, "The Rise of Administrative Overhead in the Manufacturing Industries of the United States, 1899-1947", *Oxford Economic Papers,* New Series, Vol. III, No.1, January 1951; also for the more recent record see S. Melman, *After Capitalism*, Op. Cit. pp. 178,179.

be justified in order to increase the output per production worker man-hour. This is called the alternative cost of labor to machinery.

In the United States the average "Hourly Compensation Cost"[1] of a production worker man-hour to management was $21.33 by 2002. Therefore any management seeking to minimize the cost of output per production worker was justified in making a larger capital investment per production worker man-hour in the U.S. as compared to the design of production methods where the "Hourly Compensation Cost" is much lower – e.g. Mexico $2.38.

For example, the Pioneer Corporation of Japan has invested in new manufacturing facilities in China and we learn that "Pioneer is hiring workers by the hundreds to fill jobs on the line that pay about $95 a month, above average for the region." Assuming 170 hours per month (a 40 hour week), the China wage would be about $0.56 per hour. Compare that with the cost to management of a production worker man-hour in Japan. By 2002 it averaged $18.83 per hour, 33 times as much as the Chinese wage. Accordingly, it is no surprise at all that "in China, paying workers … to do rote tasks like hunching over tiny chip assemblies and affixing pinhead-size pieces is cheaper than installing the industrial robots that would typically be used to do the same work in Japan."[2]

This is a clear demonstration of the role of alternative costs of labor to machinery, and their effect on production methods and productivity. The same considerations apply, of course, to American firms making investments in China. American firms are making the same calculation.

CONSUMER GOODS: MAKING SHOES IN THE US: NEW BALANCE RUNS THE PRODUCTIVITY RACE

This is a demonstration of what is feasible when technology is developed to respond to alternative cost of labor to machinery so as to make possible economic production, and then some, in the United States. Here are crucial parts of the story of New Balance Athletic Shoes. Stroll through New Balance Athletic Shoe Inc.'s factory in Norridgewock, Me., and you will see workers using high-tech skills to make a low-tech product. Well-trained, $14-an-hour employees work in small teams, perform a half-dozen jobs, and switch tasks every few minutes. Some operate computerized equipment with up to 20 sewing-machine heads running at once. Others control an automated stitcher guided by cameras, which allows one operator to do the work of six using ordinary sewing machines.

Now, visit a Chinese subcontractor's factory that makes the same shoe for New Balance. You might think you had traveled back in time 100 years. In the factories that manufacture shoes for New Balance, Nike, Reebok International, and other U.S.-based athletic-footwear companies, hundreds of women hunch over sewing machines much like ones used in their grandmothers' time. The story is the same across China and in Indonesia and Vietnam. Young women in their teens or early 20s, with little education and few skills, put in long hours six days a week, usually performing the same task in mind-numbing repetition for 20 cents to 40 cents an hour.

… Over the past five years, New Balance has doubled its U.S. workforce, to 1,200, and opened a fifth U.S. factory. But back in the mid-1990s, sales exploded--from about $300 million to $1.1 billion today. The company couldn't ramp up U.S. production fast enough to keep pace, so it turned to subcontractors to fill the gap. The share of its shoes produced at home fell to 25%, with the rest coming from Asia. Over time, [owner, Jim] Davis says, he aims to get back to the 70% production New Balance maintained in the U.S. five years ago.

How can New Balance make shoes at home when Nike, Reebok, and the rest can't? Mainly by adopting the latest manufacturing techniques used by U.S. companies in higher-skilled industries. *Employees start with 22 hours of classroom instruction on teamwork* and other techniques and *get constant training on the factory floor. They work in teams of five or six, sharing tasks and picking up the slack for one another to make sure they get everything done.* [emphasis added]

… *The combination of teams and technology* has slashed the cost disadvantage of producing in the U.S. New Balance's U.S. workers turn out a pair of shoes in just 24 minutes, vs. about three hours in the Asian factories that make the same product, says Herb Spivak, New Balance's head of operations. If the U.S. workers were no more efficient than those in China, New Balance's labor costs in the U.S., where it pays $14 an hour in wages and benefits, would be an untenable $44 per pair of shoes. But the company has whittled the cost down to $4 a pair vs. $1.30 in China, where labor costs are about 40 cents an hour. "[In Asia,] their labor is so inexpensive that they can waste it," says Spivak. "Ours is so dear that we come up with techniques to be very efficient." [emphasis added]

Davis says New Balance can remain competitive under these circumstances. The remaining $2.70 labor cost differential is a manageable 4% of a typical $70 shoe. And it's offset by the advantages of producing in the U.S., says Davis, where he can fill store orders faster than rivals and whip out style changes more quickly.[3] A 2003 report on New Balance brings us up to date on that firms wage and production development.

> Starting wage is $15 per hour including benefits -- a fair wage in the belt of economically depressed towns along the Merrimack River, such as Lawrence and Haverhill where many of the workers live.
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> To offset labor costs many times higher than their overseas suppliers, New Balance pushes efficiency in materials. The company has a 95 percent yield on materials, said Vachon, recalling in his early career when 70 percent was considered efficient. A 530-sq.-ft. piece, for example, can yield 216 pairs of women's shoes cut in roughly two hours. The factory uses four basic patterns, but can make 13 different men's and women's styles from those standards.[4] …
>
> … Bucking the trend toward moving, [out of the U.S.] New Balance has actually expanded its U.S. manufacturing base, and expects to grow it by another 10 percent in 2003….
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> "I can't see [shifting all production overseas], to be quite honest," said Jim Tompkins, president and COO of New Balance, which produces approximately 25 percent of its products in five factories throughout Maine and Massachusetts. "We are privately held and that is a statement we want to make," he said. "There is no one to tell us otherwise." According to Tompkins, New Balance's U.S. factories allow the company to deliver product more quickly domestically, and also give it the opportunity to monitor a shoe's development more closely. "There's nothing more interesting and fun than developing a product, then walking down the hall six months later and seeing it," he said.[5]

This new production system instituted by New Balance is a demonstration of classic, innovative development of manufacturing methods. Every main aspect of operations was addressed: economy in use of raw materials; major innovation in production machines;

training production workers; reducing variability in timing of production operations; reducing scrap rates; and reducing frequency of unscheduled down-time.

This New-Balance agenda of changes in production methods contrasts with the more frequent employer focus on worker wages and union demands which so many employers strive to escape by "going offshore".

CAPITAL GOODS: CAN U.S. FIRMS PRODUCE THE CAPITAL GOODS NEEDED FOR U.S. INFRASTRUCTURE RENEWAL?

MACHINE TOOLS—MADE IN CALIFORNIA

Haas Automation is a designer and manufacturer of Computer Numerically Controlled, (CNC) machine tools, including machining and turning centers and controls. (The Haas web site is at www.haascnc.com and includes rich detail not only on products and facilities, but also on the organization of work.)

Haas Automation is privately held and therefore has no published record of profit and loss and related data. The firm began operations in 1983 and at this writing has 750 employees, of whom nearly 200 are engineers. The offices and production facilities of Haas are located in Oxnard, CA.

Haas manufactures both the computer numerical controls (CNC) and the associated machine tools. Other firms that are principal producers of CNC controls for machine tools include Siemens, Fanuc, and Heidenhain (in Germany and Japan). In 2003 Haas Automation produced between 318-472 machines per month, with an average of 366 machines per month. This number of produced machine tools is built on the basis of a *schedule*. They are not individually built "to order". Characteristically, the firm retains a one-month stock of machines as a continuing inventory.

Haas Automation strives to operate its production facilities on a three-shift basis: *one shift manned and two shifts unmanned*. Unmanned means that production operations are programmed and regulated by the CNC devices that can be set to regulate the performance of single machining centers or turning centers, as well as the transfer of work-pieces mounted on pallets among machine tools.

Haas makes extensive use of flexible manufacturing systems, robotic loaders, "just-in-time" production methods and lean manufacturing practices. Machine tools are linked to and controlled by the company's ERP system, (enterprise resource planning – software that integrates many functions of an enterprise) which is also tied into the production schedule and inventory control.

Essentially, Haas operates a "machinery inventory bank" following the pattern of such an inventory system proposed in 1959 in discussions at Columbia University on the machine tool industry.*

Haas Automation places considerable importance on the idea of designing its machines and controls on the basis of "modules". Thus the 59 horizontal and vertical machining centers identified in the Haas Model Guide all use many comparable modules including, for example, the tool changers. There is also commonality in many of the base castings used on the machining centers, and in the many components that appear frequently in machine tools – like linear guides, ball screws, and a variety of pumps.

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* Those discussions focused on the problem of how to operate a stable production system for a machine tool industry instead of the established pattern of "boom and bust".

Haas Automation makes its own gears, having decided some time ago that they could manufacture a better quality set of gear products with the gear making under their own supervision. Whereupon they purchased the requisite array of gear making machines, and operate them continuously.

The market for Haas machines and controls has been mainly among job shops. During the last five years however, they have been successful in entering the market of "second-tier" customers, like the manufacturing facilities of automobile firms. This extended interest in CNC machine tools on the part of the automobile manufacturing fraternity stems from an increasing interest in flexibility for product design. A commitment to using the more traditional "transfer-type" machines for fabricating automobile parts has had the automatic effect of committing the firm so invested to long-term production for a particular class of products. In contrast, the machining centers permit rapid change in product design while still retaining many features of machine control and transferring work in process among machining locations. This kind of versatility is facilitated by the use of pallet changer devices that hold and transfer products from one machine tool to another. (Haas includes appropriate types of pallets in its product line.)

Palletization of workpieces, sometimes with accompanying vehicles for pallet transfer among machines, may well be a growing option whose effects clearly will include facilitating mechanization of product movement among machining centers. Notably, some production designs use robots for inter-machine product transfer. Options for these purposes include setting up multiple machining centers in "cellular" units with palletized handling of workpieces.

Of course, it is still the case that in the job shop class of CNC machine tool operations, "hand" movement of workpieces among machines remains the customary method.

Haas management views the company as a producer of quality, affordable machines. With this understanding, new technology is implemented in ways that have a far-reaching effect across an array of machine tool types and therefore user industries. Accordingly, Haas is *not* a "cutting edge" company. It does not operate a separately designated research team for machine tool design. Instead, Haas relies on a stream of technological modifications that can improve the characteristics of entire classes of the Haas product line. The engineering staff of nearly 200, includes electrical, mechanical and "manufacturing" engineers whose combined skills contribute to modifications in product design and manufacturing methods.

To my knowledge, Haas Automation is the only manufacturer of machine tools to publish prices for its principal products in public view. Prices for Haas's products are available on their web site: *www.haascnc.com*. Haas regards the publication of prices and the consequent curtailment of bargaining opportunities as a positive characteristic for the continued operation and future of the firm.

These details on Haas Automation are included because they demonstrate the feasibility of producing technically sophisticated capital goods in the United States and marketing them in the U.S., Europe and Asia. Note that there is a Haas marketing office and staff in Shanghai.

Haas Automation currently (Fall-Winter, 2003) regards the West European and the China market as important opportunities and challenges. In the case of China, the Haas management is aware of finance problems associated with the dollar-Yuan exchange value problem. With respect to China they also see it as an important positive factor that their machines are designed with a modular concept. It is expected that that will help in reaching Chinese markets because then there is greater interchangeability, readier replacement of components etc. For example: the modular design principle facilitates "servicing" capability for Haas products; the circuit boards on the computer numerical controls are to a large degree interchangeable.

Haas is heavily involved in education programs throughout the U.S. and has established nearly 60 Haas Technical Education Centers at learning institutions around the country. One of these, the Factory for Advanced Manufacturing Education was established at Penn State University in 2000. With 10 Haas machining and turning centers and an associated portable "multimedia-broadcasting cart", demonstrations of sophisticated machine tool operations can be brought into classrooms and auditoriums to facilitate discussion and training in Penn State's industrial and manufacturing engineering programs. There are also Haas machines used at hundreds of other centers in high schools, community colleges, technical colleges, and universities nationwide. Thereby Haas managers generate a body of professionals trained in Haas CNC and machining technologies.

The firm is also noteworthy for the fact that it has no debt, is not obligated to banks for funding and is in the enviable position of striving to build market share. It has a position of strength for purposes of reaching diverse markets. Accordingly, the management of Haas sees itself as a target firm for many competitors, even as it has been striving to build market share.

To illuminate the further meaning of the Haas operation a comparison is made between approximately comparable machining centers offered by Haas and by an important competing firm, Mazak.* As you can see from the basic dimensions and characteristics identified here, these are machines with comparable capabilities. The Haas $17,000 price advantage is substantial and probably derives from unusually close attention to economies due to the organization of work at Haas Automation.

Model	**Mazak Nexus 410 A**	**Haas VF-2SS**
Horsepower	25 HP	30 HP (Peak)
Number of tools	32	25
Tool change time	2.9 seconds	1.5 seconds
RPM	12,000 rpm	12,000 rpm
Rapid rate movement	1,471 inches / minute	1,400 inches / minute
X, Y, Z, travel	22" x 16" x 20"	30" x 16" x 20"
Price	**$73,900**	**$56,900**

COMPONENTS OF REINDUSTRIALIZATION – CAPITAL GOODS

In order to repair each category of infrastructure it is necessary to have the use of a set of specialized devices. This equipment, in turn is produced in factories that utilize machine tools to fabricate their component parts. These machine tools are the *core capital goods*, for

* Note: Mazak is a highly respected, innovative manufacturer of machine tools. The parent company, Yamazaki Mazak Corporation is headquartered in Nagoya, Japan with 4,000 employees worldwide, and branches in 15 countries, including production and servicing facilities in the United States. The Mazak website is at: www.mazak.co.jp

they are used to fabricate many types of useful equipments—as required for making railcars, wastewater treatment plants, earth moving machines, energy producing equipment, etc.

This connection between *capital goods* and specialized machines that are used to make every element of infrastructure is a vital link that helps to define the need for renewal of the means of production throughout the industrial system if the U.S. is to graduate from the present quagmire.

The most generalized formulation of the nature of capital goods is the following abstracted from the work of Dr. Jon Rynn.

> Production required by a community takes place in a sequence of stages. The stage of production that is the focus of economics is *final production*. In the *final production* stage, factories use production machinery to create consumer goods. …
> But how were the machines and buildings that constitute the factories created? Machine tools – are the primary equipment. First, they can produce more of their own kind.
> *Machine tools also make production machinery*; and *production machinery* is then used to create final goods and services.

What are the major planning methods that would be required to execute this Infrastructure program? There are formal methods for making detailed assessments so that one could know what outputs from particular industries are required for actually executing a production program that is defined by the Report Card on Infrastructure proposal. The methodology for that sort of operation is available in the form of the "input-output analysis" that is performed following the methodology once developed by Wassily Leontief.[6]

Four classes of products will have strategic importance as required basic inputs for a serious effort to carry forward the Report Card recommendations: steel, electricity, machine tools and computers.

Owing to the thoughtful work of Dr. Jon Rynn we have a helpful formulation of the role of such "capital" goods.[*]

THE ROLE OF CAPITAL GOODS IN PRODUCTION

Beyond machine tools there are several other strategically important technologies of production. Since the end of the nineteenth century, steel-making has been critical for the production of machines. Steel-making equipment is therefore used to make the steel for *production machinery*, machine tools, and for more steel-making machinery. Also, since the turn of the last century, electricity generation has been the most important form of energy conversion within the production process, allowing for the development of motors (most critically, in machine tools), the use of electric lances in steel-making, and most famously, the development of electronic machinery.

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[*] From a paper by Jon Rynn to the 2003 annual meeting of the American Political Science Association. He formulated a pattern for appreciating the functional role of "capital" goods in a larger production system.

Computers, the most important form of electronic equipment, are dependent, since the introduction of integrated circuits in the 1960s, on a form of equipment called semiconductor-making equipment. All of these forms of machinery possess these crucial qualities: first, they are used to make more of themselves; second, they are used to make more of other forms of *production machinery*; and third, technological advances in one form of *production machinery* accelerates technological development in other forms of machinery (and other sectors of the production system as well).

The history of technology is replete with the positive feedback effects of change in one class of machines affecting change in a large set of different machines. The most critical type of semiconductor-making equipment is optical lithography equipment. Advances in this kind of machine allow for denser and denser central processing units. … Advances in computers led to advances in machine tool design, in particular, numerically and then computer-controlled machine tools. Better machine tools then led to better precision glass cutting, among other things, which led to better optical lithography equipment.

Better computers led to more automated, highly-efficient steel factories; better kinds of steel led to better machine tools … Better machine tools made mass production possible, because mass production is dependent on the ability to produce interchangeable parts, which can then be assembled in a final product using an assembly line, as opposed to custom-fitting each component to a particular car or machine. The declining cost of electricity-generation, itself a by-product of advances in machine tools, steel-making, and information-processing, led to better and cheaper machines and goods.[7] As suggested by these formulations of "capital" goods, consider the recent quality of U.S. production of three classes of capital goods: electricity; machine tools; steel.

ELECTRIC POWER GENERATING MACHINERY

Unintended, the August 14, 2003 breakdown of electricity supply in Canada, the US Midwest and New England was a solid demonstration of the "capital goods" role of electricity. Vital manufacturing industries in all these areas were stopped, as were uncountable arrays of consumer activities. Unintended too was the unplanned test of the idea that production has become "old hat", now succeeded by a "service economy".

Soon after August 14, 2003, a federal government report was issued that included an assessment of basic failures in capital goods operation that led to this breakdown in electricity supply. Several industry reports addressing this breakdown identified a set of interlocking failures that contributed to the calamitous loss of power. The findings included the following.

- In one Ohio power company "workers could not act to halt an escalating crisis because they did not even know it existed";[8]
- "The blackout could have been safely contained if not for the utility's malfunctioning computers and inadequately trained control workers";[9]
- There was a "failure by First Energy to do the most basic maintenance of the company's transmission lines – namely the trimming of trees underneath and alongside the lines."[10] A variety of experts now say the findings were too narrow, ignoring the federal government's role in the recent reshaping of the power industry;[11]
- "Maybe the report doesn't go there because the answer is not one that is comfortable politically", said Alan H. Richardson, the president of the American Public Power Association;[12]

• "FirstEnergy was hobbled by the failure of a computer program that was supposed to set off alarms in the company's main control room when power lines failed or were stressed beyond their limits. That, in turn, caused the computer system itself to fail, and then a backup system, as well. It meant that operators in the control room were getting delayed, incomplete information about the failures of transmission lines and power plants in their region.";[13]

Commenting on the Report of the *U.S.-Canada Power Systems Outage Task Force*, John A Cosazza (a retired executive with *Public Service Electric and Gas of New Jersey,* stated: "The root causes that they name are not really the root causes. The root causes are that deregulation had 'provided the incentive to maximize profits now rather than provide long range service,' and basic maintenance like tree trimming."[14]

The report of the *U.S.-Canada Power System Outage Task Force* triggered a set of assessments that indicated a need for fundamental power system change. Thus "Much of the broad picture the report paints of Aug. 14 (2003) -- the malfunctioning computer systems, the lack of information, the sequence of failures -- has been known for months. But the details released today lay out previously unknown layers of dysfunction, presenting the hours leading up to the blackout as almost a comedy of errors among the people who were supposed to know and control what was happening to that section of the power grid."[15]

The federal government and its military-serving agencies have played a dominant part in enlarging funds for research and for graduate-student support, and in opening up new job opportunities for young engineers and scientists. One of the main effects of these initiatives following World War II was to induce the deans and faculties of American engineering schools to revise their curricula and research orientations to emphasize knowledge and training for servicing the expanding requirement of the military economy. Owing to the new emphasis on where the action was (money, jobs), there was a relative de-emphasis of manpower, attention and money in the universities and technical schools from training their students for civilian-industry technologies. Curricula and technical research in classic fields of civilian-engineering responsibility, like power engineering, were accorded lesser priorities.[*][16]

MACHINE TOOLS

The shortcomings of the U.S. machine tool industry, partly reported in chapter 3 deserve further detailing. As far back as the 1960's graduate students in the Department of Industrial Engineering / Operations Research at Columbia University were writing papers that defined preferred practices for a U.S. machine tool industry. The recommendations were aimed at inducing greater productivity in the industry that supplied the machines that are used to produce all other machines. Nevertheless, decay in the industry has proceeded so that by

[*] I recall the comment of a senior electronics engineer, saying that during the 1950s and 1960s those who went into power engineering were "the dregs" of the profession. With this "I'm all right, Jack" outlook, this man's main concern was to justify the priority accorded his brand of work, and never mind these awkward problems about energy supply and utilization. By implication such topics can be left to "the dregs."

2003 two thirds and more of the supply of machine tools to American firms is dependent on imports, mainly from Japan and Germany.

The following practices were identified in the Columbia 1960 studies as important for optimizing the performance of the machine tool industry.

Modular design. This means fashioning a set of components that could have a place in diverse machine tools, thereby encouraging economics of quantity in producing sections of these machines.

Production equipment. The American machine tool industry has been undercutting itself by its failure to make use of the most productive machine tools that it produces for the manufacture of new machine tools.

Standardization. Formulating and applying a set of standards for machine tool components would produce substantial economies and improvements in reliability. But the machine tool industry associations declined to apply themselves to this task.

Numerical control systems. Even during the earliest period of introduction of CNC (Computer Numerical Control) it was clear that substantial advantages were to be scored if the design of the controls was carried forward in connection with the design of the machinery elements they were charged with controlling. The principal U.S. firms ignored this possible advantage.

Market fluctuation. The managers in the machine tool industry viewed themselves as unavoidably functioning within a framework of market forces that left them unable to forecast market demand. In fact, proposals were formulated, but never discussed by industry managers, for establishing a Machinery Inventory Bank, a financing institution designed to stabilize sales and production.

Stable production system. Managers in this industry gave little attention to the consequences of production operations at a "stable" rate. Evidence from diverse sources has demonstrated that stabilizing production operations yielded: reduction in unscheduled downtime; reduction in scrap rates; an increased percent of product falling within desired dimensions, and other specifications; enabling smaller inventories of work in process and major reduction in inventories of raw materials and components; all these in combination yielding increased productivity of the capital goods producing factories.

These desirable characteristics for optimizing productivity in the actual production of machine tools have been mainly absent from the factories of the U.S. machine tool industry. By 2003 however, the performance of U.S. machine tool builder, Haas Automation, Inc, included many characteristics like the ones identified above. They have been accompanied by substantial gains in terms of productivity of capital and labor, and competitive product pricing (discussed below).

MAKING STEEL

Steel continues to be the single most important material of choice for an enormous array of consumer goods and capital goods. The various structural and managerial limitations in the operation of American steel making firms have been discussed elsewhere.[*] These have included dismaying inattention to R&D for new production methods, especially among the older, larger steel industry firms. Nevertheless, two major factors have appeared in the 21st century that offer a fresh opportunity for American steel makers: a historically

[*] S. Melman, *Profits Without Production*, (Alfred A. Knopf, NY 1988), pp. 188-199.

unprecedented expansion in steel consumption worldwide, and concomitant market demand for steel; second, the development within the American steel industry of "mini-mills" whose major raw material is the scrap metal from discarded metal products. Mini-mill operating methods include sophisticated techniques for continuous casting that bypass major traditional investments in rolling mills.

As to the first factor, increased steel consumption. For the first time in many years there is a global steel shortage, largely driven by the rapid and massive growth in Chinese demand for every sort of raw material used in steel manufacture. Locker Associates, a New York firm that monitors the steel industry, reports that the *addition* to China's steel capacity during the last ten years is greater than the entire capacity of the U.S. steel industry. Locker Associates report that in the spring of 2003 "when Chinese demand was particularly feverish, even U.S. producers were exporting to the mainland, and China essentially absorbed the world's excess steel production …"

All told, these market conditions have given the U.S. steel industry a new opportunity for internal renewal. This opens up fresh perspectives for technological advance and for stabilized employment in the U.S. steel industry.

Nevertheless, American conventional wisdom continues to hold that manufacturing in the United States cannot possibly produce goods to compete against the products of Chinese and the exploited battalions of workers in other poor countries. Workers in such countries may be paid $72 / month to work 12 hour shifts, six or seven days a week.

HOW JAPAN'S FIRMS COPE WITH WAGE DIFFERENTIALS

From agile reporters at *The Wall Street Journal*, we have up-to-date reports on how several major Japan-based firms—Matsushita and Hitachi—have been sustaining production in Japan where industrial workers' "Hourly Compensation Cost" (2002) is $18.83 per hour. They do this while carrying out parts of their firms' production in China paying Chinese workers about $.56 per hour. [17] "Big manufacturers such as Hitachi Construction and consumer-electronics giant Matsushita Electric Industrial Co. have boosted efficiency and can now make highly complex goods as cheaply in Japan as they can overseas." During the 1990's Japan experienced a similar situation as the U.S., losing manufacturing jobs to locations in China. Recently however, the Japanese manufacturing sector has been bolstered due to higher demand in China for Japanese products—including the machinery needed to produce various consumer goods.

Panasonic Factory Solutions, a branch of Matsushita, … is one of the world's biggest makers of insertion machines -- highly sophisticated industrial robots that stick tiny semiconductors and other components onto green circuit boards. The boards form the guts of electronic products which are being churned out in increasing volumes in China. The company's machines contain up to 30,000 separate parts. The most popular model can punch 16 chips per second onto a circuit board, with a precision of five-hundredths of a millimeter -- about the width of a few grains of pollen. Panasonic Factory Solutions' big-ticket machines see sales of only about 50 units each month. … it's more cost-effective to keep production in Japan, close by the company's suppliers and research centers.

Japanese manufacturers of construction and mining equipment have also benefited from the boom in China. The largest pieces of equipment are even imported into China completed, instead of using Chinese labor for assembly. Hitachi Construction is fielding increasing orders for ultralarge power shovels -- behemoths as big as a house that manipulate truck-size scoops in strip mines. Instead of making these monster shovels overseas, Hitachi

Construction in September plans to expand production by renting a nearby factory. By contrast, midsize power shovels for building sites are mass-produced and they are generally put together in local markets. Of the nearly 3,000 that Hitachi Construction sold in China over the past six months, 2,200 were assembled in a factory in China's inland city of Hefei. But some 43% of the value of a made-in-China shovel comes from Japan. … revenue jumped 25% in the year ended March 31. Hitachi Construction says it plans always to produce key components in Japan: the engine, computer controllers and the hydraulic valve. Concentrating production in one place saves on plant investment. It also leads to better machines. Japanese factories will also continue to produce components for consumer goods whose production is difficult and requires greater sophistication. Although simple circuit boards for cellphones are being made in China, multilayer boards for more advanced handsets are produced in Japan -- and are seeing sales rise, … Digital-camera components, now mostly manufactured in Japan, will soon be produced in China as well. But Matsushita is likely to keep in Japan the production of hard-to-make key parts that are constantly upgraded, such as semiconductors and lenses. Japan's manufacturing expertise is having clear economic impacts. While the U.S. trade deficit with China surged 20% to $124 billion in 2003, Japan's deficit with China shrank 24% to the equivalent of $19 billion. This February [2004], Japan ran a monthly trade surplus with China for the first time in 10 years. Exports of Japanese machinery and electronic gadgets … are among the biggest drivers of Japan's recent expansion.

If production competence of American manufacturing is to be restored, two major requirements must be met. First, a large population of engineers and blue-collar workers must become convinced that there are alternatives to every class of operation, and that ways for organizing work can make major differences with any given means of production. But more than that: a way is also needed to mobilize vast production talents and resources if the production competence of American industry is to be restored.

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[5] "Sole Survivors: Why Some U.S. Factories Are Still Making Footwear.", *Gale Group Business and Industry - FN*, April 7, 2003.

[6] One of Wassily Leontief's basic works is *Input-Output Economics* (New York : Oxford University Press, 1986). The Columbia University library includes many studies done by Leontief and others using his methodology in the U.S. and other countries.

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[14] Ibid., Nov. 24, 2003.

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[17] "As Japan Recovers, An Unlikely Source Gets Credit: China", *Wall Street Journal*, May 4, 2004.