**NYT The iEconomy**

**How U.S. Lost Out on iPhone Work**

[**http://www.nytimes.com/2012/01/22/business/apple-america-and-a-squeezed-middle-class.html?hp**](http://www.nytimes.com/2012/01/22/business/apple-america-and-a-squeezed-middle-class.html?hp)



People flooded Foxconn Technology with résumés at a 2010 job fair in Henan Province, China.

**By** [**CHARLES DUHIGG**](http://topics.nytimes.com/top/reference/timestopics/people/d/charles_duhigg/index.html?inline=nyt-per) **and** [**KEITH BRADSHER**](http://topics.nytimes.com/top/reference/timestopics/people/b/keith_bradsher/index.html?inline=nyt-per)

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When [Barack Obama](http://topics.nytimes.com/top/reference/timestopics/people/o/barack_obama/index.html?inline=nyt-per) joined Silicon Valley’s top luminaries [for dinner in California](http://dealbook.nytimes.com/2011/02/18/obamas-summit-in-the-valley/) last February, each guest was asked to come with a question for the president.

[**The iPhone Economy**](http://www.nytimes.com/interactive/2012/01/20/business/the-iphone-economy.html?ref=business)



A production line in Foxconn City in Shenzhen, China. The iPhone is assembled in this vast facility, which has 230,000 employees, many at the plant up to 12 hours a day, six days a week.

But as [Steven P. Jobs](http://topics.nytimes.com/top/reference/timestopics/people/j/steven_p_jobs/index.html?inline=nyt-per) of [Apple](http://topics.nytimes.com/top/news/business/companies/apple_computer_inc/index.html?inline=nyt-org) spoke, [President Obama](http://topics.nytimes.com/top/reference/timestopics/people/o/barack_obama/index.html?inline=nyt-per) interrupted with an inquiry of his own: what would it take to make iPhones in the United States?

Not long ago, Apple boasted that its products were made in America. Today, few are. Almost all of the 70 million iPhones, 30 million iPads and 59 million other products Apple sold last year were manufactured overseas.

Why can’t that work come home? Mr. Obama asked.

Mr. Jobs’s reply was unambiguous. “Those jobs aren’t coming back,” he said, according to another dinner guest.

The president’s question touched upon a central conviction at Apple. It isn’t just that workers are cheaper abroad. Rather, Apple’s executives believe the vast scale of overseas factories as well as the flexibility, diligence and industrial skills of foreign workers have so outpaced their American counterparts that “Made in the U.S.A.” is no longer a viable option for most Apple products.

Apple has become one of the best-known, most admired and most imitated companies on earth, in part through an unrelenting mastery of global operations. Last year, it earned over $400,000 in profit per employee, more than Goldman Sachs, Exxon Mobil or Google.

However, what has vexed Mr. Obama as well as economists and policy makers is that Apple — and many of its high-technology peers — are not nearly as avid in creating American jobs as other famous companies were in their heydays.

Apple employs [43,000 people in the United States and 20,000 overseas](http://investor.apple.com/secfiling.cfm?filingID=1193125-11-282113&CIK=320193), a small fraction of the over 400,000 American workers at General Motors in the 1950s, or the hundreds of thousands at General Electric in the 1980s. Many more people work for Apple’s contractors: an additional 700,000 people engineer, build and assemble iPads, iPhones and Apple’s other products. But almost none of them work in the United States. Instead, they work for foreign companies in Asia, Europe and elsewhere, at factories that almost all electronics designers rely upon to build their wares.

“Apple’s an example of why it’s so hard to create middle-class jobs in the U.S. now,” said Jared Bernstein, who until last year was an economic adviser to the White House.

“If it’s the pinnacle of capitalism, we should be worried.”

Apple executives say that going overseas, at this point, is their only option. One former executive described how the company relied upon a Chinese factory to revamp [iPhone](http://topics.nytimes.com/top/reference/timestopics/subjects/i/iphone/index.html?inline=nyt-classifier) manufacturing just weeks before the device was due on shelves. Apple had redesigned the iPhone’s screen at the last minute, forcing an assembly line overhaul. New screens began arriving at the plant near midnight.

A foreman immediately roused 8,000 workers inside the company’s dormitories, according to the executive. Each employee was given a biscuit and a cup of tea, guided to a workstation and within half an hour started a 12-hour shift fitting glass screens into beveled frames. Within 96 hours, the plant was producing over 10,000 iPhones a day.

“The speed and flexibility is breathtaking,” the executive said. “There’s no American plant that can match that.”

Similar stories could be told about almost any electronics company — and outsourcing has also become common in hundreds of industries, including accounting, legal services, banking, auto manufacturing and pharmaceuticals.

But while Apple is far from alone, it offers a window into why the success of some prominent companies has not translated into large numbers of domestic jobs. What’s more, the company’s decisions pose broader questions about what corporate America owes Americans as the global and national economies are increasingly intertwined.

“Companies once felt an obligation to support American workers, even when it wasn’t the best financial choice,” said Betsey Stevenson, the chief economist at the Labor Department until last September. “That’s disappeared. Profits and efficiency have trumped generosity.”

Companies and other economists say that notion is naïve. Though Americans are among the most educated workers in the world, the nation has stopped training enough people in the mid-level skills that factories need, executives say.



In China, Lina Lin is a project manager at PCH International, which contracts with Apple. “There are lots of jobs,” she said. “Especially in Shenzhen.”

To thrive, companies argue they need to move work where it can generate enough profits to keep paying for innovation. Doing otherwise risks losing even more American jobs over time, as evidenced by the legions of once-proud domestic manufacturers — including G.M. and others — that have shrunk as nimble competitors have emerged.

Apple was provided with extensive summaries of The New York Times’s reporting for this article, but the company, which has a reputation for secrecy, declined to comment.

This article is based on interviews with more than three dozen current and former Apple employees and contractors — many of whom requested anonymity to protect their jobs — as well as economists, manufacturing experts, international trade specialists, technology analysts, academic researchers, employees at Apple’s suppliers, competitors and corporate partners, and government officials.

Privately, Apple executives say the world is now such a changed place that it is a mistake to measure a company’s contribution simply by tallying its employees — though they note that Apple employs more workers in the United States than ever before.

They say Apple’s success has benefited the economy by empowering entrepreneurs and creating jobs at companies like cellular providers and businesses shipping Apple products. And, ultimately, they say curing unemployment is not their job.

“We sell iPhones in over a hundred countries,” a current Apple executive said. “We don’t have an obligation to solve America’s problems. Our only obligation is making the best product possible.”

**‘I Want a Glass Screen’**

In 2007, a little over a month before the iPhone was scheduled to appear in stores, Mr. Jobs beckoned a handful of lieutenants into an office. For weeks, he had been carrying a prototype of the device in his pocket.

Mr. Jobs angrily held up his iPhone, angling it so everyone could see the dozens of tiny scratches marring its plastic screen, according to someone who attended the meeting. He then pulled his keys from his jeans.

People will carry this phone in their pocket, he said. People also carry their keys in their pocket. “I won’t sell a product that gets scratched,” he said tensely. The only solution was using unscratchable glass instead. “I want a glass screen, and I want it perfect in six weeks.”

After one executive left that meeting, he booked a flight to [Shenzhen](http://travel.nytimes.com/frommers/travel/guides/asia/china/shenzhen/frm_shenzhen_3391010001.html), [China](http://topics.nytimes.com/top/news/international/countriesandterritories/china/index.html?inline=nyt-geo). If Mr. Jobs wanted perfect, there was nowhere else to go.

For over two years, the company had been working on a project — code-named Purple 2 — that presented the same questions at every turn: how do you completely reimagine the cellphone? And how do you design it at the highest quality — with an unscratchable screen, for instance — while also ensuring that millions can be manufactured quickly and inexpensively enough to earn a significant profit?

The answers, almost every time, were found outside the United States. Though components differ between versions, all iPhones contain hundreds of parts, an estimated 90 percent of which are manufactured abroad. Advanced semiconductors have come from Germany and Taiwan, memory from Korea and Japan, display panels and circuitry from Korea and Taiwan, chipsets from Europe and rare metals from Africa and Asia. And all of it is put together in China.

In its early days, Apple usually didn’t look beyond its own backyard for manufacturing solutions. A few years after Apple began building the Macintosh in 1983, for instance, Mr. Jobs bragged that it was [“a machine that is made in America.”](http://www.nytimes.com/1984/03/25/jobs/new-plants-may-not-mean-new-jobs.html) In 1990, while Mr. Jobs was running NeXT, which was eventually bought by Apple, the executive told a reporter that [“I’m as proud of the factory as I am of the computer.”](http://money.cnn.com/magazines/fortune/fortune_archive/1990/02/26/73121/index.htm) As late as 2002, top Apple executives occasionally drove two hours northeast of their headquarters to visit the company’s [iMac](http://nytimes.com.com/desktops/apple-imac-core-2/4505-3118_7-32065020.html?tag=api&part=nytimes&subj=re&inline=nyt-classifier) plant in Elk Grove, Calif.

But by 2004, Apple had largely turned to foreign manufacturing. Guiding that decision was Apple’s operations expert, [Timothy D. Cook](http://www.apple.com/pr/bios/tim-cook.html), who replaced Mr. Jobs as chief executive last August, six weeks before Mr. Jobs’s death. Most other American electronics companies had already gone abroad, and Apple, which at the time was struggling, felt it had to grasp every advantage.

In part, Asia was attractive because the semiskilled workers there were cheaper. But that wasn’t driving Apple. For technology companies, the cost of labor is minimal compared with the expense of buying parts and managing supply chains that bring together components and services from hundreds of companies.

For Mr. Cook, the focus on Asia “came down to two things,” said one former high-ranking Apple executive. Factories in Asia “can scale up and down faster” and “Asian supply chains have surpassed what’s in the U.S.” The result is that “we can’t compete at this point,” the executive said.

The impact of such advantages became obvious as soon as Mr. Jobs demanded glass screens in 2007.

For years, cellphone makers had avoided using glass because it required precision in cutting and grinding that was extremely difficult to achieve. Apple had already selected an American company, [Corning Inc.](http://www.corninggorillaglass.com/), to manufacture large panes of strengthened glass. But figuring out how to cut those panes into millions of iPhone screens required finding an empty cutting plant, hundreds of pieces of glass to use in experiments and an army of midlevel engineers. It would cost a fortune simply to prepare.

Then a bid for the work arrived from a Chinese factory.

When an Apple team visited, the Chinese plant’s owners were already constructing a new wing. “This is in case you give us the contract,” the manager said, according to a former Apple executive. The Chinese government had agreed to underwrite costs for numerous industries, and those subsidies had trickled down to the glass-cutting factory. It had a warehouse filled with glass samples available to Apple, free of charge. The owners made engineers available at almost no cost. They had built on-site dormitories so employees would be available 24 hours a day.

The Chinese plant got the job.

“The entire supply chain is in China now,” said another former high-ranking Apple executive. “You need a thousand rubber gaskets? That’s the factory next door. You need a million screws? That factory is a block away. You need that screw made a little bit different? It will take three hours.”

**In Foxconn City**

An eight-hour drive from that glass factory is a complex, known informally as Foxconn City, where the iPhone is assembled. To Apple executives, Foxconn City was further evidence that China could deliver workers — and diligence — that outpaced their American counterparts.

That’s because nothing like Foxconn City exists in the United States.

The facility has 230,000 employees, many working six days a week, often spending up to 12 hours a day at the plant. Over a quarter of Foxconn’s work force lives in company barracks and many workers earn less than $17 a day. When one Apple executive arrived during a shift change, his car was stuck in a river of employees streaming past. “The scale is unimaginable,” he said.

Foxconn employs nearly 300 guards to direct foot traffic so workers are not crushed in doorway bottlenecks. The facility’s central kitchen cooks an average of three tons of pork and 13 tons of rice a day. While factories are spotless, the air inside nearby teahouses is hazy with the smoke and stench of cigarettes.

[Foxconn Technology](http://www.foxconn.com/) has dozens of facilities in Asia and Eastern Europe, and in Mexico and Brazil, and it assembles an estimated 40 percent of the world’s consumer electronics for customers like Amazon, Dell, Hewlett-Packard, Motorola, Nintendo, Nokia, Samsung and Sony.

“They could hire 3,000 people overnight,” said Jennifer Rigoni, who was Apple’s worldwide supply demand manager until 2010, but declined to discuss specifics of her work. “What U.S. plant can find 3,000 people overnight and convince them to live in dorms?”

In mid-2007, after a month of experimentation, Apple’s engineers finally perfected a method for cutting strengthened glass so it could be used in the iPhone’s screen. The first truckloads of cut glass arrived at Foxconn City in the dead of night, according to the former Apple executive. That’s when managers woke thousands of workers, who crawled into their uniforms — white and black shirts for men, red for women — and quickly lined up to assemble, by hand, the phones. Within three months, Apple had sold one million iPhones. Since then, Foxconn has assembled over 200 million more.

Foxconn, in statements, declined to speak about specific clients.

“Any worker recruited by our firm is covered by a clear contract outlining terms and conditions and by Chinese government law that protects their rights,” the company wrote. Foxconn “takes our responsibility to our employees very seriously and we work hard to give our more than one million employees a safe and positive environment.”

The company disputed some details of the former Apple executive’s account, and wrote that a midnight shift, such as the one described, was impossible “because we have strict regulations regarding the working hours of our employees based on their designated shifts, and every employee has computerized timecards that would bar them from working at any facility at a time outside of their approved shift.” The company said that all shifts began at either 7 a.m. or 7 p.m., and that employees receive at least 12 hours’ notice of any schedule changes.

Foxconn employees, in interviews, have challenged those assertions.

Another critical advantage for Apple was that China provided engineers at a scale the United States could not match. Apple’s executives had estimated that about 8,700 industrial engineers were needed to oversee and guide the 200,000 assembly-line workers eventually involved in manufacturing iPhones. The company’s analysts had forecast it would take as long as nine months to find that many qualified engineers in the United States.

In China, it took 15 days.

Companies like Apple “say the challenge in setting up U.S. plants is finding a technical work force,” said [Martin Schmidt](http://web.mit.edu/manufacturing/amp/event/bios/schmidt.pdf), associate provost at the Massachusetts Institute of Technology. In particular, companies say they need engineers with more than high school, but not necessarily a bachelor’s degree. Americans at that skill level are hard to find, executives contend. “They’re good jobs, but the country doesn’t have enough to feed the demand,” Mr. Schmidt said.

Some aspects of the iPhone are uniquely American. The device’s software, for instance, and its innovative marketing campaigns were largely created in the United States. Apple recently built a $500 million data center in North Carolina. Crucial semiconductors inside the iPhone 4 and 4S are manufactured in an Austin, Tex., factory by Samsung, of South Korea.

But even those facilities are not enormous sources of jobs. Apple’s North Carolina center, for instance, has only 100 full-time employees. The Samsung plant has an estimated 2,400 workers.

“If you scale up from selling one million phones to 30 million phones, you don’t really need more programmers,” said Jean-Louis Gassée, who oversaw product development and marketing for Apple until he left in 1990. “All these new companies — Facebook, Google, Twitter — benefit from this. They grow, but they don’t really need to hire much.”

It is hard to estimate how much more it would cost to build iPhones in the United States. However, various academics and manufacturing analysts estimate that because labor is such a small part of technology manufacturing, paying American wages would add up to $65 to each iPhone’s expense. Since Apple’s profits are often hundreds of dollars per phone, building domestically, in theory, would still give the company a healthy reward.

But such calculations are, in many respects, meaningless because building the iPhone in the United States would demand much more than hiring Americans — it would require transforming the national and global economies. Apple executives believe there simply aren’t enough American workers with the skills the company needs or factories with sufficient speed and flexibility. Other companies that work with Apple, like Corning, also say they must go abroad.

Manufacturing glass for the iPhone revived a Corning factory in Kentucky, and today, much of the glass in iPhones is still made there. After the iPhone became a success, Corning received a flood of orders from other companies hoping to imitate Apple’s designs. Its strengthened glass sales have grown to more than $700 million a year, and it has hired or continued employing about 1,000 Americans to support the emerging market.

But as that market has expanded, the bulk of Corning’s strengthened glass manufacturing has occurred at plants in Japan and Taiwan.

“Our customers are in Taiwan, Korea, Japan and China,” said James B. Flaws, Corning’s vice chairman and chief financial officer. “We could make the glass here, and then ship it by boat, but that takes 35 days. Or, we could ship it by air, but that’s 10 times as expensive. So we build our glass factories next door to assembly factories, and those are overseas.”

Corning was founded in America 161 years ago and its headquarters are still in upstate New York. Theoretically, the company could manufacture all its glass domestically. But it would “require a total overhaul in how the industry is structured,” Mr. Flaws said. “The consumer electronics business has become an Asian business. As an American, I worry about that, but there’s nothing I can do to stop it. Asia has become what the U.S. was for the last 40 years.”

**Middle-Class Jobs Fade**

The first time Eric Saragoza stepped into Apple’s manufacturing plant in Elk Grove, Calif., he felt as if he were entering an engineering wonderland.

It was 1995, and the facility near Sacramento employed more than 1,500 workers. It was a kaleidoscope of robotic arms, conveyor belts ferrying circuit boards and, eventually, candy-colored iMacs in various stages of assembly. Mr. Saragoza, an engineer, quickly moved up the plant’s ranks and joined an elite diagnostic team. His salary climbed to $50,000. He and his wife had three children. They bought a home with a pool.

“It felt like, finally, school was paying off,” he said. “I knew the world needed people who can build things.”

At the same time, however, the electronics industry was changing, and Apple — with products that were declining in popularity — was struggling to remake itself. One focus was improving manufacturing. A few years after Mr. Saragoza started his job, his bosses explained how the California plant stacked up against overseas factories: the cost, excluding the materials, of building a $1,500 computer in Elk Grove was $22 a machine. In Singapore, it was $6. In Taiwan, $4.85. Wages weren’t the major reason for the disparities. Rather it was costs like inventory and how long it took workers to finish a task.

“We were told we would have to do 12-hour days, and come in on Saturdays,” Mr. Saragoza said. “I had a family. I wanted to see my kids play soccer.”

Modernization has always caused some kinds of jobs to change or disappear. As the American economy transitioned from agriculture to manufacturing and then to other industries, farmers became steelworkers, and then salesmen and middle managers. These shifts have carried many economic benefits, and in general, with each progression, even unskilled workers received better wages and greater chances at upward mobility.

But in the last two decades, something more fundamental has changed, economists say. Midwage jobs started disappearing. Particularly among Americans without college degrees, today’s new jobs are disproportionately in service occupations — at restaurants or call centers, or as hospital attendants or temporary workers — that offer fewer opportunities for reaching the middle class.

Even Mr. Saragoza, with his college degree, was vulnerable to these trends. First, some of Elk Grove’s routine tasks were sent overseas. Mr. Saragoza didn’t mind. Then the robotics that made Apple a futuristic playground allowed executives to replace workers with machines. Some diagnostic engineering went to Singapore. Middle managers who oversaw the plant’s inventory were laid off because, suddenly, a few people with Internet connections were all that were needed.

Mr. Saragoza was too expensive for an unskilled position. He was also insufficiently credentialed for upper management. He was called into a small office in 2002 after a night shift, laid off and then escorted from the plant. He taught high school for a while, and then tried a return to technology. But Apple, which had helped anoint the region as “Silicon Valley North,” had by then converted much of the Elk Grove plant into an AppleCare call center, where new employees often earn $12 an hour.

There were employment prospects in Silicon Valley, but none of them panned out. “What they really want are 30-year-olds without children,” said Mr. Saragoza, who today is 48, and whose family now includes five of his own.

After a few months of looking for work, he started feeling desperate. Even teaching jobs had dried up. So he took a position with an electronics temp agency that had been hired by Apple to check returned iPhones and iPads before they were sent back to customers. Every day, Mr. Saragoza would drive to the building where he had once worked as an engineer, and for $10 an hour with no benefits, wipe thousands of glass screens and test audio ports by plugging in headphones.

**Paydays for Apple**

As Apple’s overseas operations and sales have expanded, its top employees have thrived. Last fiscal year, Apple’s revenue topped $108 billion, a sum larger than the combined state budgets of Michigan, New Jersey and Massachusetts. Since 2005, when the company’s stock split, share prices have risen from about $45 to more than $427.

Some of that wealth has gone to shareholders. Apple is among the most widely held stocks, and the rising share price has benefited millions of individual investors, [401(k)’s](http://topics.nytimes.com/your-money/retirement/401ks-and-similar-plans/index.html?inline=nyt-classifier) and pension plans. The bounty has also enriched Apple workers. Last fiscal year, in addition to their salaries, Apple’s employees and directors received stock worth $2 billion and exercised or vested stock and options worth an added $1.4 billion.

The biggest rewards, however, have often gone to Apple’s top employees. Mr. Cook, Apple’s chief, last year received [stock grants](http://files.shareholder.com/downloads/AAPL/1640544083x0xS1193125-12-6704/320193/filing.pdf) — which vest over a 10-year period — that, at today’s share price, would be worth $427 million, and his salary was raised to $1.4 million. In 2010, Mr. Cook’s compensation package was valued at $59 million, according to Apple’s security filings.

A person close to Apple argued that the compensation received by Apple’s employees was fair, in part because the company had brought so much value to the nation and world. As the company has grown, it has expanded its domestic work force, including manufacturing jobs. Last year, Apple’s American work force grew by 8,000 people.

While other companies have sent call centers abroad, Apple has kept its centers in the United States. One source estimated that sales of Apple’s products have caused other companies to hire tens of thousands of Americans. FedEx and United Parcel Service, for instance, both say they have created American jobs because of the volume of Apple’s shipments, though neither would provide specific figures without permission from Apple, which the company declined to provide.

“We shouldn’t be criticized for using Chinese workers,” a current Apple executive said. “The U.S. has stopped producing people with the skills we need.”

What’s more, Apple sources say the company has created plenty of good American jobs inside its retail stores and among entrepreneurs selling iPhone and [iPad](http://topics.nytimes.com/top/reference/timestopics/subjects/i/ipad/index.html?inline=nyt-classifier) applications.

After two months of testing iPads, Mr. Saragoza quit. The pay was so low that he was better off, he figured, spending those hours applying for other jobs. On a recent October evening, while Mr. Saragoza sat at his MacBook and submitted another round of résumés online, halfway around the world a woman arrived at her office. The worker, Lina Lin, is a project manager in Shenzhen, China, at PCH International, which contracts with Apple and other electronics companies to coordinate production of accessories, like the cases that protect the iPad’s glass screens. She is not an Apple employee. But Mrs. Lin is integral to Apple’s ability to deliver its products.

Mrs. Lin earns a bit less than what Mr. Saragoza was paid by Apple. She speaks fluent English, learned from watching television and in a Chinese university. She and her husband put a quarter of their salaries in the bank every month. They live in a 1,080-square-foot apartment, which they share with their in-laws and son.

“There are lots of jobs,” Mrs. Lin said. “Especially in Shenzhen.”

**Innovation’s Losers**

Toward the end of Mr. Obama’s dinner last year with Mr. Jobs and other Silicon Valley executives, as everyone stood to leave, a crowd of photo seekers formed around the president. A slightly smaller scrum gathered around Mr. Jobs. Rumors had spread that his illness had worsened, and some hoped for a photograph with him, perhaps for the last time.

Eventually, the orbits of the men overlapped. “I’m not worried about the country’s long-term future,” Mr. Jobs told Mr. Obama, according to one observer. “This country is insanely great. What I’m worried about is that we don’t talk enough about solutions.”

At dinner, for instance, the executives had suggested that the government should reform visa programs to help companies hire foreign engineers. Some had urged the president to give companies a “tax holiday” so they could bring back overseas profits which, they argued, would be used to create work. Mr. Jobs even suggested it might be possible, someday, to locate some of Apple’s skilled manufacturing in the United States if the government helped train more American engineers.

Economists debate the usefulness of those and other efforts, and note that a struggling economy is sometimes transformed by unexpected developments. The last time analysts wrung their hands about prolonged American unemployment, for instance, in the early 1980s, the Internet hardly existed. Few at the time would have guessed that a degree in graphic design was rapidly becoming a smart bet, while studying telephone repair a dead end.

What remains unknown, however, is whether the United States will be able to leverage tomorrow’s innovations into millions of jobs.

In the last decade, technological leaps in solar and [wind energy](http://topics.nytimes.com/top/reference/timestopics/subjects/w/wind_power/index.html?inline=nyt-classifier), semiconductor fabrication and display technologies have created thousands of jobs. But while many of those industries started in America, much of the employment has occurred abroad. Companies have closed major facilities in the United States to reopen in China. By way of explanation, executives say they are competing with Apple for shareholders. If they cannot rival Apple’s growth and profit margins, they won’t survive.

“New middle-class jobs will eventually emerge,” said Lawrence Katz, a Harvard economist. “But will someone in his 40s have the skills for them? Or will he be bypassed for a new graduate and never find his way back into the middle class?”

The pace of innovation, say executives from a variety of industries, has been quickened by businessmen like Mr. Jobs. G.M. went as long as half a decade between major automobile redesigns. Apple, by comparison, has released five iPhones in four years, doubling the devices’ speed and memory while dropping the price that some consumers pay.

Before Mr. Obama and Mr. Jobs said goodbye, the Apple executive pulled an iPhone from his pocket to show off a new application — a driving game — with incredibly detailed graphics. The device reflected the soft glow of the room’s lights. The other executives, whose combined worth exceeded $69 billion, jostled for position to glance over his shoulder. The game, everyone agreed, was wonderful.

There wasn’t even a tiny scratch on the screen.

<http://www.nytimes.com/2012/01/26/business/ieconomy-apples-ipad-and-the-human-costs-for-workers-in-china.html?pagewanted=8&_r=1&hpw>

# NYT

# Human Costs Are Built Into an iPad

###### By [CHARLES DUHIGG](http://topics.nytimes.com/top/reference/timestopics/people/d/charles_duhigg/index.html?inline=nyt-per) and [DAVID BARBOZA](http://topics.nytimes.com/top/reference/timestopics/people/b/david_barboza/index.html?inline=nyt-per)

###### Published: January 25, 2012

The explosion ripped through Building A5 on a Friday evening last May, an eruption of fire and noise that twisted metal pipes as if they were discarded straws.

Compliance with Apple Code of Conduct  
<http://www.nytimes.com/interactive/2012/01/26/business/apple-suppliers-compliance-by-the-numbers.html?ref=business>

[](javascript:pop_me_up2('http://www.nytimes.com/imagepages/2012/01/26/business/26appletwo_337.html','26appletwo_337_html','width=720,height=605,scrollbars=yes,toolbars=no,resizable=yes'))

An explosion last May at a Foxconn factory in Chengdu, China, killed four people and injured 18.

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Workers installed staircase barriers at a Foxconn plant dormitory.

When workers in the cafeteria ran outside, they saw black smoke pouring from shattered windows. It came from the area where employees polished thousands of [iPad](http://topics.nytimes.com/top/reference/timestopics/subjects/i/ipad/index.html?inline=nyt-classifier) cases a day.

Two people were killed immediately, and over a dozen others hurt. As the injured were rushed into ambulances, one in particular stood out. His features had been smeared by the blast, scrubbed by heat and violence until a mat of red and black had replaced his mouth and nose.

“Are you Lai Xiaodong’s father?” a caller asked when the phone rang at Mr. Lai’s childhood home. Six months earlier, the 22-year-old had moved to Chengdu, in southwest China, to become one of the millions of human cogs powering the largest, fastest and most sophisticated manufacturing system on earth. That system has made it possible for [Apple](http://topics.nytimes.com/top/news/business/companies/apple_computer_inc/index.html?inline=nyt-org) and hundreds of other companies to build devices almost as quickly as they can be dreamed up.

“He’s in trouble,” the caller told Mr. Lai’s father. “Get to the hospital as soon as possible.”

In the last decade, Apple has become one of the mightiest, richest and most successful companies in the world, in part by mastering global manufacturing. Apple and its high-technology peers — as well as dozens of other American industries — have achieved a pace of innovation nearly unmatched in modern history.

However, the workers assembling iPhones, iPads and other devices often labor in harsh conditions, according to employees inside those plants, worker advocates and documents published by companies themselves. Problems are as varied as onerous work environments and serious — sometimes deadly — safety problems.

Employees work excessive overtime, in some cases seven days a week, and live in crowded dorms. Some say they stand so long that their legs swell until they can hardly walk. Under-age workers have helped build Apple’s products, and the company’s suppliers have improperly disposed of hazardous waste and falsified records, according to company reports and advocacy groups that, within China, are often considered reliable, independent monitors.

More troubling, the groups say, is some suppliers’ disregard for workers’ health. Two years ago, 137 workers at an Apple supplier in eastern China were injured after they were ordered to use a poisonous chemical to clean [iPhone](http://topics.nytimes.com/top/reference/timestopics/subjects/i/iphone/index.html?inline=nyt-classifier) screens. Within seven months last year, two explosions at iPad factories, including in Chengdu, killed four people and injured 77. Before those blasts, Apple had been alerted to hazardous conditions inside the Chengdu plant, according to a Chinese group that [published that warning](http://sacom.hk/wp-content/uploads/2011/05/2011-05-06_foxconn-and-apple-fail-to-fulfill-promises.pdf).

“If Apple was warned, and didn’t act, that’s reprehensible,” said Nicholas Ashford, a former chairman of the National Advisory Committee on Occupational Safety and Health, a group that advises the United States Labor Department. “But what’s morally repugnant in one country is accepted business practices in another, and companies take advantage of that.”

Apple is not the only electronics company doing business within a troubling supply system. Bleak working conditions have been documented at factories manufacturing products for Dell, Hewlett-Packard, I.B.M., Lenovo, Motorola, Nokia, Sony, Toshiba and others.

Current and former Apple executives, moreover, say the company has made significant strides in improving factories in recent years. Apple has a [supplier code of conduct](http://www.apple.com/supplierresponsibility/code-of-conduct/) that details standards on labor issues, safety protections and other topics. The company has mounted a vigorous auditing campaign, and when abuses are discovered, Apple says, corrections are demanded.

And Apple’s annual [supplier responsibility reports](http://www.apple.com/supplierresponsibility/), in many cases, are the first to report abuses. This month, for the first time, the company [released a list](http://www.nytimes.com/2012/01/14/technology/apple-releases-list-of-its-suppliers-for-the-first-time.html) identifying many of its suppliers.

But significant problems remain. More than half of the suppliers audited by Apple have violated at least one aspect of the code of conduct every year since 2007, according to Apple’s reports, and in some instances have violated the law. While many violations involve working conditions, rather than safety hazards, troubling patterns persist.

“Apple never cared about anything other than increasing product quality and decreasing production cost,” said Li Mingqi, who until April worked in management at [Foxconn Technology](http://topics.nytimes.com/top/news/business/companies/foxconn_technology/index.html?inline=nyt-org), one of Apple’s most important manufacturing partners. Mr. Li, who is suing Foxconn over his dismissal, helped manage the Chengdu factory where the explosion occurred.

“Workers’ welfare has nothing to do with their interests,” he said.

Some former Apple executives say there is an unresolved tension within the company: executives want to improve conditions within factories, but that dedication falters when it conflicts with crucial supplier relationships or the fast delivery of new products. On Tuesday, Apple reported one of the most profitable quarters of any corporation in history, with $46.3 billion in sales. Those sales would have been even higher, executives said, if overseas factories had been able to produce more.

Executives at other corporations report similar internal pressures. This system may not be pretty, they argue, but a radical overhaul would slow innovation. Customers want amazing new electronics delivered every year.

“We’ve known about labor abuses in some factories for four years, and they’re still going on,” said one former Apple executive who, like others, spoke on the condition of anonymity because of confidentiality agreements. “Why? Because the system works for us. Suppliers would change everything tomorrow if Apple told them they didn’t have another choice.”

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Lai Youngshan with a shrine to her son, Lai Xiaodong, who died after being injured in an explosion at a Foxconn plant.

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Damage is visible on the roof of the Foxconn factory.

“If half of iPhones were malfunctioning, do you think Apple would let it go on for four years?” the executive asked.

Apple, in its published reports, has said it requires every discovered labor violation to be remedied, and suppliers that refuse are terminated. Privately, however, some former executives concede that finding new suppliers is time-consuming and costly. Foxconn is one of the few manufacturers in the world with the scale to build sufficient numbers of iPhones and iPads. So Apple is “not going to leave Foxconn and they’re not going to leave China,” said Heather White, a research fellow at Harvard and a former member of the Monitoring International Labor Standards committee at the National Academy of Sciences. “There’s a lot of rationalization.”

Apple was provided with extensive summaries of this article, but the company declined to comment. The reporting is based on interviews with more than three dozen current or former employees and contractors, including a half-dozen current or former executives with firsthand knowledge of Apple’s supplier responsibility group, as well as others within the technology industry.

In 2010, Steven P. Jobs discussed the company’s relationships with suppliers [at an industry conference](http://allthingsd.com/video/?video_id=43D148EF-4ABF-402D-B149-8681DF01981A).

“I actually think Apple does one of the best jobs of any companies in our industry, and maybe in any industry, of understanding the working conditions in our supply chain,” said Mr. Jobs, who was Apple’s chief executive at the time and who died last October.

“I mean, you go to this place, and, it’s a factory, but, my gosh, I mean, they’ve got restaurants and movie theaters and hospitals and swimming pools, and I mean, for a factory, it’s a pretty nice factory.”

Others, including workers inside such plants, acknowledge the cafeterias and medical facilities, but insist conditions are punishing.

“We’re trying really hard to make things better,” said one former Apple executive. “But most people would still be really disturbed if they saw where their iPhone comes from.”

**The Road to Chengdu**

In the fall of 2010, about six months before the explosion in the iPad factory, Lai Xiaodong carefully wrapped his clothes around his college diploma, so it wouldn’t crease in his suitcase. He told friends he would no longer be around for their weekly poker games, and said goodbye to his teachers. He was leaving for Chengdu, a city of 12 million that was rapidly becoming one of the world’s most important manufacturing hubs.

Though painfully shy, Mr. Lai had surprised everyone by persuading a beautiful nursing student to become his girlfriend. She wanted to marry, she said, and so his goal was to earn enough money to buy an apartment.

Factories in Chengdu manufacture products for hundreds of companies. But Mr. Lai was focused on Foxconn Technology, China’s largest exporter and one of the nation’s biggest employers, with 1.2 million workers. The company has plants throughout China, and assembles an estimated 40 percent of the world’s consumer electronics, including for customers like Amazon, Dell, Hewlett-Packard, Nintendo, Nokia and Samsung.

Foxconn’s factory in Chengdu, Mr. Lai knew, was special. Inside, workers were building Apple’s latest, potentially greatest product: the iPad.

When Mr. Lai finally landed a job repairing machines at the plant, one of the first things he noticed were the almost blinding lights. Shifts ran 24 hours a day, and the factory was always bright. At any moment, there were thousands of workers standing on assembly lines or sitting in backless chairs, crouching next to large machinery, or jogging between loading bays. Some workers’ legs swelled so much they waddled. “It’s hard to stand all day,” said Zhao Sheng, a plant worker.

Banners on the walls warned the 120,000 employees: “Work hard on the job today or work hard to find a job tomorrow.” Apple’s supplier code of conduct dictates that, except in unusual circumstances, employees are not supposed to work more than 60 hours a week. But at Foxconn, some worked more, according to interviews, workers’ pay stubs and surveys by outside groups. Mr. Lai was soon spending 12 hours a day, six days a week inside the factory, according to his paychecks. Employees who arrived late were sometimes required to write confession letters and copy quotations. There were “continuous shifts,” when workers were told to work two stretches in a row, according to interviews.

Mr. Lai’s college degree enabled him to earn a salary of around $22 a day, including overtime — more than many others. When his days ended, he would retreat to a small bedroom just big enough for a mattress, wardrobe and a desk where he obsessively played an online game called Fight the Landlord, said his girlfriend, Luo Xiaohong.

Those accommodations were better than many of the company’s dorms, where 70,000 Foxconn workers lived, at times stuffed 20 people to a three-room apartment, employees said. Last year, a dispute over paychecks set off a riot in one of the dormitories, and workers started throwing bottles, trash cans and flaming paper from their windows, according to witnesses. Two hundred police officers wrestled with workers, arresting eight. Afterward, trash cans were removed, and piles of rubbish — and rodents — became a problem. Mr. Lai felt lucky to have a place of his own.

Foxconn, in a statement, disputed workers’ accounts of continuous shifts, extended overtime, crowded living accommodations and the causes of the riot. The company said that its operations adhered to customers’ codes of conduct, industry standards and national laws. “Conditions at Foxconn are anything but harsh,” the company wrote. Foxconn also said that it had never been cited by a customer or government for under-age or overworked employees or toxic exposures.

“All assembly line employees are given regular breaks, including one-hour lunch breaks,” the company wrote, and only 5 percent of assembly line workers are required to stand to carry out their tasks. Work stations have been designed to ergonomic standards, and employees have opportunities for job rotation and promotion, the statement said.

“Foxconn has a very good safety record,” the company wrote. “Foxconn has come a long way in our efforts to lead our industry in China in areas such as workplace conditions and the care and treatment of our employees.”

**Apple’s Code of Conduct**

In 2005, some of Apple’s top executives gathered inside their Cupertino, Calif., headquarters for a special meeting. Other companies had created codes of conduct to police their suppliers. It was time, Apple decided, to follow suit. The code Apple published that year demands “that working conditions in Apple’s supply chain are safe, that workers are treated with respect and dignity, and that manufacturing processes are environmentally responsible.”

But the next year, a British newspaper, The Mail on Sunday, [secretly visited a Foxconn factory](http://www.dailymail.co.uk/news/article-401234/The-stark-reality-iPods-Chinese-factories.html) in Shenzhen, China, where iPods were manufactured, and reported on workers’ long hours, push-ups meted out as punishment and crowded dorms. Executives in Cupertino were shocked. “Apple is filled with really good people who had no idea this was going on,” a former employee said. “We wanted it changed, immediately.”

Apple audited that factory, the company’s first such inspection, and ordered improvements. Executives also undertook a series of initiatives that included an annual audit report, first published in 2007. By last year, Apple had inspected 396 facilities — including the company’s direct suppliers, as well as many of those suppliers’ suppliers — one of the largest such programs within the electronics industry.

Those audits have found consistent violations of Apple’s code of conduct, [according to summaries](http://www.apple.com/supplierresponsibility/reports.html) published by the company. In 2007, for instance, Apple conducted over three dozen audits, two-thirds of which indicated that employees regularly worked more than 60 hours a week. In addition, there were six “core violations,” the most serious kind, including hiring 15-year-olds as well as falsifying records.

Over the next three years, Apple conducted 312 audits, and every year, about half or more showed evidence of large numbers of employees laboring more than six days a week as well as working extended overtime. Some workers received less than minimum wage or had pay withheld as punishment. Apple found 70 core violations over that period, including cases of involuntary labor, under-age workers, record falsifications, improper disposal of hazardous waste and over a hundred workers injured by toxic chemical exposures.

Last year, the company conducted 229 audits. There were slight improvements in some categories and the detected rate of core violations declined. However, at 93 facilities that at least half of workers exceeded the 60-hours-a-week work limit. A similar number showed employees working more than six days a week. There were incidents of discrimination, improper safety precautions, failure to pay required overtime rates and other violations. That year, four employees were killed and 77 injured in workplace explosions.

“If you see the same pattern of problems, year after year, that means the company’s ignoring the issue rather than solving it,” said one former Apple executive with firsthand knowledge of the supplier responsibility group. “Noncompliance is tolerated, as long as the suppliers promise to try harder next time. If we meant business, core violations would disappear.”

Apple says that when an audit reveals a violation, the company requires suppliers to address the problem within 90 days and make changes to prevent a recurrence. “If a supplier is unwilling to change, we terminate our relationship,” [the company says](http://www.apple.com/supplierresponsibility/auditing.html) on its Web site.

The seriousness of that threat, however, is unclear. Apple has found violations in hundreds of audits, but fewer than 15 suppliers have been terminated for transgressions since 2007, according to former Apple executives.

“Once the deal is set and Foxconn becomes an authorized Apple supplier, Apple will no longer give any attention to worker conditions or anything that is irrelevant to its products,” said Mr. Li, the former Foxconn manager. Mr. Li spent seven years with Foxconn in Shenzhen and Chengdu and was forced out in April after he objected to a relocation to Chengdu, he said. Foxconn disputed his comments, and said “both Foxconn and Apple take the welfare of our employees very seriously.”

Apple’s efforts have spurred some changes. Facilities that were reaudited “showed continued performance improvements and better working conditions,” the company wrote in its [2011 supplier responsibility progress report](http://images.apple.com/supplierresponsibility/pdf/Apple_SR_2011_Progress_Report.pdf). In addition, the number of audited facilities has grown every year, and some executives say those expanding efforts obscure year-to-year improvements.

Apple also has trained over a million workers about their rights and methods for injury and disease prevention. A few years ago, after auditors insisted on interviewing low-level factory employees, they discovered that some had been forced to pay onerous “recruitment fees” — which Apple classifies as involuntary labor. As of last year, the company had forced suppliers to reimburse more than $6.7 million in such charges.

“Apple is a leader in preventing under-age labor,” said Dionne Harrison of Impactt, a firm paid by Apple to help prevent and respond to [child labor](http://topics.nytimes.com/top/reference/timestopics/subjects/c/child_labor/index.html?inline=nyt-classifier) among its suppliers. “They’re doing as much as they possibly can.”

Other consultants disagree.

“We’ve spent years telling Apple there are serious problems and recommending changes,” said a consultant at BSR — also known as Business for Social Responsibility — which has been twice retained by Apple to provide advice on labor issues. “They don’t want to pre-empt problems, they just want to avoid embarrassments.”

**‘We Could Have Saved Lives’**

In 2006, BSR, along with a division of the World Bank and other groups, initiated a project to improve working conditions in factories building cellphones and other devices in China and elsewhere. The groups and companies pledged to test various ideas. Foxconn agreed to participate.

For four months, BSR and another group negotiated with Foxconn regarding a pilot program to create worker “hotlines,” so that employees could report abusive conditions, seek mental counseling and discuss workplace problems. Apple was not a participant in the project, but was briefed on it, according to the BSR consultant, who had detailed knowledge.

As negotiations proceeded, Foxconn’s requirements for participation kept changing. First Foxconn asked to shift from installing new hotlines to evaluating existing hotlines. Then Foxconn insisted that mental health counseling be excluded. Foxconn asked participants to sign agreements saying they would not disclose what they observed, and then rewrote those agreements multiple times. Finally, an agreement was struck, and the project was scheduled to begin in January 2008. A day before the start, Foxconn demanded more changes, until it was clear the project would not proceed, according to the consultant and a 2008 summary by BSR that did not name Foxconn.

The next year, a Foxconn employee fell or jumped from an apartment building after losing an iPhone prototype. Over the next two years, at least 18 other Foxconn workers attempted suicide or fell from buildings in manners that suggested suicide attempts. In 2010, two years after the pilot program fell apart and after multiple suicide attempts, Foxconn created a dedicated mental health hotline and began offering free psychological counseling.

“We could have saved lives, and we asked Apple to pressure Foxconn, but they wouldn’t do it,” said the BSR consultant, who asked not to be identified because of confidentiality agreements. “Companies like H.P. and Intel and Nike push their suppliers. But Apple wants to keep an arm’s length, and Foxconn is their most important manufacturer, so they refuse to push.”

BSR, in a written statement, said the views of that consultant were not those of the company.

“My BSR colleagues and I view Apple as a company that is making a highly serious effort to ensure that labor conditions in its supply chain meet the expectations of applicable laws, the company’s standards and the expectations of consumers,” wrote Aron Cramer, BSR’s president. Mr. Cramer added that asking Apple to pressure Foxconn would have been inconsistent with the purpose of the pilot program, and there were multiple reasons the pilot program did not proceed.

Foxconn, in a statement, said it acted quickly and comprehensively to address suicides, and “the record has shown that those measures have been successful.”

**A Demanding Client**

Every month, officials at companies from around the world trek to Cupertino or invite Apple executives to visit their foreign factories, all in pursuit of a goal: becoming a supplier.

When news arrives that Apple is interested in a particular product or service, small celebrations often erupt. Whiskey is drunk. Karaoke is sung.

Then, Apple’s requests start.

Apple typically asks suppliers to specify how much every part costs, how many workers are needed and the size of their salaries. Executives want to know every financial detail. Afterward, Apple calculates how much it will pay for a part. Most suppliers are allowed only the slimmest of profits.

So suppliers often try to cut corners, replace expensive chemicals with less costly alternatives, or push their employees to work faster and longer, according to people at those companies.

“The only way you make money working for Apple is figuring out how to do things more efficiently or cheaper,” said an executive at one company that helped bring the iPad to market. “And then they’ll come back the next year, and force a 10 percent price cut.”

In January 2010, workers at a Chinese factory owned by Wintek, an Apple manufacturing partner, went on strike over a variety of issues, including widespread rumors that workers were being exposed to toxins. Investigations by news organizations revealed that over a hundred employees had been injured by n-hexane, a toxic chemical that can cause nerve damage and paralysis.

Employees said they had been ordered to use n-hexane to clean iPhone screens because it evaporated almost three times as fast as rubbing alcohol. Faster evaporation meant workers could clean more screens each minute.

Apple commented on the Wintek injuries a year later. In its supplier responsibility report, Apple said it had “required Wintek to stop using n-hexane” and that “Apple has verified that all affected workers have been treated successfully, and we continue to monitor their medical reports until full recuperation.” Apple also said it required Wintek to fix the ventilation system.

That same month, a New York Times reporter interviewed a dozen injured Wintek workers [who said they had never been contacted](http://www.nytimes.com/2011/02/23/technology/23apple.html) by Apple or its intermediaries, and that Wintek had pressured them to resign and take cash settlements that would absolve the company of liability. After those interviews, Wintek pledged to provide more compensation to the injured workers and Apple sent a representative to speak with some of them.

Six months later, trade publications reported that Apple significantly cut prices paid to Wintek.

“You can set all the rules you want, but they’re meaningless if you don’t give suppliers enough profit to treat workers well,” said one former Apple executive with firsthand knowledge of the supplier responsibility group. “If you squeeze margins, you’re forcing them to cut safety.”

Wintek is still one of Apple’s most important suppliers. Wintek, in a statement, declined to comment except to say that after the episode, the company took “ample measures” to address the situation and “is committed to ensuring employee welfare and creating a safe and healthy work environment.”

Many major technology companies have worked with factories where conditions are troubling. However, independent monitors and suppliers say some act differently. Executives at multiple suppliers, in interviews, said that Hewlett-Packard and others allowed them slightly more profits and other allowances if they were used to improve worker conditions.

“Our suppliers are very open with us,” said Zoe McMahon, an executive in Hewlett-Packard’s supply chain social and environmental responsibility program. “They let us know when they are struggling to meet our expectations, and that influences our decisions.”

**The Explosion**

On the afternoon of the blast at the iPad plant, Lai Xiaodong telephoned his girlfriend, as he did every day. They had hoped to see each other that evening, but Mr. Lai’s manager said he had to work overtime, he told her.

He had been promoted quickly at Foxconn, and after just a few months was in charge of a team that maintained the machines that polished iPad cases. The sanding area was loud and hazy with aluminum dust. Workers wore masks and earplugs, but no matter how many times they showered, they were recognizable by the slight aluminum sparkle in their hair and at the corners of their eyes.

Just two weeks before the explosion, an advocacy group in Hong Kong published a report warning of unsafe conditions at the Chengdu plant, including problems with aluminum dust. The group, Students and Scholars Against Corporate Misbehavior, or Sacom, had videotaped workers covered with tiny aluminum particles. “Occupational health and safety issues in Chengdu are alarming,” [the report read](http://sacom.hk/wp-content/uploads/2011/05/2011-05-06_foxconn-and-apple-fail-to-fulfill-promises1.pdf). “Workers also highlight the problem of poor ventilation and inadequate personal protective equipment.”

A copy of that report was sent to Apple. “There was no response,” said Debby Chan Sze Wan of the group. “A few months later I went to Cupertino, and went into the Apple lobby, but no one would meet with me. I’ve never heard from anyone from Apple at all.”

The morning of the explosion, Mr. Lai rode his bicycle to work. The iPad had gone on sale just weeks earlier, and workers were told thousands of cases needed to be polished each day. The factory was frantic, employees said. Rows of machines buffed cases as masked employees pushed buttons. Large air ducts hovered over each station, but they could not keep up with the three lines of machines polishing nonstop. Aluminum dust was everywhere.

Dust is a known safety hazard. In 2003, an aluminum dust explosion in Indiana destroyed a wheel factory and killed a worker. In 2008, agricultural dust inside a sugar factory in Georgia [caused an explosion](http://www.nytimes.com/2008/02/09/us/09sugar.html) that killed 14.

Two hours into Mr. Lai’s second shift, the building started to shake, as if an earthquake was under way. There was a series of blasts, plant workers said.

Then the screams began.

When Mr. Lai’s colleagues ran outside, dark smoke was mixing with a light rain, according to cellphone videos. The toll would eventually count four dead, 18 injured.

At the hospital, Mr. Lai’s girlfriend saw that his skin was almost completely burned away. “I recognized him from his legs, otherwise I wouldn’t know who that person was,” she said.

Eventually, his family arrived. Over 90 percent of his body had been seared. “My mom ran away from the room at the first sight of him. I cried. Nobody could stand it,” his brother said. When his mother eventually returned, she tried to avoid touching her son, for fear that it would cause pain.

“If I had known,” she said, “I would have grabbed his arm, I would have touched him.”

“He was very tough,” she said. “He held on for two days.”

After Mr. Lai died, Foxconn workers drove to Mr. Lai’s hometown and delivered a box of ashes. The company later wired a check for about $150,000.

Foxconn, in a statement, said that at the time of the explosion the Chengdu plant was in compliance with all relevant laws and regulations, and “after ensuring that the families of the deceased employees were given the support they required, we ensured that all of the injured employees were given the highest quality medical care.” After the explosion, the company added, Foxconn immediately halted work in all polishing workshops, and later improved ventilation and dust disposal, and adopted technologies to enhance worker safety.

In its most recent supplier responsibility report, Apple wrote that after the explosion, the company contacted “the foremost experts in process safety” and assembled a team to investigate and make recommendations to prevent future accidents.

In December, however, seven months after the blast that killed Mr. Lai, another iPad factory exploded, this one in Shanghai. Once again, aluminum dust was the cause, according to interviews and Apple’s most recent supplier responsibility report. That blast injured 59 workers, with 23 hospitalized.

“It is gross negligence, after an explosion occurs, not to realize that every factory should be inspected,” said Nicholas Ashford, the occupational safety expert, who is now at the Massachusetts Institute of Technology. “If it were terribly difficult to deal with aluminum dust, I would understand. But do you know how easy dust is to control? It’s called ventilation. We solved this problem over a century ago.”

In its most recent supplier responsibility report, Apple wrote that while the explosions both involved combustible aluminum dust, the causes were different. The company declined, however, to provide details. The report added that Apple had now audited all suppliers polishing aluminum products and had put stronger precautions in place. All suppliers have initiated required countermeasures, except one, which remains shut down, the report said.

For Mr. Lai’s family, questions remain. “We’re really not sure why he died,” said Mr. Lai’s mother, standing beside a shrine she built near their home. “We don’t understand what happened.”

**Hitting the Apple Lottery**

Every year, as rumors about Apple’s forthcoming products start to emerge, trade publications and Web sites begin speculating about which suppliers are likely to win the Apple lottery. Getting a contract from Apple can lift a company’s value by millions because of the implied endorsement of manufacturing quality. But few companies openly brag about the work: Apple generally requires suppliers to sign contracts promising they will not divulge anything, including the partnership.

That lack of transparency gives Apple an edge at keeping its plans secret. But it also has been a barrier to improving working conditions, according to advocates and former Apple executives.

This month, after numerous requests by advocacy and news organizations, including The New York Times, [Apple released](http://www.nytimes.com/2012/01/14/technology/apple-releases-list-of-its-suppliers-for-the-first-time.html) the names of 156 of its suppliers. In the report accompanying that list, Apple said they “account for more than 97 percent of what we pay to suppliers to manufacture our products.”

However, the company has not revealed the names of hundreds of other companies that do not directly contract with Apple, but supply the suppliers. The company’s supplier list does not disclose where factories are, and many are hard to find. And independent monitoring organizations say when they have tried to inspect Apple’s suppliers, they have been barred from entry — on Apple’s orders, they have been told.

“We’ve had this conversation hundreds of times,” said a former executive in Apple’s supplier responsibility group. “There is a genuine, companywide commitment to the code of conduct. But taking it to the next level and creating real change conflicts with secrecy and business goals, and so there’s only so far we can go.” Former Apple employees say they were generally prohibited from engaging with most outside groups.

“There’s a real culture of secrecy here that influences everything,” the former executive said.

Some other technology companies operate differently.

“We talk to a lot of outsiders,” said Gary Niekerk, director of corporate citizenship at Intel. “The world’s complex, and unless we’re dialoguing with outside groups, we miss a lot.”

Given Apple’s prominence and leadership in global manufacturing, if the company were to radically change its ways, it could overhaul how business is done. “Every company wants to be Apple,” said Sasha Lezhnev at the Enough Project, a group focused on corporate accountability. “If they committed to building a conflict-free iPhone, it would transform technology.”

But ultimately, say former Apple executives, there are few real outside pressures for change. Apple is one of the most admired brands. In a national survey conducted by The New York Times in November, 56 percent of respondents said they couldn’t think of anything negative about Apple. Fourteen percent said the worst thing about the company was that its products were too expensive. Just 2 percent mentioned overseas labor practices.

People like Ms. White of Harvard say that until consumers demand better conditions in overseas factories — as they did for companies like Nike and Gap, which today have overhauled conditions among suppliers — or regulators act, there is little impetus for radical change. Some Apple insiders agree.

“You can either manufacture in comfortable, worker-friendly factories, or you can reinvent the product every year, and make it better and faster and cheaper, which requires factories that seem harsh by American standards,” said a current Apple executive.

“And right now, customers care more about a new iPhone than working conditions in China.”

# NYT

# Foxconn Plans to Lift Pay Sharply at Factories in China



Foxconn employees on the production line at the Lunghua plant in Shenzhen, China, in 2010.

###### By [DAVID BARBOZA](http://topics.nytimes.com/top/reference/timestopics/people/b/david_barboza/index.html?inline=nyt-per)

###### Published: February 18, 2012

BEIJING — [Foxconn Technology](http://topics.nytimes.com/top/news/business/companies/foxconn_technology/index.html?inline=nyt-org), one of the biggest manufacturers of products for [Apple](http://topics.nytimes.com/top/news/business/companies/apple_computer_inc/index.html?inline=nyt-org), Dell, Hewlett-Packard and other electronics companies, said Saturday that it would sharply raise worker salaries at its Chinese factories.

###### [Early Praise in Inspection at Foxconn Brings Doubt](http://www.nytimes.com/2012/02/17/business/early-praise-in-foxconn-inspection-brings-doubt.html?ref=technology) (February 17, 2012)

Foxconn said that salaries for many workers would immediately jump by 16 to 25 percent, to about $400 a month, before overtime.

The company also said it would reduce overtime hours at its factories.

Labor rights groups say that over the years, many Foxconn plants have violated Chinese labor laws by pushing workers to endure excessive amounts of overtime.

[Criticism has grown](http://www.nytimes.com/2012/01/26/business/ieconomy-apples-ipad-and-the-human-costs-for-workers-in-china.html) over working conditions at several Apple suppliers in [China](http://topics.nytimes.com/top/news/international/countriesandterritories/china/index.html?inline=nyt-geo), including Foxconn, which employs more than one million workers to assemble some of the world’s most popular devices.

Apple announced last Monday that the Fair Labor Association, a nonprofit group, [would provide independent audits](http://bits.blogs.nytimes.com/2012/02/13/apple-announces-independent-factory-inspections/?scp=4&sq=fair%20labor%20association&st=cse) of its supplier factories in China and elsewhere. Apple said the group’s findings would be made public. The association began inspecting Foxconn operations in China this week.

Apple and Foxconn, which is based in Taiwan, have strongly denied allegations that the workers are treated poorly. But Apple has acknowledged in its own audits that some of its suppliers in China violate Apple’s own code of conduct, with instances of [child labor](http://topics.nytimes.com/top/reference/timestopics/subjects/c/child_labor/index.html?inline=nyt-classifier), forced overtime and unsafe working conditions and evidence that employees are sometimes exposed to hazardous and toxic chemicals.

In recent years, Foxconn facilities in China have experienced a series of worker suicides, and labor rights groups have documented varied abuses.

Last year, four workers were killed and about 20 were injured because of a dust explosion at a Chinese factory that was producing the Apple [iPad](http://topics.nytimes.com/top/reference/timestopics/subjects/i/ipad/index.html?inline=nyt-classifier).

According to Bloomberg News, the auditor at the Fair Labor Association said recently that he had already found “[tons of issues](http://www.bloomberg.com/news/2012-02-17/foxconn-auditor-finds-tons-of-issues-.html)” at Foxconn plants. He did not detail the problems.

A Foxconn spokesman could not be reached late Saturday.

NYT Pressure, Chinese and Foreign, Drives Changes at Foxconn



Foxconn, which recruited workers at a 2010 job fair in Shenzhen, China, said Saturday it would sharply raise its wages.

###### By [DAVID BARBOZA](http://topics.nytimes.com/top/reference/timestopics/people/b/david_barboza/index.html?inline=nyt-per) and [CHARLES DUHIGG](http://topics.nytimes.com/top/reference/timestopics/people/d/charles_duhigg/index.html?inline=nyt-per)

###### Published: February 19, 2012

BEIJING — The announcement Saturday that [Foxconn Technology](http://topics.nytimes.com/top/news/business/companies/foxconn_technology/index.html?inline=nyt-org) — one of the world’s largest electronics manufacturers — [will sharply raise salaries and reduce overtime](http://www.nytimes.com/2012/02/19/technology/foxconn-to-raise-salaries-for-workers-by-up-to-25.html) at its Chinese factories signals that pressure from workers, international markets and concerns among Western consumers about working conditions is driving a fundamental shift that could accelerate an already rapidly changing Chinese economy.

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Trainees at a Foxconn industrial park in Shenzhen, China, walked beneath a poster of Terry Gou, chairman of Foxconn's parent, Hon Hai Precision Industry.

[](javascript:pop_me_up2('http://www.nytimes.com/imagepages/2012/02/20/business/jp-foxconn-2.html','jp_foxconn_2_html','width=720,height=551,scrollbars=yes,toolbars=no,resizable=yes'))

Foxconn employees in Shenzhen. The company has announced plans to invest in automation.

But the true meaning of Foxconn’s reforms, analysts say, will depend in part on how effectively the company can remake an economic system that has relied for much of the last decade on luring migrants to work cheaply for long hours in mammoth factories building smartphones, computers and other electronics.

Plants depend on workers’ being at assembly lines six or seven days a week, often for as long as 14 hours a day. Such facilities have made it possible for devices to be turned out almost as quickly as they are dreamed up.

For that system to genuinely change, Foxconn, its competitors and their clients — which include Apple, Hewlett-Packard, Dell and the world’s other large electronics firms — must convince consumers in America and elsewhere that improving factories to benefit workers is worth the higher prices of goods.

“This is the way capitalism is supposed to work,” said David Autor, an economist at the Massachusetts Institute of Technology. “As nations develop, wages rise and life theoretically gets better for everyone.

“But in China, for that change to be permanent, consumers have to be willing to bear the consequences. When people read about bad Chinese factories in the paper, they might have a moment of outrage. But then they go to Amazon and are as ruthless as ever about paying the lowest prices.”

Foxconn, with 1.2 million Chinese employees, is one of China’s largest employers. It assembles an estimated 40 percent of the smartphones, computers and other electronic gadgets sold around the world. Foxconn’s decisions set standards other manufacturers must compete with.

The announcement by Foxconn, which said that it would raise salaries as much as 25 percent, to about $400 a month, came after an outcry over working conditions at its factories. In recent weeks, labor rights groups have staged coordinated protests in various countries after reports that some of Apple’s Chinese suppliers operate [harsh, abusive and dangerous facilities](http://www.nytimes.com/2012/01/26/business/ieconomy-apples-ipad-and-the-human-costs-for-workers-in-china.html). To stem criticism, Apple [hired a nonprofit labor group](http://bits.blogs.nytimes.com/2012/02/13/apple-announces-independent-factory-inspections/) to inspect the plants it uses.

Workers welcomed the announced raises and overtime limits, though some were skeptical they would cause much real change. “When I was in Foxconn, there were rumors about pay raises every now and then, but I’ve never seen that day happen until I left,” said Gan Lunqun, 23, a former Foxconn worker. “This time it sounds more credible.”

By bowing to such demands, Foxconn has conceded that employees and consumers have gained a sway once possessed only by Chinese bureaucrats and executives at the global electronics firms that hire Foxconn to build their products.

Foxconn’s announcement also reflects how quickly China’s economy is shifting. Many of the country’s employers are facing labor shortages, which also puts upward pressure on wages, as do inflation and government demands to raise minimum wages.

Over 100 million migrant workers returned to their village homes this month to celebrate China’s Spring Festival, otherwise known as the New Year. Traditionally, factories have had no problem luring those workers back. But many Chinese cities are still confronting serious labor shortages, even though the holiday ended weeks ago. A recent Chinese government report said this year’s labor shortage was more pronounced than those in previous years.

And just as China’s exporters are struggling to cope with labor shortages in coastal regions, they are also confronting higher raw material costs and a strengthening Chinese currency, which makes Chinese goods more expensive in other nations.

“China can’t guarantee the low wages and costs they once did,” said Ron Turi of Element 3 Battery Venture, a consulting firm in the battery industry. “And companies like Foxconn have developed international profiles, and so they have to worry about how they’re seen by people living in places with very different standards.”

No other company in the world has quite the manufacturing scale of Foxconn. Nearly every global electronics company has some tie to the manufacturing giant, and while much of its work can be done cheaply, with low-skilled workers, the sheer volume of goods and scale of its operations make it China’s single biggest exporter.

Some of its campuses are considered small cities, with as many as 200,000 workers. Many are housed in dormitories near the assembly lines and are expected to be ready to rush into work should new orders flow in.

The Foxconn model, though, is under pressure. While most companies operate with similar dormitories, wage structures and work schedules, staffing Foxconn’s large sites has grown increasingly difficult. A new generation of young people in China are more reluctant to migrate to coastal cities, live in factory dorms and toil long hours. Many are staying closer to home, because of new opportunities in inland provinces. That has created labor shortages on the coast.

Social scientists say young people here are also less willing to accept factory jobs for long periods. Meanwhile, demographic changes have meant China has fewer young people to join the work force.

If the workers will not move to the coast, the logic is that the coastal factories ought to move to where the workers are living. Big manufacturers like Foxconn have responded to such challenges by moving factories inland.

And worried that the old model is dying, Foxconn has announced plans to invest in millions of robots and automate aspects of production.

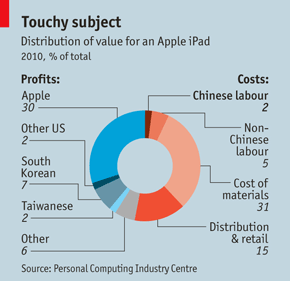
## Trade statistics

### iPadded

# The trade gap between America and China is much exaggerated

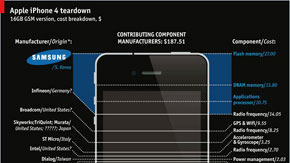
Jan 21st 2012 | from the print edition

AMERICA’S trade deficit with China hit another record last year. Estimated at almost $300 billion, it made up over 40% of America’s total deficit. Yet official data grossly overstate US imports from China.



Take the iPad, which America imports from China even though it is entirely designed and owned by Apple, an American company. iPads are assembled in Chinese factories owned by Foxconn, a Taiwanese firm, largely from parts produced outside China. According to a [study](http://pcic.merage.uci.edu/papers/2011/Value_iPad_iPhone.pdf" \t "_blank) by the Personal Computing Industry Centre, each iPad sold in America adds $275, the total production cost, to America’s trade deficit with China, yet the value of the actual work performed in China accounts for only $10. Using these numbers, The Economist estimates that iPads accounted for around $4 billion of America’s reported trade deficit with China in 2011; but if China’s exports were measured on a value-added basis, the deficit was only $150m.

The chart shows a geographical breakdown of the retail price of an iPad. The main rewards go to American shareholders and workers. Apple’s profit amounts to about 30% of the sales price. Product design, software development and marketing are based in America. Add in the profits and wages of American suppliers, and distribution and retail costs, and America retains about half the total value of an iPad sold there. The next biggest gainers are South Korean firms like Samsung and LG, which provide the display and memory chips, whose profits account for 7% of an iPad’s value. The main financial benefit to China is wages paid to workers for assembling the product and for manufacturing some inputs—equivalent to only 2% of the retail price.

Find out how much of an Apple iPhone is actually a Samsung with our [**"teardown" infographic**](http://www.economist.com/blogs/dailychart/2011/08/apple-and-samsungs-symbiotic-relationship)

China’s small contribution to total costs suggests that a yuan appreciation would have little impact on its exports. A 20% rise in the yuan would add less than 1% to the import price of an iPad. For imports such as clothing and toys the Chinese value added is much higher. But electrical machinery and equipment, with more complex cross-border supply chains, make up one-quarter of China’s exports to America. Pascal Lamy, the head of the World Trade Organisation, has suggested that if trade statistics reflected true domestic content, America’s deficit with China might be more than halved.

NYT

March 6, 2012

###### Economic Scene

# Dividends Emerge in Pressing Apple Over Working Conditions in China



A protester, Dana Johnsen of Santa Clara, Calif., outside Apple's shareholder meeting last month in Cupertino.

###### By EDUARDO PORTER

###### Published: March 6, 2012

The American sweatshop opposition movement was born the day we discovered how our Nikes were stitched together. Two decades later, we are discovering how our cherished iPhones are made, giving [Apple](http://topics.nytimes.com/top/news/business/companies/apple_computer_inc/index.html?inline=nyt-org) a “Nike moment” of its own.

Worker suicides at Apple’s main Chinese supplier, [Foxconn](http://topics.nytimes.com/top/news/business/companies/foxconn_technology/index.html?inline=nyt-org), in 2010, followed by [reports](http://www.nytimes.com/2012/01/26/business/ieconomy-apples-ipad-and-the-human-costs-for-workers-in-china.html?_r=1&pagewanted=all) of forced overtime, [child labor](http://topics.nytimes.com/top/reference/timestopics/subjects/c/child_labor/index.html?inline=nyt-classifier), minimum wage violations and unsafe working conditions at its suppliers, have contrasted with Apple’s status as creator of hallowed devices and its spectacular $13 billion in profit — 30 percent of sales — in the first quarter.

The reports have fueled a budding protest among [students](http://sacom.hk/) and labor unions who call for Apple to compel its suppliers in [China](http://topics.nytimes.com/top/news/international/countriesandterritories/china/index.html?inline=nyt-geo) to improve the conditions for hundreds of thousands of workers who assemble its products — workers whose wages contribute [a mere $10](http://pcic.merage.uci.edu/papers/2011/Value_iPad_iPhone.pdf) to the cost of a contract-free $549 [iPhone](http://topics.nytimes.com/top/reference/timestopics/subjects/i/iphone/index.html?inline=nyt-classifier) 4.

But if the troubling conditions at Foxconn’s assembly lines raise anew fundamental questions about the responsibility of corporations in this age of global capitalism, the outcry raises a basic question too. Does pressure by consumers and governments in the West to improve multinationals’ behavior in poor countries do more harm than good?

Sweatshop opposition in the past offers limited hope. But Apple is different in some ways than the garment and shoemakers of earlier campaigns. Its high profile and deep pockets suggest that consumer pressure might indeed effect change for workers at Apple’s suppliers in China.

In the 1990s, when the anti-sweatshop movement was going strong, Paul Krugman, before he became a columnist for The New York Times, [wrote](http://www.slate.com/articles/business/the_dismal_science/1997/03/in_praise_of_cheap_labor.html) that “as long as you have no realistic alternative to industrialization based on low wages, to oppose it means that you are willing to deny desperately poor people the best chance they have of progress for the sake of what amounts to an aesthetic standard — that is, the fact that you don’t like the idea of workers being paid a pittance to supply rich Westerners with fashion items.”

Today, globalization has a decidedly better track record than its alternative. Countries that receive lots of multinational investment have grown faster. They report less poverty and less use of child labor.

China is an example of globalization’s benefits. Foreign investment has surged over the last 20 years, driving spectacular economic growth. Wages in the nonfarm sector have risen 10 percent a year in real terms over the last decade, according to Nicholas Lardy of the Brookings Institution.

The nation’s poverty rate, measured by the share of the population living on less than $1.25 a day, fell to 17 percent by the middle of the last decade, from 64 percent in the early 1990s, according to World Bank statistics. In Bangladesh, ignored by foreign capital, half of the population live in abject poverty, roughly the same share as in 1981. As Joan Robinson, a British economist, [noted](http://www.economist.com/node/16693333) half a century ago, “the misery of being exploited by capitalists is nothing compared to the misery of not being exploited at all.”

This poses a quandary for would-be activists in the West. They see their task as convincing multinationals like Apple that whatever the cost of improved working conditions at its suppliers’ plants, it is less than the potential cost to its reputation of allowing workers to toil in sweatshop conditions. But they must not forget that the No. 1 priority for most of Foxconn’s workers is to keep their job. While outside pressure might improve their lives, it could also persuade Foxconn to [replace them](http://www.economist.com/node/21525432).

The anti-sweatshop movement’s origins can be [traced](http://depts.washington.edu/ccce/polcommcampaigns/NikeChronology.htm) to late 1980s Indonesia, a global hub of the apparel and footwear business. Reports of violations of workers’ rights at Indonesian suppliers to big brands like Nike and Reebok led unions and human rights groups to press the United States to suspend Indonesian trade preferences. Articles about women stitching Nikes in dismal conditions for [91 cents a day](http://articles.latimes.com/1992-09-22/news/wr-1105_1_minimum-wage) appeared in the press, mobilizing campaigns against the apparel giant.

For a while it seemed that [activism could win](http://mgmt.wharton.upenn.edu/documents/research/ImprovingConditions_of_Workers.pdf) the day: the Indonesian minimum wage rose from less than 80 cents to about $1.80 a day from 1990 to 1996. Wages at factories for brand-name sneakers rose even faster, as the brands forced suppliers to comply with the wage floor. Nike issued a [code of conduct](http://nikeinc.com/pages/compliance) requiring suppliers to adhere to labor, health and environmental standards. [Many](http://www.fairlabor.org/report/bjb-factory-dominican-republic) [other](http://usas.org/2011/05/23/victory-at-jerzees-nuevo-dia-groundbreaking-contract-signed-at-russell-plant-in-honduras/) [victories](http://usas.org/campaigns-old/sweat-free-campus/dont-pay-the-fla/about-the-fla/corporate-cover-up-1-nike/) followed, with big brands repeatedly acceding to demands that they enforce better working conditions at their suppliers’ plants across the third world.

But in time, many of the victories of consumer activism turned a little sour. Though Indonesian factories that stitched sneakers for big brands like Nike did add jobs in the 1990s, despite the sharply higher wages, economists reported significant [job losses](http://mgmt.wharton.upenn.edu/documents/research/ImprovingConditions_of_Workers.pdf) throughout the economy. Activists bemoan the fact that even when they persuade brands to press their suppliers to improve working conditions, [victories turn to defeat](http://usas.org/campaigns-old/sweat-free-campus/dont-pay-the-fla/about-the-fla/corporate-cover-up-3-bjb-factory-case/) when suppliers try to pass on the additional cost of higher wages, shorter hours or increased benefits.

“When brands get caught at one facility, and pressure is brought to bear, they can be forced to push for changes at that facility,” said Scott Nova, executive director of the Workers Rights Consortium, which monitors working conditions at plants that make college-brand clothes. “However, if those changes raise costs and slow delivery times, it is easy enough, a year or two down the road, for the brand to reduce orders at that factory in favor of others.”

The most telling commentary on the effectiveness of the anti-sweatshop movement is the prevalence, years later, of [dismal](http://news.bbc.co.uk/2/hi/asia-pacific/1860217.stm) working conditions and illegally [low wages](http://www.itglwf.org/lang/en/documents/ITGLWFSportswearReport2011.pdf) at many suppliers of the world’s large multinational brands

Apple’s critics should not despair, however. Despite failures and drawbacks, activists have made progress.

For one thing, they have persuaded major brands and retailers to take responsibility for working conditions along their supplier pipeline — something unheard-of two decades ago. And the anti-sweatshop movement has contributed to improvements in workers’ lives in concrete ways, forcing better compliance with health and safety norms and reducing the most egregious forms of harassment.

But the most promising consideration for critics is just how different Apple is from the companies singled out by the anti-sweatshop movement of the 1990s.

For starters, Apple’s enormous profit margins — owing to the great popularity of the inimitable products it sells — vastly outstrip the thin margins prevalent in the garment and footwear industry and make it much easier for the company to absorb the cost of improving worker conditions at its suppliers.

What’s more, supplier contracts in the electronic industry tend to be much longer than the three-month terms common in the apparel business. This gives Apple a much bigger stake in the long-term success of Foxconn as a supplier, and makes it less attractive to cut and run to a cheaper option.

And Apple’s vaunted ability to make suppliers twirl on a dime to satisfy its most exacting specifications in the shortest possible time suggests the company would have little trouble imposing rules on wages or workers’ rights.

Consumer pressure and bad publicity have already led Apple to make some big changes. In 2005 it created a code of conduct for its suppliers, monitored regularly. Last month it became the first electronics company to join the Fair Labor Association, a group set up in 1999 by companies, universities and nonprofit groups to monitor working conditions at garment makers in the third world. Over the last two years, Foxconn has announced repeated wage increases at its plant in Shenzhen.

These are early days. Who knows, if activists keep up the pressure, they might help lead to significant improvements in the lives of Foxconn’s workers and make us feel better about how our iPhones are made.

NYT

# Electronic Giant Vowing Reforms in China Plants

###### By [CHARLES DUHIGG](http://topics.nytimes.com/top/reference/timestopics/people/d/charles_duhigg/index.html?inline=nyt-per) and [STEVEN GREENHOUSE](http://topics.nytimes.com/top/reference/timestopics/people/g/steven_greenhouse/index.html?inline=nyt-per)

###### Published: March 29, 2012

Responding to a critical investigation of its factories, the manufacturing giant [Foxconn](http://topics.nytimes.com/top/news/business/companies/foxconn_technology/index.html?inline=nyt-org) has pledged to sharply curtail working hours and significantly increase wages inside Chinese plants making electronic products for [Apple](http://topics.nytimes.com/top/news/business/companies/apple_computer_inc/index.html?inline=nyt-org) and others. The move could improve working conditions across China.

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Auret van Heerden, president and chief executive of the Fair Labor Association, left, and Jorge Perez-Lopez, executive director of F.L.A.



###### [Laboring At Foxconn](javascript:void(0);)

###### [A List of Labor Concerns at Foxconn](http://www.nytimes.com/interactive/2012/03/29/business/problems-found-at-foxconn.html?ref=business)

The shift comes after a far-ranging inspection by the Fair Labor Association, a monitoring group, [found widespread problems](http://www.fairlabor.org/report/foxconn-investigation-report) — including at least 43 violations of Chinese laws and regulations, and numerous instances where Foxconn defied industry codes of conduct by having employees work more than 60 hours a week, and sometimes more than 11 days in a row. The group released a report Thursday with its findings.

The monitoring group, which surveyed more than 35,000 Foxconn employees and inspected three large facilities where Apple products are manufactured, also found that 43 percent of workers had experienced or witnessed accidents, and almost two-thirds said their compensation “does not meet their basic needs.” Many said that the unions available to them do “not provide true worker representation.”

“There’s this lingering sense among workers that they’re in a dangerous place,” Auret van Heerden, president and chief executive of the Fair Labor Association, said in an interview. But Foxconn has “reached a tipping point,” he added. “They have publicly promised to make changes in a manner that they will have to deliver on it.”

Apple, which recently joined the Fair Labor Association, had asked the group to investigate plants manufacturing iPhones, iPads and other devices. In past months, a growing outcry over conditions at such factories has drawn protests and petitions, and several labor rights organizations started independently scrutinizing Apple’s suppliers. Earlier this week a collection of advocacy groups sent Apple an open letter calling on the company to “ensure decent working conditions at all its suppliers.”

Since January, Apple has released the names of 156 of its suppliers — which it had previously declined to identify — and has started posting regular monitoring reports on the number of hours worked by factory employees. Apple, which has audited its suppliers since 2006, said in a statement Thursday that it shares “the F.L.A.’s goal of improving lives and raising the bar for manufacturing companies everywhere.”

Foxconn did not reveal how much it would raise wages or details on how its promises would be put into place. But the impact of Foxconn’s hour and wage reforms could signal a new, wide-reaching change in working conditions throughout China. Foxconn makes over 40 percent of the world’s electronics products — including for such brands as Amazon, Dell and Hewlett-Packard — and is China’s largest and most prominent private employer, with 1.2 million workers.

In response to the report, Foxconn said it was “committed to work with Apple to carry out the remediation program, developed by both our companies.”

Apple, in a statement, said the company fully supported the monitoring group’s recommendations. “Our team has been working for years to educate workers, improve conditions and make Apple’s supply chain a model for the industry, which is why we asked the F.L.A. to conduct these audits.”

Foxconn’s promises include a commitment that by July of next year, no worker will labor for more than 49 hours per week — the limit set by Chinese law. Foxconn, which is based in Taiwan, has also pledged that despite cutting hours, employees’ pay will not decline. Experts say such promises will most likely require Foxconn to hire tens of thousands of additional employees, which along with the wage increases could cost hundreds of millions of dollars annually.

Those moves, in turn, are likely to influence the prices paid by Foxconn’s customers, and could increase the retail cost of consumer electronics products like smartphones and tablets unless Apple and others accept lower profit margins.

“At the end of the day it’s a matter of image, a matter of recognition, a matter of reputation,” said Ricardo Ernst, a professor of global logistics at Georgetown University. But regardless of motivation, when a company as large as Foxconn changes, it reshapes other companies’ decisions, he added.

This is not the first time that independent monitors have criticized conditions at Foxconn — or that change has been promised. In 2006, Apple said that Foxconn “has enacted a policy change to enforce the weekly overtime limits set by our Code of Conduct.” That change, however, did not bring Foxconn into line with the law or Apple’s regulations.

Last year, Apple wrote in its yearly audit summary that “reducing excessive overtime is a top priority” in 2012. This year, the company began weekly tracking of 110 facilities — including Foxconn — where excessive work-hour violations were commonplace. Last month, according to that tracking, the average employee worked 48 hours, and 89 percent of monitored employees worked 60 hours or less per week, which is the limit mandated in most circumstances by Apple’s supplier code of conduct.

“It is not news that Apple and Foxconn are promising to end labor rights abuses at these factories,” said Scott Nova, executive director of the Workers Rights Consortium, a university-backed monitoring group based in Washington. “They have been promising to do that since 2006. And they have not delivered. I hope this time will be different.”

Mr. van Heerden of the Fair Labor Association said he believed this time the promised changes would occur because his organization would continue monitoring Foxconn and because worldwide attention was focused on the issue more sharply than ever. “I think they have crossed the Rubicon,” he said, of Foxconn and its chief executive, Terry Gou. “He’d be crazy to make these commitments without fulfilling them,” he added.

In the extensive report documenting its findings, the Fair Labor Association said a majority or near majority of workers surveyed said they felt pain after working a full day, that wages were not sufficient to pay for health care or education and that dorms were crowded. But the group’s surveys found that not all employees had complaints or objected to long hours. Some wanted to work more to earn more money. Foxconn workers at one plant start at about $285 a month, and average wages are about $426 to $455 per month, according to the group’s report.

Many of the group’s findings align with what Apple has found in the audits the company performs, said Mr. van Heerden. But the group’s findings that unions and other worker representation groups are dominated by nominees chosen by management contradict Apple’s reports that most factories allow free association among workers.

The association’s findings also strongly contradict Foxconn’s statement, sent earlier this year to The New York Times, that workers generally “are limited to no more than 60 hours per week.”

Among other things, the group found that Foxconn in the past prepped workers with answers to give to monitors to avoid detection of violations.

“We found a cheat sheet,” said Mr. van Heerden. “If you’re asked how many hours you work, say this, for instance. Since we’re not asking the questions that conventional auditors ask, we were able to see what’s really going on.”

The association will soon begin inspecting other companies in Apple’s supply chain, said Mr. van Heerden.

# NYT

# Foxconn Gets Japan Foothold With Stake in Sharp

###### By [HIROKO TABUCHI](http://topics.nytimes.com/top/reference/timestopics/people/t/hiroko_tabuchi/index.html?inline=nyt-per)

###### Published: March 27, 2012

TOKYO — In another sign of China’s manufacturing ascent as Japan struggles, the Taiwanese giant [Foxconn Technology](http://topics.nytimes.com/top/news/business/companies/foxconn_technology/index.html?inline=nyt-org) will become the largest shareholder in Sharp, a former exemplar of Japan’s electronics empire that has fallen on hard times.

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###### Yoshikazu Tsuno/Agence France-Presse — Getty Images

Sharp’s 80-inch LCD display. Foxconn will buy an 11 percent interest in the company.

Besides giving Sharp an injection of cash, the Foxconn deal, announced here Tuesday, will aim to help the Japanese company restore profitability to its TV manufacturing and liquid-crystal display businesses.

Sharp is a big maker of flat-panel television sets, and is still considered an innovator in liquid-crystal display, or LCD, technology. But the company is hemorrhaging money. And, like its compatriots Sony and Panasonic, Sharp has lost ground to more nimble South Korean companies like Samsung and LG.

Headquartered in Taiwan, Foxconn has become a world leader on the strength of its sprawling factory campuses on the Chinese mainland. It is primarily a contract manufacturer, with premier clients that include Apple for which it makes iPads and iPhones.

Foxconn, whose formal name is the Hon Hai Precision Industry Company, has repeatedly come under scrutiny for the labor practices that enable it to crank out products at high volume and low cost.

In response to reports of suicides at Foxconn’s plants and accusations that it forces employees to work grueling shifts under sometimes dangerous conditions, Apple has hired a nonprofit group, the Fair Labor Association, to [investigate](http://www.nytimes.com/2012/02/17/business/early-praise-in-foxconn-inspection-brings-doubt.html). The association, which is examining Apple’s various suppliers, is expected to release its report soon.

China, which long served Japanese industry primarily as a low-cost operating base for manufacturing, is now [bringing its money and methods](http://www.nytimes.com/2012/03/09/business/global/japan-looks-beyond-its-borders-for-investors.html) to Japan. Last year, a Chinese company bought the washing machine and refrigerator manufacturing business of Sanyo Electric.

Chinese manufacturers have recently agreed to build a plastics plant and a heavy machinery factory in western Japan. And in 2011, for the first time, the number of mergers and acquisitions by Chinese companies in Japan exceeded those by American businesses.

Even if Sharp does not fully adopt Foxconn’s methods after the investment, the Japanese company’s manufacturing model could benefit from streamlining.

Japanese manufacturers have long clung to a vertically integrated approach in which they try to make most of their products in-house. It is a business model that served companies like Sharp well in the 1980s and 1990s, but more recently has been overtaken by electronics companies that outsource most of their manufacturing.

Especially in high-cost Japan, vertical integration is strangling profitability, Sharp’s incoming president, Takashi Okuda, said Tuesday.

“Sharp can no longer handle everything on its own, from R.&D. to design, production, procurement, sales and services,” said Mr. Okuda. “In the competitive global market, Sharp’s vertically integrated model has reached its limit.”

Mr. Okuda, who previously led Sharp’s global business, is set to take the president’s job on April 1, replacing Mikio Katayama. Mr. Katayama was edged out and up to the chairman’s post after Sharp in January projected its highest net loss ever — 290 billion yen ($3.5 billion) for the year through March — hurt by a glut of LCD panels worldwide and a punishingly strong yen.

Tuesday’s deal calls for Hon Hai to take a stake of nearly 11 percent in Sharp.

Sharp will issue 66.5 billion yen, more than $800 million, in new shares to Hon Hai, and will also sell the Taiwanese company a nearly 47 percent stake in a flat-panel television factory in western Japan where the two companies plan to make TV sets together.

Mr. Okuda said Sharp would use the proceeds of the share issue to invest in new LCD technology, for which the company expects robust demand because of mobile devices. The two companies plan to jointly develop and produce a wide range of devices, including smartphones, Mr. Okuda said.

Sharp’s financial woes have been made worse by a 1 trillion yen bet on its state-of-the-art television factory in Sakai, near the western hub of Osaka, in 2009. But that investment weighed heavily on Sharp’s finances, as demand for large panels slumped and inventory piled up.

It remains unclear whether Sharp can rebuild a business to compete with the cheap capital and manufacturing muscle of South Korea’s Samsung, for instance, or the innovation of Silicon Valley companies like Apple. But a recognition that it must outsource, or even discontinue, cheap mass-market products could be a step toward improving profitability.

For Hon Hai, the deal with Sharp comes as further recognition of its dominance in global manufacturing.

“Sharp is one of the most recognized brands worldwide and is also the leader in R.&D.,” said Hon Hai’s chairman, Terry Gou, who addressed reporters in Tokyo in a video message. “Hon Hai — well, it’s not a brand, but has an excellent manufacturing record.”

“This is truly a winning alliance,” Mr. Gou said.

# NYT

# Apple’s Chief Puts Stamp on Labor Issues



A Foxconn factory in Guangdong Province, China.

###### By [NICK WINGFIELD](http://topics.nytimes.com/top/reference/timestopics/people/w/nick_wingfield/index.html?inline=nyt-per)

###### Published: April 1, 2012

A day after [Timothy D. Cook](http://topics.nytimes.com/top/reference/timestopics/people/c/timothy_cook/index.html?inline=nyt-per), [Apple](http://topics.nytimes.com/top/news/business/companies/apple_computer_inc/index.html?inline=nyt-org)’s chief executive, toured a Chinese factory where the company’s products are made, an audit commissioned by Apple criticized the long hours and dangerous working conditions at plants run by [Foxconn](http://topics.nytimes.com/top/news/business/companies/foxconn_technology/index.html?inline=nyt-org), the operator of the factory Mr. Cook visited last week.

### Related

###### [Electronic Giant Vowing Reforms in China Plants](http://www.nytimes.com/2012/03/30/business/apple-supplier-in-china-pledges-changes-in-working-conditions.html?ref=technology) (March 30, 2012)

In response, Foxconn vowed to reduce working hours and significantly increase wages at its factories.

Mr. Cook’s appearance at a facility where Apple devices are made was an illustration of how differently Apple’s new chief relates to an issue that first surfaced under his predecessor, Steven P. Jobs.

Since Mr. Cook became chief executive in August, shortly before the death of Mr. Jobs, Apple has taken a number of significant steps to address concerns about how Apple products are made.

When he became chief, many people wondered whether Mr. Cook, a skilled manager of Apple’s operations, could ever rival the visionary influence of Mr. Jobs on Apple products. Instead, it appears Mr. Cook could make his earliest and most significant mark by changing how Apple’s products are made.

“I want to give credit to Tim Cook for this,” said Dara O’Rourke, associate professor of environmental and labor policy at the University of California, Berkeley. “He’s admitting they’ve got problems.”

Apple’s supply chain is a subject much closer to Mr. Cook than it was to his predecessor. Not long after Mr. Jobs returned to lead Apple in 1997, he hired Mr. Cook to clean up the manufacturing operations, which were in disarray, with bloated inventory that hurt its profits. Over more than a decade, Mr. Cook helped transform Apple’s operations into the envy of the electronics industry, with an array of partners, mostly in Asia, able to efficiently pump out its latest products.

In contrast to Mr. Cook, Mr. Jobs never visited the factories in [China](http://topics.nytimes.com/top/news/international/countriesandterritories/china/index.html?inline=nyt-geo) where Apple’s products were made, according to two people with knowledge of the matter who declined to be identified to avoid antagonizing Apple.

During the years when he was chief executive, Mr. Jobs was never as directly engaged with Apple’s effort to audit its suppliers as Mr. Cook was, according to a former Apple executive who declined to be identified. Still, when Mr. Jobs learned of the more serious violations of its supplier code of conduct — instances where [child labor](http://topics.nytimes.com/top/reference/timestopics/subjects/c/child_labor/index.html?inline=nyt-classifier) was used, for example — he was outraged, this person said.

Mr. Cook has spoken publicly of how his blue-collar roots growing up in Alabama gave him an early appreciation for factory work. “I spent a lot of time in factories personally, and not just as an executive,” Mr. Cook told investors at a conference in San Francisco in February. “I worked in a paper mill in Alabama and an aluminum plant in Virginia.”

Some labor rights advocates, though, said they were not yet convinced that last week’s report about conditions in Foxconn factories would lead to meaningful improvements for workers, saying that earlier promises of progress by Apple and its partners had not been fulfilled.

“It looks like a pattern I’ve observed before,” said Jeff Ballinger, a global labor activist and researcher. “It’s a report to get you over and hopefully things will die down. It’s not very convincing.”

Since 2007, Apple has published annual reports with the results of audits of factories where its products are produced. But in the last several months under Mr. Cook’s watch, the company has taken a bolder set of steps to prod its suppliers into making workplace improvements.

In January, when Apple published its 2012 annual report on conditions within its suppliers’ factories, the company also released the names of 156 companies that supplied it with parts and other services involved in the manufacturing of Apple products, something it had previously declined to do.

To help end excessive overtime work, it began publishing monthly reports on compliance with Apple’s policy of a 60-hour workweek at its supplier factories. For the month of February, Apple said that compliance figure rose to 89 percent from 84 percent in January.

This year, Apple also became the first technology company to join the Fair Labor Association, and it invited the nonprofit global monitoring group to conduct inspections of its suppliers’ factories in China and elsewhere.

Last week, the group published the results of its first inspections of Apple’s supply chain, citing numerous violations of Chinese labor laws and regulations at Foxconn factories, including instances where workers exceeded the 60-hour workweek that is the association’s standard.

Foxconn, which is based in [Taiwan](http://topics.nytimes.com/top/news/international/countriesandterritories/taiwan/index.html?inline=nyt-geo), promised that by July 2013 its employees would no longer exceed the 49-hour workweek limit set by Chinese law. Workers will not see a pay decline because of corresponding wage increases, Foxconn pledged.

In a statement, Apple said, “Our team has been working for years to educate workers, improve conditions and make Apple’s supply chain a model for the industry, which is why we asked the F.L.A. to conduct these audits.”

Apple has said it had made many improvements to factory conditions over the years. In 2008, for example, company inspectors discovered a situation in which a supplier had forced foreign workers to give up their passports to factory managers, effectively limiting their ability to leave their jobs. Apple demanded that the supplier, unnamed in Apple’s annual report mentioning the incident, return the passports to the workers.

Other problems have been harder for Apple to eradicate. Even Mr. Cook conceded in his speech at the investor conference in February that Apple had consistently found that suppliers had violated the company’s overtime policies.

Daniel Diermeier, a professor at Northwestern University who studies reputation management, says he believes the more aggressive stance by Apple toward factory conditions is the result of greater scrutiny of the company by media and advocacy groups, at a time when there is also intense interest in Apple’s soaring share price and cash reserves. But he also believes Mr. Cook’s leadership has played a role in the changes.

“I think he probably has a deeper understanding, and this is more personal for him than it might be for other executives,” Mr. Diermeier said.

Some worker advocates say they are hopeful the changes that have occurred under Mr. Cook will lead to lasting improvements in the manufacturing of electronics products.

“They have an opportunity to become the new face of sustainable production in the electronics sector,” said Meg Roggensack, senior adviser, business and human rights at Human Rights First, a nongovernmental organization. “They’re smart enough. They’re well capitalized enough.”

# NYT

# Two Sides to Labor in China

###### By [KEITH BRADSHER](http://topics.nytimes.com/top/reference/timestopics/people/b/keith_bradsher/index.html?inline=nyt-per)

###### Published: March 30, 2012

HONG KONG — The shorter workweeks and higher pay that Apple’s biggest contract manufacturer, [Foxconn](http://topics.nytimes.com/top/news/business/companies/foxconn_technology/index.html?inline=nyt-org), has promised would mean fundamental changes to factory work in China — assuming enough workers can be found in the first place.

[](javascript:pop_me_up2('http://www.nytimes.com/imagepages/2012/03/31/business/Yuanjp1.html','Yuanjp1_html','width=720,height=592,scrollbars=yes,toolbars=no,resizable=yes'))

Searching the job listings at an agency in Guangzhou, China.

[](javascript:pop_me_up2('http://www.nytimes.com/imagepages/2012/03/31/business/Yuan2.html','Yuan2_html','width=720,height=605,scrollbars=yes,toolbars=no,resizable=yes'))

Gao Qing, 21, waits to interview for a job at the Liteon electronics plant in Guangzhou. She says she wants more than just a minimum-wage job.

No worker is likely to oppose higher hourly pay, of course. But one reason that workweeks of 60 hours or more have been possible at factories run by Foxconn and others is that at least some laborers already on the payroll have wanted the extra hours.

Perhaps just as important: there is a growing shortage of blue-collar workers willing to work in China’s factories. This shortage is a big factor in the long shifts and workweeks manufacturers have used to meet production quotas. It has already been forcing wages higher in China’s industrial heartland.

That does not mean the work is not also grueling and sometimes even dangerous, as the Fair Labor Association said in a [report](http://www.fairlabor.org/report/foxconn-investigation-report) on Foxconn it [released on Thursday](http://www.nytimes.com/2012/03/30/business/apple-supplier-in-china-pledges-changes-in-working-conditions.html). But it could mean that even if Foxconn intends to carry out its promises, the Chinese labor market may not be able to respond quickly.

“This is an evolutionary process,” said Ricardo Ernst, professor of global logistics at the McDonough School of Business at Georgetown University. “The United States has a particular working environment in terms of shape and conditions, and you shouldn’t necessarily expect tomorrow morning to see the same working environment in Asia.”

Labor shortages are already so acute in many Chinese industrial zones that factories struggle to find enough people to operate their assembly lines. Factories often pay fees to agents who try to recruit workers arriving on long-haul buses and trains from distant provinces.

At midday this month in Guangzhou, the capital of the industrial Guandong province, about 100 workers stood outside the gray gates of the factory complex of one of Foxconn’s many rivals in consumer electronics, Liteon.

Behind them stood a couple of dozen agents hoping for fees from the factories for finding employees deemed acceptable. The agents’ fees can equal as much as a week’s wages for a worker, and they come out of the factory’s costs, not the workers’ pay. The workers themselves often receive signing bonuses as well, although these may only be a day’s pay.

So the added expense of hiring additional workers can make it cheaper to ask employees for extra overtime, even when the factories honor regulations requiring that workers be paid double time for overtime and triple wages for each hour worked on holidays.

But many workers also want long hours. The Fair Labor Association’s survey of Foxconn workers found that 48 percent said their hours were reasonable and another 34 percent said they actually wanted even more hours. Only 18 percent said their hours were too long.

In interviews with The New York Times over the last several years, workers at other factories in southeastern China have frequently said that they wanted long hours because they were young, had little to do during free time in their factory dormitories and were eager to make as much money as quickly as possible so as to return to their home villages.

When China imposed its current laws limiting overtime four years ago, the regulations set off considerable complaints from workers and companies alike. There is a limit of three hours a day of overtime and six days of work a week.

“The law is very restrictive about what it allows,” a foreign businessman in southeastern China said Friday. He insisted on anonymity lest his comments be construed as criticism of the government or of labor advocates. Labor laws in the United States are actually less restrictive, in some ways, in allowing workers to put in even longer hours than in China. Generally speaking, as long as American workers receive time and a half pay for anything over 40 hours a week, there are no limits on total hours.

China officially bans workers and factories from arranging longer hours even by mutual consent, for fear that employers will put inappropriate pressure on workers to put in extremely long hours.

The current Chinese law, which took effect in 2008, requires overtime pay for workers who put in more than eight hours in a day or more than 40 hours in a week.

The Fair Labor Association accused Foxconn and Apple of consistently violating the legal limits on hours. The companies now say they will ensure full compliance with regulatory maximums by the middle of next year. Geoffrey Crothall, a spokesman for China Labor Bulletin, a nonprofit group in Hong Kong seeking collective bargaining and other labor protections for workers in mainland China, said there was considerable variation among workers in China in the number of hours they wanted to work.

“If you talk to workers, you quickly understand some want to work a minimum number of hours and just get by, and others want to work a lot more and earn more,” he said on Friday night. “The point is, Foxconn doesn’t give them a voice in the matter.”

Apple and Foxconn said that they would protect workers’ wages while eliminating excessive overtime. With wages rising close to 15 percent a year in southeastern China, Foxconn may be able to do this without increasing pay at a much faster tempo than previously planned.

The minimum wage in Shenzhen, where Foxconn has the bulk of its 1.2 million employees, has gone from 635 renminbi a month in 2005 to 1,500 renminbi now.

The rise in wages has been even faster in dollar terms, because [the renminbi](http://topics.nytimes.com/top/reference/timestopics/subjects/c/currency/yuan/index.html?inline=nyt-classifier)’s value has been climbing gradually in currency markets. The minimum wage in 2005 was worth about $80 a month at the exchange rate then. Today’s minimum wage is worth about $240 a month.

Higher [food prices](http://topics.nytimes.com/top/reference/timestopics/subjects/f/food_prices/index.html?inline=nyt-classifier) have offset a small part of the increase, but rents have soared. That makes it costlier for workers to rent apartments, which can cost the equivalent of $30 a month for each bedroom, instead of living in dormitories. But more workers are moving out of dormitories and into apartments anyway as their wages rise.

Workers’ expectations have climbed even faster, though, as the Internet has made it easier for them to see images of how more affluent families live elsewhere in China and in other parts of the world.

Workers at Foxconn often earn nearly twice as much as the minimum wage. The company has raised wages to keep them above the legal minimums, but the higher pay at Foxconn also reflects heavy overtime, the Fair Labor Association report found.

Gao Qing, a 21-year-old from Zhengzhou in north-central China with a high school diploma but no further education, stood outside the Liteon gate waiting to be hired this month. She said that finding a minimum wage job was no problem — but she wished she could find something better.

“It’s hard to find a good job,” she said. “It’s easy to find just any job.”

## Working conditions in factories

### When the jobs inspector calls

# Do campaigns for “ethical supply chains” help workers?

Mar 31st 2012 | NEW YORK | from the print edition

“DEATH to Apple executives,” a protester shouted after a recent performance of “The Agony and Ecstasy of Steve Jobs”, a popular off-Broadway play. Apple executives must have been delighted when Mike Daisey, the playwright and star, recently retracted his nastiest allegations about the mistreatment of workers making Apple’s products in China. Apparently, he did not meet a worker poisoned by exposure to chemicals, or child workers at the factory gate. With its share price soaring as the latest iPad storms the market, Apple might be tempted to forget about the fuss over its labour practices. But that would be a mistake.

Any big company that makes things in poor countries faces scrutiny of its supply chain. Campaigners against harsh working conditions (and unions back home that hate competition from low-wage countries) will pounce on any hint of scandal. Horrified headlines can tarnish a brand. Companies need to pay heed.

Wages for factory workers in China have been soaring at double-digit rates for years, for reasons that have little if anything to do with Western activists and a lot to do with productivity improvements. But some workers are abused, as even Apple admits. In February it invited the Fair Labour Association (FLA), a prominent non-governmental organisation (NGO), to look at the factories it uses in China, including those of Foxconn, which assembles iPhones and iPads for Apple and is owned by Hon Hai, a Taiwanese firm (see [article](http://www.economist.com/node/21551499)). The FLA report, expected soon, is unlikely to give Apple a clean bill of health. Auret van Heerden, the organisation’s boss, gripes that although conditions in the factories are better than he expected, there are “tons of issues”.

In the past 20 years what has become known as the “ethical supply chain” movement has targeted brands such as Nike, Gap and Coca-Cola. But its army of activists, some in business themselves, are grappling with growing evidence that appointing an outside body to audit and set standards, as Apple has done, is not going as well as it should. Apple could turn into a test case of how to improve things.

**Not a bad Apple**

Tim Cook, Apple’s boss, this week visited a new Foxconn factory in central China which employs 120,000 people. He has insisted that Apple is doing a lot to improve working conditions. But he also echoes the concerns of critics. “We think the use of underage labour is abhorrent. It’s extremely rare in our supply chain, but our top priority is to eliminate it totally,” he declared.

After a bad press in the early 1990s, Nike is now one of the loudest advocates of improving working conditions. In 1992 it established a code of conduct for suppliers. (Apple did not get around to that until 2005.) In 1996 Nike helped create the Apparel Industry Partnership, which drew up a code of conduct for factories, and in 1999 evolved into the FLA.

Having a code of conduct and being part of an industry initiative on workers’ rights has become standard practice for multinationals. But there are big differences in the toughness of codes, how rigorously compliance is monitored and how remedial action is taken.

Factory audits also vary. Nike first published the overall results of its monitoring in 2000, but did not list details of all the factories in its supply chain until 2006. (Apple did not publish details of its supply chain until this year.)

When Nike opened up it was a conscious effort to challenge industry norms. Clothing and shoe firms took it for granted that revealing which factories they used would put them at a competitive disadvantage. But Nike reckoned the downside was negligible and the lack of transparency hindered the monitoring process, says Hannah Jones, the firm’s head of corporate social responsibility. Secrecy led to some factories that worked for a variety of companies undergoing multiple audits. Other factories escaped entirely.

Another challenge is preventing corruption, says Alan Hassenfeld, a former boss of Hasbro who is now the driving force behind the International Council of Toy Industries’ code, called ICTI Care. Factory managers sometimes bribe auditors. Some firms use fake books showing shorter hours and higher pay. Some workers collaborate in these violations more willingly than is assumed. Many migrants, for example, want to work long hours to save as much money as possible in a short time—and then go home.

NGOs can be both a help and a hindrance, reckons Mr Hassenfeld. Some only campaign. Others work with firms to help put things right. Some do both. Campaigning NGOs can put pressure on a firm to do better, but they rarely support it when expelling a factory from its supply chain, which also hurts workers, says Mr Hassenfeld. “One of the things we need to do is be tougher with repeat offenders, to make an example of them,” he adds.

“Governments are not pulling their weight,” complains Aron Cramer of BSR, an NGO. He thinks there has been “too much outsourcing of enforcement to the private sector”. Individual firms may find enforcement difficult. Governments may do better, but few governments of emerging markets like to be bossed around.

“Nobody thinks this process is perfect, but we have made progress,” says Mr Hassenfeld. Mr Cramer agrees. At least for firms at the top of the supply chain, “the old problems of forced labour and child labour are largely gone,” he says. The worst abuses tend to be further down the supply chain, and in particular sectors, such as agriculture and mining. Nonetheless, there remains much to do even among first-tier suppliers on things like excessive hours and inadequate pay, says Mr Cramer.

Richard Locke of the Massachusetts Institute of Technology has taken a detailed look at how things really work. He persuaded four global firms regarded as leaders in ethical supply chains (Nike, Coca-Cola, HP and PVH, a big American producer of clothing) to let him analyse six years of data from their factory audits, starting in 2005. His research, to be published this year in a book, “Promoting Labour Rights in a Global Economy”, drew four conclusions.

First, codes of conduct, compliance programmes and audits “[do] not deliver sustained improvements in labour conditions over time,” he says. Rather, these things help gather information that highlights the problem without remedying it. At HP, for example, only seven of the 276 factories in its supply chain fully complied with its code of conduct at the last audit. At the factories he visited, Mr Locke typically found that many suppliers serving global brands drift in and out of compliance.

**Down the chain**

Second, investing time and money in helping factories improve their managerial and technical capabilities did produce some benefit in improved working conditions. But his third conclusion found that for significant and sustained improvement to take place, the relationship between a company and its suppliers needed to change too. The relationship had to become more collaborative. In particular, gains from changes in the production process needed to be shared.

Mr Locke’s fourth conclusion poses the toughest challenge. For firms trying to improve working conditions the fault may well be in their own business model. Just-in-time manufacturing has made supply chains leaner. Slimmer inventory cuts costs and allows firms to move more quickly. As products’ life-cycles shorten, this is a crucial competitive edge. But a last-minute design change or the launch of a new product can mean suppliers having to pull out all the stops to keep up—or face a stiff financial penalty.

Timberland, a bootmaker and vocal supporter of ethical working practices, admitted as much in 2007 in a company report, noting that “some of our procedures were making it difficult for factories to control working hours”, including developing a huge number of new styles and the simultaneous launch of many new products. Nike has since said much the same.

As part of his research, Mr Locke visited an inkjet-printer factory in Malaysia which, at its historic peak in 2007, produced 1m products a month for HP. The factory, which made six to eight models a year with an average lifespan of less than nine months, experienced extreme demand volatility—with the result that it sometimes had to increase monthly output by 250%, then cut it again. This forces suppliers to ask their workers to put in vast amounts of overtime. Apple’s product launches presumably produce similar surges.

Nike’s Ms Jones says her company has taken this to heart by trying to incorporate the need to protect workers into the design of its production process. She is now jointly accountable for enforcing the code of conduct with the head of the supply chain, a change which she says has removed an “us-versus-them problem”. Members of Nike’s 140-strong corporate social responsibility team are now involved in all branches of the supply chain. The firm is thinking harder about how it schedules product launches. And it espouses a philosophy of continuous improvement by delegating more responsibility to workers. This will only work if they are treated well, says Ms Jones.

Apple’s sales continue to boom despite all the stories about the working conditions of the people who make iPads and iPhones. So how seriously should firms take these issues? Nike claims its approach means that good labour and environmental practices boost profits—even without taking into account any reputational benefits they may deliver. Productivity is rising and the turnover of workers is down, which saves money recruiting and training replacements. With hindsight, the criticism seems to have been good for Nike. Could the same be true for Apple?

NYT

# Work Conditions Said to Improve at Apple Supplier

###### By REUTERS

###### Published: August 22, 2012

Apple and its main supplier, Foxconn, have improved working conditions at Chinese factories that make most of the world’s iPads and iPhones, according to auditors the companies enlisted to monitor the process, but tough tasks still lie ahead.

The Fair Labor Association said local laws would require the companies — which came under fire because of conditions at the plants blamed for a series of suicides in 2010 — to reduce hours by almost a third by 2013 for the hundreds of thousands working in Foxconn plants across southern China.

Foxconn said Wednesday it would continue to cut overtime, aiming for fewer than nine hours a week instead of the current 20, even though that could raise labor costs while making it difficult to attract workers.

“It is a challenge. When we reduce overtime it means we need to hire more people and implement more automation, more investment on robotic engineering. More workers also mean more dormitories and recreational facilities; it takes time,” said Louis Woo, special assistant to the chief executive of Foxconn.

“But I expect more loyalty from workers as a result, and then we can save more costs on recruitment and retainment,” he said. “Yield rates will also improve. Efficiency in terms of productivity, yield gain, retention and lower turnover rates should be able to improve next year.”

At Foxconn’s huge factory in Shenzhen’s Longhua district, six workers interviewed by Reuters said overtime hours had been cut to 48 to 60 hours a month, from some 80 before. In March, the Fair Labor Association — of which Apple is a member — found multiple violations of labor law, including extremely long hours, after starting one of the largest investigations ever conducted of an American company’s operations outside the United States.

Apple, the world’s most valuable company, and Foxconn — the trading name of Taiwan’s Hon Hai Precision Industry, whose clients also include Dell, Sony and Hewlett-Packard — agreed to slash overtime, improve safety, hire new workers and upgrade dormitories.

Mr. Woo said Foxconn not only wanted to do “the right thing” for its one million employees, but also wanted to serve as a model for other companies.

In a report tracking the progress of those commitments, the Fair Labor Association said it had verified that agreed-upon changes had been instituted and that Apple was trying to hold its partner, the world’s largest contract manufacturer, accountable.

Auret van Heerden, president and chief executive of the Fair Labor Association, said Foxconn faces a challenge from workers’ expectations.

“A lot of workers have clearly come to Shenzhen to make as much money as they can in as short a period as they can, and overtime hours are very important in that calculation,” he said. Mr. Woo said Foxconn had been constantly telling workers about the importance of the quality of life and health.

“This is the thing we need to continue to communicate with workers, especially young migrant workers, that anyone who works more than a certain number of hours will feel tired and not well,” he said. “If we can improve the work environment and benefits, they can enjoy their life better.”

# Vox

# <http://voxeu.org/article/how-iphone-widens-us-trade-deficit-china>

# How the iPhone widens the US trade deficit with China

**Yuqing Xing,** 10 April 2011

What can the iPhone tell us about the trade imbalance between China and the US? This column argues that current trade statistics greatly inflate the value of China’s iPhone exports to the US, since China's value added accounts for only a very small portion of the Apple product's price. Given this, the renminbi’s appreciation would have little impact on the global demand for products assembled in China.

At the centre of global imbalances is the bilateral trade imbalance between China and the US. Most attention to date has been focused on macro factors and China’s exchange-rate regime. Little attention, however, has been paid to the structural factors of economies and global production networks that have reversed conventional trade patterns, transformed the implications of trade statistics and weakened the effectiveness of exchange rates on trade balances.

Today’s trade is not that experienced by the British economist David Ricardo two hundred years ago ([Grossman and Rossi-Hansberg 2008](http://ideas.repec.org/a/aea/aecrev/v98y2008i5p1978-97.html" \t "_blank)). It is almost impossible to define clearly where a manufactured product is made in the global market. This is why on the back of an iPhone one can read “Designed by Apple in California, Assembled in China”. In this column, I use the smartphone in your pocket to argue that current trade statistics have distorted the reality of the Sino-US trade imbalance and the appreciation of the renminbi would have little impact on the imbalance.

# How iPhones are produced

The iPhone is designed and marketed by Apple. Apart from its software and product design, the production of iPhones primarily takes place outside of the US. Manufacturing iPhones involves nine companies, which are located in China, South Korea, Japan, Germany and the US (Table 1). All iPhone components produced by these companies are shipped to Foxconn, a Taiwanese company located in China, for assembly into final products and then exported to the US and the rest of the world.

By any definition, the iPhone belongs to high-tech products, where the US has an indisputable comparative advantage and China does not domestically produce any products that could compete with it. However, the iPhone trade pattern is not what is predicted by either the Ricardian comparative advantage theory or the Heckscher-Ohlin theory. The manufacturing process of the iPhone illustrates how the global production network functions, why a developing country such as China can export high-tech goods, and why the US, the country that invented the iPhone, becomes an importer.

**Table 1**. Apple iPhone 3G’s major components and cost drivers

|  |  |  |
| --- | --- | --- |
| **Manufacturer** | **Component** | **Cost** |
| Toshiba (Japan) | Flash Memory | $24 |
| Display Module | $19.25 |
| Touch Screen | $16.00 |
| Samsung (Korea) | Application Processor | $14.46 |
| SDRAM-Mobile DDR | $8.50 |
| Infineon (Germany) | Baseband | $13.00 |
| Camera Module | $9.55 |
| RF Transceiver | $2.80 |
| GPS Receiver | $2.25 |
| Power IC RF Function | $1.25 |
| Broadcom (USA) | Bluetooth/FM/WLAN | $5.95 |
| Numonyx (USA) | Memory MCP | $3.65 |
| Murata (Japan) | FEM | $1.35 |
| Dialog Semiconductor (Germany) | Power IC Application Processor Function | $1.30 |
| Cirrus Logic (USA) | Audio Codec | $1.15 |
| **Rest of Bill of Materials** | | **$48.00** |
| **Total Bill of Materials** | | **$172.46** |
| **Manufacturing costs** | | **$6.50** |
| **Grand Total** | | **$178.96** |

Source: Rassweiler (2009)

# iPhones and the Sino-US trade imbalance

The shipment of the ready-to-use iPhones from China to the US is recorded as China’s exports to the US. Using the total manufacturing cost $178.96 as the price of the iPhone, China’s iPhone exports to the US amounted $2.0 billion in 2009. Assuming that the parts supplied by Broadcom, Numonyx and Cirrus Logic, valued at $121.5 million, were imported from the US the iPhone alone contributed $1.9 billion trade deficit to the US, about 0.8% of the US trade deficit with China (Table 2).

On the other hand, most of the export value and the deficit due to the iPhone are attributed to imported parts and components from the third countries and have nothing to do with China. Chinese workers simply put all these parts and components together and contributed only $6.50 to each iPhone, about 3.6% of the total manufacturing cost (e.g. the shipping price). The traditional way of measuring trade credits all $178.98 to China when an iPhone is shipped to the US, thus exaggerating the export volume as well as the imbalance. Decomposing the value added along the value chain of the iPhone manufacturing suggest that, of the $2.0 billion iPhone export from China, 96.4% is actually the transfer from Germany ($326 million), Japan ($670 million), Korea($259 million), the US ($108 million) and others ($ 542 million). All of these countries are involved in the iPhone production chain.

If China’s iPhone exports were calculated based on the value added, i.e., the assembling cost, the export value as well as the trade deficit in the iPhone would be much smaller, at only $73 million, just 3.6% of the $2.0 billion calculated with the prevailing method (Table 2). The sharp contrast of the two different measurements indicates that conventional trade statistics are inconsistent with trade where global production networks and production fragmentation determine cross-country flows of parts, components, and final products. The traditional method of recording trade has failed to reflect the actual value chain distribution and painted a distorted picture about the bilateral trade relations. The Sino-US bilateral trade imbalance has been greatly inflated.

**Table 2**. iPhone trade and the US trade deficit with China

|  |  |  |  |
| --- | --- | --- | --- |
| Year | 2007 | 2008 | 2009 |
| iPhone Sales in the US\* (million Units) | 3.0 | 5.3 | 11.3 |
| Shipping Price/unit\*\*  (the US dollar) | 229 | 174 | 179 |
| China’s Export to the US in iPhone (million US dollar) | 687 | 922.2 | 2,022.7 |
| China’s Trade Surplus with the US in iPhones | N/A | N/A | 1,901.2[[1]](http://voxeu.org/article/how-iphone-widens-us-trade-deficit-china" \l "_ftn1" \o ") |
| China’s iPhone exports to the US based on value added ( million US dollar) | 19.5 | 34.35 | 73.45 |
| Value added / total exports | 2.8% | 3.7% | 3.6% |
| China’s trade surplus with the US in iPhones based on value added | N/A | N/A | 73.45[[2]](http://voxeu.org/article/how-iphone-widens-us-trade-deficit-china" \l "_ftn2" \o ") |

Sources: \* Hughes (2010); \*\* Rassweiler (2009)

[[1]](http://voxeu.org/article/how-iphone-widens-us-trade-deficit-china" \l "_ftnref1" \o ") When calculating trade deficits between PRC and the US in iPhones, we assume that all parts supplied by Broadcom and Numunyx were imported from the US.

[[2]](http://voxeu.org/article/how-iphone-widens-us-trade-deficit-china" \l "_ftnref2" \o ") The parts provided by Broadcom and Numunyx are shipped back to the US within the ready-to-use iPhones. They are “round tripping” exports, which should not be considered as actual exports in the value-added approach.

# iPhone trade and the appreciation of the renminbi

Many believe that appreciation of the renminbi would be an effective means to solve the Sino-US trade imbalance. Appreciation proponents ignore the fact that the appreciation can only affect a small portion of the cost of made/assembled-in-China products. If the renminbi appreciated against the US dollar  by 20%, the iPhone's assembly cost would rise to $7.80 per unit, from $6.50, and add merely $1.30 to the total manufacturing costs. This would be equivalent to a 0.73% increase in total manufacturing costs. It is doubtful that Apple would pass this $1.30 to American consumers. Even a 50% appreciation would not bring a significant change in the total manufacturing cost, as the appreciation would only affect the assembling cost. Therefore, the expected pass-though effect of the renminbi’s appreciation on the price of the iPhone would be zero and the American consumers’ demand on the iPhone would not be affected. The appreciation of the renminbi would have little impact on the Sino-US trade imbalance.

# Could the iPhone be assembled in the US?

There is no doubt that US workers and firms are capable of assembling iPhones. If all iPhones were assembled in the US, the $1.9 billion trade deficit would not exist. There are two possible reasons for Apple to use China as an exclusive assembly centre for iPhones. One is competition, the other is profit maximisation.

The gross profit margin of the iPhone was 62% when the phone was launched in 2007, then rose to 64% in 2009 due to reductions in manufacturing costs (table 3). If the market were perfectly competitive, the expected profit margin would be much lower and close to its marginal cost. The surging sales and high profit margin suggest that the intensity of competition is fairly low and Apple maintains a relative monopoly position. Therefore, it is not the competition but profit maximisation that drives the iPhone’ s assembly to China.

**Table 3**. Profit margin of the iPhone

|  |  |  |  |
| --- | --- | --- | --- |
|  | 2007 | 2008 | 2009 |
| Unit Price to carriers | $600 | $500 | $500 |
| Unit manufacturing costs\* | $229 | $174.33 | $178.96 |
| Profit margin | $371 | $325.67 | $321.4 |
| Profit Margin (%) | 62 | 65 | 64 |

Sources: iSupply, and the authors’ calculations.

An interesting hypothetical scenario is one where Apple had all iPhones assembled in the US. Assuming that the wage of American workers is ten times as high as those of their Chinese counterparts, the total assembly cost would rise to $68 and total manufacturing cost would be pushed to approximately $240. Selling iPhones assembled by American workers at $500 per unit would still leave a 50% profit margin for Apple. In this hypothetical scenario, the iPhone could contribute to US exports and reduce the US trade deficit, not only with China, but also with the rest of world. More importantly, Apple would create jobs for US low-skilled workers.

In a market economy, there is nothing wrong with a firm pursuing profit maximisation. Governments should not restrict such behaviour in any way. However, corporate social responsibility has been adopted as a part of corporate values by many multinational companies, including Apple. Employing American workers to assemble iPhones may be an effective way to practice corporate social responsibility.

# Concluding remarks

Due to the limitations of the data, it is not possible to outline a more detailed distribution of the iPhone’s manufacturing value chain across all countries involved. However, adding additional countries and parts into the analysis would not change the bottom line – the value added created by Chinese workers accounts for only a small portion of a ready-to-use iPhone, so current trade statistics greatly inflate the value of China’s iPhone export to the US as well as the corresponding trade imbalance. Given this, the renminbi’s appreciation would have little impact on the global demand of the products simply assembled in China.

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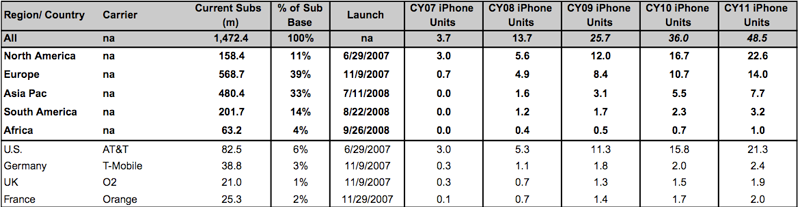
<http://appleinsider.com/articles/10/01/06/piper_15_8m_us_iphone_sales_in_2010_even_without_verizon.html>

Wednesday, January 06, 2010, 08:00 am

# Piper: 15.8M US iPhone sales in 2010, even without Verizon

By [Neil Hughes](mailto:neil@appleinsider.com)

Apple is projected to sell 36 million iPhones worldwide in 2010, but Piper Jaffray concedes that total is likely conservative for international sales, and doesn't include the possibility of expansion to other carriers in the U.S.  
  
If Apple does sell 36 million iPhones in 2010, it would be a 40 percent increase from 2009 estimates. In a note to investors Wednesday morning, Gene Munster, senior research analyst with Piper Jaffray, noted that 2010 will mark the first full year of sales with two new carriers in France, Canada and the U.K., and it will also include a full year of sales in China. Sales will be driven by a new iPhone model expected to arrive mid-year.  
  
"We estimated unit figures for the U.S., U.K., France and Germany, then divided the remaining units proportionally by sub count among the remaining carriers," Munster said of his estimates. "The results show that our international iPhone estimates may be a point of conservatism in our model.  
  
"For example, we are modeling for three Russian carriers to sell 1.8M units into a collective sub base of 160M in (calendar year) 2010 vs. AT&T which we estimate will sell 15.8M units to its sub base of 82.5M."  
  
Munster's U.S. estimates don't include projections for a possible Verizon expansion. Currently, AT&T is the exclusive carrier of the iPhone in the U.S. Munster has [previously predicted](http://www.appleinsider.com/articles/09/12/09/piper_apples_next_big_iphone_feature_is_verizon.html) that the Verizon network will be the "next big feature" for the iPhone.  
  
This week, another report speculated that Apple and Verizon [are at odds](http://www.appleinsider.com/articles/10/01/05/apple_verizon_disagree_on_iphone_pricing_report.html) over the pricing of a CDMA iPhone. Recent reports have suggested that a [Verizon-capable iPhone](http://www.appleinsider.com/articles/09/11/12/conflicting_reports_within_qualcomm_suggest_verizon_only_iphone.html) could arrive this year.  
  
"We continue to believe that it is highly likely that Verizon will launch the iPhone by the end of 2010," Munster said. "However, Verizon is not in our model and may be a source of significant upside for iPhone units in 2010 and beyond."  
  
By 2011, on AT&T alone, Munster has forecast 21.3 million iPhone sales in the U.S. He expects the platform to continue its rapid growth, with at least 48.5 million total unit sales next year, based on his "conservative" estimates.



**iSuppli**

<http://www.isuppli.com/Teardowns/News/Pages/iPhone-3G-S-Carries-178-96-BOM-and-Manufacturing-Cost-iSuppli-Teardown-Reveals.aspx>

iPhone 3G S Carries $178.96 BOM and Manufacturing Cost, iSuppli Teardown Reveals

June 24, 2009

[Andrew Rassweiler](http://www.isuppli.com/Teardowns-Manufacturing-and-Pricing/Analyst/Pages/Andrew-Rassweiler.aspx)

With the new iPhone 3G S’s Bill of Materials (BOM) and feature set nearly the same as the previous model in the iPhone line, you might think the product’s component selection would be virtually unchanged. However, a dissection conducted by iSuppli Corp.’s [Teardown Analysis](http://www.isuppli.com/Pages/L2_Teardowns-MobileHandsets.aspx?PID=1046&PR) team reveals some interesting changes in the parts and suppliers.

"The entry-level, 16Gbyte version of Apple Inc.’s new iPhone 3G S carries a BOM cost of $172.46 and a manufacturing expense of $6.50, for a total of $178.96," said Andrew Rassweiler, director and principal analyst, teardown services, for iSuppli. "This is slightly higher than iSuppli’s estimate of $174.33 for the [original 8Gbyte iPhone 3G](http://www.isuppli.com/ProductDetail.aspx?ID=28120&PR) based on pricing in July 2008. Although the retail price of the 16Gbyte iPhone 3G S is $199, the same as for the 8Gbyte version of the original iPhone 3G, the actual price of the phone paid by the service provider is considerably higher, reflecting the common wireless industry practice of subsidizing the upfront cost of a mobile phone and then making a profit on subscriptions."



The table and cost data presented in this article consist only of the iPhone 3G S’s BOM. The total does not include other costs, including manufacturing software development, shipping and distribution, packaging, royalty fees and miscellaneous accessories included with each phone.

This Year’s Model  
Beyond faster performance, the iPhone 3G S differentiates itself from the original 3G with the addition of video capture, an autofocus 3-Megapixel camera—compared to 2 Megapixels before—and a built-in digital compass. Besides these extras, the 3G S hardware feature set is not much different from that of the 3G.

"From a component and design perspective, there’s also a great deal of similarity between the 3G and the 3G S. By leveraging this commonality to optimize materials costs, and taking advantage of price erosion in the electronic component marketplace, Apple can provide a higher-performing product with more memory and features at only a slightly higher materials and manufacturing cost," Rassweiler said. "Nonetheless, there are a few key differences in component selection compared to the iPhone 3G introduced a year ago."

Broadcom and Dialog Dial in to iPhone  
One of the more noteworthy changes in hardware is the use of a Broadcom Corp. single-chip Bluetooth/FM/WLAN device, costing $5.95. This represents the ongoing industry trend of moving to higher levels of integration, by putting all of these functions into one chip. Previously, to implement these functions, the 3G employed two devices: a Marvell Technology Group Ltd. WLAN chip and a Cambridge Silicon Radio (CSR) Bluetooth Integrated Circuit (IC).

Making its debut in the iPhone line is Dialog Semiconductor with its power management IC serving the 3G S’s applications processor. At an estimated cost of $1.30, the Dialog chip replaces a corresponding NXP Semiconductors device in the 3G.

STMicroelectronics and AKM Find Way into 3G S  
To implement the digital compass feature, the iPhone 3G S adds AKM Semiconductor Inc.’s electronic compass and STMicroelectronics’ [accelerometer](http://www.isuppli.com/ProductDetail.aspx?ID=28531&L1ID=178&L2ID=1011&PR), both of which are 3-axis devices. The STMicroelectronics part allows the 3G S to determine device orientation or inclination, while the AKM sensor detects device movement relative to magnetic north, supporting the 3G S’s capability to reorient a map displayed on the screen to correspond with the direction the user is facing.

Infineon and TriQuint Hold Down the Fort  
Prior the 3G S introduction, speculation was rife that Qualcomm Inc. might displace Infineon Technologies AG as the supplier of the phone’s critical baseband chip. However, Infineon has held onto this critical spot with its PMB8878 baseband chip, which accounts for $13 of the 3G S component costs.  Similarly, TriQuint has kept its slot as the 3G power amplifier module supplier, supporting the tri-band HSPA functionality of the phone.

Major Cost Drivers  
Toshiba Corp. scored the biggest single design win in the 3G S, with its 16Gbyte Multilevel-Cell (MLC) [NAND flash](http://www.isuppli.com/Pages/L2_DataFlashMemory-NAND.aspx?PID=962&PR) costing $24. With the price of NAND flash having risen in recent months due to supply constraints, this represents a lucrative design win for Toshiba. However, while Toshiba was the supplier of the NAND in the specific 3G S torn down by iSuppli, the part is available from other sources that Apple is likely to use, most notably Samsung Electronics Co. Ltd.

Samsung also maintained its position as iPhone’s applications processor supplier. Priced at $14.46, the applications processor is the fourth most costly component in the iPhone 3G S after the NAND flash, the [display module](http://www.isuppli.com/ProductDetail.aspx?ID=28532&L1ID=168&L2ID=985&PR) and the touch-screen assembly.

The applications processor plays a key role in the 3G S’s faster performance. In the 3G, the processor used an ARM RISC microprocessor with 400MHz clock speed; the 3G S employs a 600MHz version.

##### [THE iECONOMY](http://www.nytimes.com/interactive/business/ieconomy.html)

###### Part 8: Writing the Software

# As Boom Lures App Creators, Tough Part Is Making a Living



Daniel Rosenbaum for The New York Times

Shawn and Stephanie Grimes’s efforts have cost $200,000 in lost income and savings, but their apps have earned less than $5,000 this year.

###### By [DAVID STREITFELD](http://topics.nytimes.com/top/reference/timestopics/people/s/david_streitfeld/index.html)

ROSEDALE, Md. — Shawn and Stephanie Grimes spent much of the last two years pursuing their dream of doing research and development for [Apple](http://topics.nytimes.com/top/news/business/companies/apple_computer_inc/index.html?inline=nyt-org), the world’s most successful corporation.

###### [Job Prospects for App Writers](http://www.nytimes.com/interactive/2012/11/18/business/App-Writing-A-Good-Job-Prospect-This-Decade.html?ref=business)

###### Application software developers rank 72nd out of 749 occupations tracked by the government in terms of job growth to 2020. Here is a range of those job projections, which were made in 2010, just as the apps era was beginning in earnest.

### Related

###### [What It Takes to Be an App Developer](http://www.nytimes.com/2012/11/18/business/what-it-takes-to-be-an-app-developer.html?ref=business) (November 18, 2012)

###### [Bits Blog: Apple and the Desire for Control](http://bits.blogs.nytimes.com/2012/11/19/apple-and-the-desire-for-control/?ref=business) (November 19, 2012)

[](javascript:pop_me_up2('http://www.nytimes.com/imagepages/2012/11/18/us/jp-apps-2.html','jp_apps_2_html','width=720,height=550,scrollbars=yes,toolbars=no,resizable=yes'))

Ethan Nicholas has made more than $1 million on an artillery game.

But they did not actually have jobs at Apple. It was freelance work that came with nothing in the way of a regular income, health insurance or retirement plan. Instead, the Grimeses tried to prepare by willingly, even eagerly, throwing overboard just about everything they could.

They sold one of their cars, gave some possessions to relatives and sold others in a yard sale, rented out their six-bedroom house and stayed with family for a while. They even cashed in Mr. Grimes’s 401(k).

“We didn’t lose any sleep over it,” said Mr. Grimes, 32. “I’ll retire when I die.”

The couple’s chosen field is so new it did not even exist a few years ago: writing software applications for mobile devices like the [iPhone](http://topics.nytimes.com/top/reference/timestopics/subjects/i/iphone/index.html?inline=nyt-classifier) or [iPad](http://topics.nytimes.com/top/reference/timestopics/subjects/i/ipad/index.html?inline=nyt-classifier). Even as unemployment remained stubbornly high and the economy struggled to emerge from the recession’s shadow, the ranks of computer software engineers, including app writers, increased nearly 8 percent in 2010 to more than a million, according to the latest available government data for that category. These software engineers now outnumber farmers and have almost caught up with lawyers.

Much as the Web set off the dot-com boom 15 years ago, apps have inspired a new class of entrepreneurs. These innovators have turned cellphones and tablets into tools for discovering, organizing and controlling the world, spawning a multibillion-dollar industry virtually overnight. The iPhone and iPad have about 700,000 apps, from Instagram to Angry Birds.

Yet with the American economy yielding few good opportunities in recent years, there is debate about how real, and lasting, the rise in app employment might be.

Despite the rumors of hordes of hip programmers starting million-dollar businesses from their kitchen tables, only a small minority of developers actually make a living by creating their own apps, according to surveys and experts. The Grimeses began their venture with high hopes, but their apps, most of them for toddlers, did not come quickly enough or sell fast enough.

And programming is not a skill that just anyone can learn. While people already employed in tech jobs have added app writing to their résumés, the profession offers few options to most unemployed, underemployed and discouraged workers.

One success story is Ethan Nicholas, who earned more than $1 million in 2009 after writing a game for the iPhone. But he says the app writing world has experienced tectonic shifts since then.

“Can someone drop everything and start writing apps? Sure,” said Mr. Nicholas, 34, who quit his job to write apps after iShoot, an artillery game, became a sensation. “Can they start writing good apps? Not often, no. I got lucky with iShoot, because back then a decent app could still be successful. But competition is fierce nowadays, and decent isn’t good enough.”

The boom in apps comes as economists are debating the changing nature of work, which technology is reshaping at an accelerating speed. The upheaval, in some ways echoing the mechanization of agriculture a century ago, began its latest turbulent phase with the migration of tech manufacturing to places like China. Now service and even white-collar jobs, like file clerks and data entry specialists or office support staff and mechanical drafters, are disappearing.

“Technology is always destroying jobs and always creating jobs, but in recent years the destruction has been happening faster than the creation,” said Erik Brynjolfsson, an economist and director of the M.I.T. Center for Digital Business.

Still, the digital transition is creating enormous wealth and opportunity. Four of the most valuable American companies — Apple, Google, Microsoft and I.B.M. — are rooted in technology. And it was Apple, more than any other company, that set off the app revolution with the iPhone and iPad. Since Apple unleashed the world’s freelance coders to build applications four years ago, it has paid them more than $6.5 billion in royalties.

Last year, federal statisticians changed the title and the exact composition of a jobs subcategory to reflect the new prominence of apps. And the tech industry has begun making claims about how apps are contributing to the broader economy.

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EchoBase’s Resonate app helps doctors manage patient records.

[](javascript:pop_me_up2('http://www.nytimes.com/imagepages/2012/11/18/us/jp-apps-4.html','jp_apps_4_html','width=559,height=630,scrollbars=yes,toolbars=no,resizable=yes'))

The Henry’s Smart Headlamp app is a learning game for preschoolers.

A study commissioned by the tech advocacy group TechNet [found that](http://www.technet.org/wp-content/uploads/2012/02/TechNet-App-Economy-Jobs-Study.pdf) the “app economy” — including Apple, Facebook, Google’s Android and other app platforms — was responsible, directly and indirectly, for 466,000 jobs. The study used a methodology that searched online help-wanted ads.

Using the same methodology, Apple [said this month](http://www.apple.com/about/job-creation/) that its app business had generated 291,250 jobs for the American economy, as varied as developers and U.P.S. drivers. That number rose 39 percent in less than a year. During that time, the number of United States developers paying the $99 annual fee to register with Apple rose 10 percent to 275,000. Some of these registered developers have other full-time jobs and write apps in their spare time.

Apple has become increasingly assertive in promoting the economic benefits of apps as its own wealth and prominence have grown and its employment and other business practices have come under scrutiny. The company issued a statement for this article saying it was “incredibly proud of the opportunities the App Store gives developers of all sizes,” but declined to answer questions.

At the company’s annual meeting this spring, the chief executive, Timothy D. Cook, noted that just a few years ago “mobile app” wasn’t even in people’s vocabulary. “Now there’s this enormous, entirely new job segment that didn’t exist before,” he said. “Apple has become a jobs platform.”

Michael Mandel, the economist who conducted the TechNet study, said it was problematic to slice the jobs data as Apple had done. “The guy who writes an Apple app one day will write an Android app the next day,” he said. “You can’t add up all the numbers from every study to get the total number of jobs.”

For many of the developers not working at traditional companies, moreover, “job” is a misnomer. Streaming Color Studios, a game developer, did a survey of game makers late last year. The 252 respondents, while not a scientifically valid sample and restricted to one segment of the app market, indicated what many people had suspected: the app world is an ecology weighted heavily toward a few winners.

A quarter of the respondents said they had made less than $200 in lifetime revenue from Apple. A quarter had made more than $30,000, and 4 percent had made over $1 million.

A few apps have made it extremely big, including Instagram, the photo-sharing app that [was bought](http://dealbook.nytimes.com/2012/04/09/facebook-buys-instagram-for-1-billion/) by Facebook in April for $1 billion. When app developers dream, they dream of triumphs like that.

Most developers, however, make their money when someone buys or upgrades their app from Apple’s online store, the only place consumers can buy an iPhone or iPad app.

Apple keeps 30 percent of each app sale. While its job creation report trumpets the $6.5 billion the company has paid out in royalties, it does not note that as much as half of that money goes to developers outside the United States. The pie, while growing rapidly, is smaller than it seems.

“My guess is that very few developers make a living off their own apps,” said Jeff Scott, who runs the Apple app review site [148Apps.com](http://148Apps.com" \t "_) and closely tracks developments in the field.

**The Struggling Entrepreneur**

Like many computer experts, Shawn Grimes started experimenting with apps almost as soon as Apple opened its doors for the iPhone. He wrote an Internet security program as well as a tool for studio photographers to manage portrait sessions. Those amateur apps pulled in more than $5,000 from Apple.

Late last year, Mr. Grimes was laid off as a computer security specialist by Legg Mason, the Baltimore financial firm. The dismissal shook his confidence. “I worked really hard,” he said. “I did my best. But ultimately my career was not in my hands.”

The layoff, a result of Legg Mason’s decision to eliminate the jobs of 300 tech support workers, had been in the works for more than a year, which gave Mr. Grimes and his wife, Stephanie, plenty of time to contemplate their future. They have strong family roots in the Baltimore area but would have moved for a position with a Silicon Valley giant.

Google, which receives two million applications a year, interviewed Mr. Grimes, but he did not make it past the preliminary stages.

With direct employment out of reach, he decided to work independently by writing apps. He had no illusion that he was likely to become rich. Mostly, he hoped to find satisfying work that paid enough to provide a middle-class living and some shelter from a shifting economy.

But with hundreds of new apps introduced every day in Apple’s store, the field is overcrowded — something the Grimeses learned quickly and painfully.

Ms. Grimes, 32, quit her job teaching kindergartners to join the couple’s new venture, [Campfire Apps](http://www.campfireapps.com/). They downsized to a two-bedroom apartment. “We either succeed and it’s awesome, or we fail and it was awesome while it lasted,” she said.

They worked steadily on apps that revolved around children. Henry’s Smart Headlamp was a learning game for preschoolers, a hunt for hidden objects that the Grimeses hoped iPhone-wielding parents would think was worth $2 for a moment of distraction. A free version called Henry’s Spooky Headlamp got 5,409 downloads during Halloween 2011.

The couple aimed for one new app a month, but progress was slow and sales were slower. In March, with the apps bringing in only about $20 a day, they cashed in Mr. Grimes’s 401(k), which yielded $30,000 after taxes and penalties. They had already spent the severance from his job at Legg Mason.

One thing they never scrimped on was technology, especially Apple technology. At one point they owned a 24-inch iMac, a Mac Mini, a 24-inch cinema display screen, two 13-inch MacBook Airs, a 15-inch MacBook Pro, two iPad 2s, two Apple TVs, two iPhone 4s and an iPhone 3GS. “We justify buying new models by saying we need them to test out the apps,” Mr. Grimes said.

Soon, though, it got to the point where Mr. Grimes needed to take on freelance work, which brought in crucial income but took time away from Campfire Apps. By the beginning of summer, troubled by several persistent health care issues, he surrendered to the need for a full-time job.

Mr. Grimes now works as an app developer for ELC Technologies, an Oregon company that allowed him to stay in Baltimore. Ms. Grimes is still working on Campfire Apps.

While Mr. Grimes was angry at Legg Mason for laying him off, Apple delivered little — but it also made no promises. “People used to expect companies to take care of them,” he said. “Now you’re in charge of your own destiny, for better or worse.”

The Grimeses’ quest cost them more than $200,000 in lost income and savings. So far this year, their eight apps have earned $4,964. When the newest iPhone came out at the end of September, the couple immediately bought two.

**Success Beyond Dreams**

Ethan Nicholas was a Sun Microsystems programmer, a games enthusiast and a father of two very young boys, and he needed some extra cash. So in late 2008 he wrote an artillery game that could be played on the iPhone, which was still relatively new. There were about 11 million in circulation — certainly a large number, but nothing like the 270 million that have now been sold.

Mr. Nicholas wrote iShoot in six weeks, in his spare time. It sold 17,000 copies at $2.99 each on a single day, Jan. 11, 2009. That was a Sunday. On Monday, he quit his job. By March, he had earned more than $1 million. “Sheer dumb luck and being in the right place at the right time,” he said.

Mr. Nicholas and a friend, Brent Miller, were inspired to form a company. “We were going to make another million or two,” said Mr. Miller, 38. But when none of their new games sold like iShoot, the pair moved in an entirely new direction. They founded [echoBase](http://www.echobasesoftware.com/), a start-up with 14 employees that is developing apps to allow doctors and nurses to view and update medical records across different computer systems. They brought in Mr. Miller’s father, Rod, a former I.B.M. sales manager, as chief executive.

EchoBase has raised about $4 million. Most of that has come from dozens of small investors, but Mr. Nicholas and the Millers have contributed about $1 million. “All of my savings and retirement account are gone,” Brent Miller said. His father took out a second mortgage. Revenue is now coming in, with 3,200 doctors signed up, but the company is a long way from making a profit. Rod Miller forecast that it would become self-sustaining in 2013.

Mr. Nicholas has cautioned his new colleagues about easy money. “The time for that has passed,” he said.

EchoBase markets its service to medical records software providers and hospitals, whose doctors download the app free. Apple makes no money here, but it gets a long-term benefit: start-ups that succeed will embed the iPad and the iPhone more thoroughly into society.

The company is, in a sense, another arm of Apple’s research and development program. “The applications are what sells the hardware,” Rod Miller said. “Without us, and thousands of others like us, Apple has limited appeal.”

On one level, it was a strange move for Apple to open its devices to people like Mr. Grimes, Mr. Nicholas and the Millers. Imagine a violinist’s horror at letting a toddler play with his Stradivarius and you would have some idea of Apple’s reluctance to let anyone outside of its walls fool with any of its technology. This is a company that sealed batteries into its devices so people could not replace them.

Apple’s brilliant but mercurial chief executive, Steven P. Jobs, agreed to unlock the gates of the fledgling iPhone only after much internal argument, and he made sure that Apple would retain strict oversight of every app. In retrospect, it might have been the smartest decision ever made by a company that prides itself on creating the future.

The App Store opened in July 2008 with 500 apps. [In an interview](http://www.nytimes.com/2008/07/10/technology/personaltech/10apps.html), Mr. Jobs laid bare the company’s goal: “Sell more iPhones.”

And so, thanks in large part to the multitude of apps, it came to pass. More iPhones — nearly seven million — were sold in the next three months than in the entire previous year, and that was just the beginning of the ascent.

“Apps changed the iPhone from a simple phone into a mobile computer,” said Mr. Scott of [148Apps.com](http://148Apps.com" \t "_).

Apple’s financial documents show just how crucial app inventors are. If the developers stop developing, the company warned again last month, “customers may choose not to buy the company’s products.”

So far, there has not been much risk of revolt. Developers have expressed flickers of grumpiness at Apple’s 30 percent cut of each app sale. A shadowy group calling itself the [App Developer Union](http://venturebeat.com/2012/06/07/ios-developers-union/) briefly posted a petition online this summer asking for “something more equitable.” Apple declined to comment about the union, which disappeared from the Web as mysteriously as it had arrived.

Mr. Nicholas has the same philosophy about Apple now as he did when he wrote iShoot. “I’d rather get 70 percent of a large pie than all of a small pie,” he said.

###### The iEconomy

# Signs of Changes Taking Hold in Electronics Factories in China

# <http://www.nytimes.com/2012/12/27/business/signs-of-changes-taking-hold-in-electronics-factories-in-china.html?hp&_r=0>



**The iEconomy: Factory Upgrade:** Change comes to factories in China.

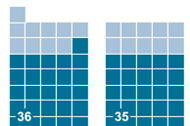
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CHENGDU, China — One day last summer, Pu Xiaolan was halfway through a shift inspecting [iPad](http://topics.nytimes.com/top/reference/timestopics/subjects/i/ipad/index.html?inline=nyt-classifier) cases when she received a beige wooden chair with white stripes and a high, sturdy back.

[[](http://www.nytimes.com/slideshow/2012/12/27/business/FACTORY.html?ref=business)Slide Show](http://www.nytimes.com/slideshow/2012/12/27/business/FACTORY.html?ref=business)

###### [Factory Conditions in China](http://www.nytimes.com/slideshow/2012/12/27/business/FACTORY.html?ref=business)

[[](http://www.nytimes.com/interactive/2012/12/27/business/Improving-Working-Conditions-at-Foxconn.html?ref=business)Graphic](http://www.nytimes.com/interactive/2012/12/27/business/Improving-Working-Conditions-at-Foxconn.html?ref=business)

###### [Improving Working Conditions at Foxconn](http://www.nytimes.com/interactive/2012/12/27/business/Improving-Working-Conditions-at-Foxconn.html?ref=business)

###### [Apple’s Statement on Factory Conditions in China](http://www.nytimes.com/2012/12/27/business/apples-statement-on-factory-conditions-in-china.html?ref=business) (December 27, 2012)

[](javascript:pop_me_up2('http://www.nytimes.com/imagepages/2012/12/27/business/IEcon.html','IEcon_html','width=720,height=555,scrollbars=yes,toolbars=no,resizable=yes'))

**ON THE LINE** Workers assembling Hewlett-Packard computers at a plant in Chongqing, China, operated by Foxconn of Taiwan. [More Photos »](http://www.nytimes.com/slideshow/2012/12/27/business/FACTORY.html)

At first, Ms. Pu wondered if someone had made a mistake. But when her bosses walked by, they just nodded curtly. So Ms. Pu gently sat down and leaned back. Her body relaxed.

The rumors were true.

When Ms. Pu was hired at this [Foxconn](http://topics.nytimes.com/top/news/business/companies/foxconn_technology/index.html?inline=nyt-org) plant a year earlier, she received a short, green plastic stool that left her unsupported back so sore that she could barely sleep at night. Eventually, she was promoted to a wooden chair, but the backrest was much too small to lean against. The managers of this 164,000-employee factory, she surmised, believed that comfort encouraged sloth.

But in March, unbeknown to Ms. Pu, a critical meeting had occurred between Foxconn’s top executives and a high-ranking [Apple](http://topics.nytimes.com/top/news/business/companies/apple_computer_inc/index.html?inline=nyt-org) official. The companies had committed themselves to a series of wide-ranging reforms. Foxconn, China’s largest private employer, pledged to sharply curtail workers’ hours and significantly increase wages — reforms that, if fully carried out next year as planned, could create a ripple effect that benefits tens of millions of workers across the electronics industry, employment experts say.

Other reforms were more personal. Protective foam sprouted on low stairwell ceilings inside factories. Automatic shut-off devices appeared on whirring machines. Ms. Pu got her chair. This autumn, she even heard that some workers had received cushioned seats.

The changes also extend to California, where Apple is based. Apple, the electronics industry’s behemoth, in the last year has tripled its corporate social responsibility staff, has re-evaluated how it works with manufacturers, has asked competitors to help curb excessive overtime in China and has reached out to advocacy groups it once rebuffed.

Executives at companies like [Hewlett-Packard](http://topics.nytimes.com/top/news/business/companies/hewlett_packard_corporation/index.html?inline=nyt-org) and Intel say those shifts have convinced many electronics companies that they must also overhaul how they interact with foreign plants and workers — often at a cost to their bottom lines, though, analysts say, probably not so much as to affect consumer prices. As Apple and Foxconn became fodder for [“Saturday Night Live”](http://www.washingtonpost.com/blogs/worldviews/wp/2012/10/15/what-saturday-night-live-got-right-and-wrong-about-chinas-foxconn-workers/) and [questions during presidential debates](http://news.cnet.com/8301-13578_3-57533842-38/apple-made-in-china-issue-surfaces-at-presidential-debate/), device designers and manufacturers concluded the industry’s reputation was at risk.

“The days of easy globalization are done,” said an Apple executive who, like many people interviewed for this article, requested anonymity because of confidentiality agreements. “We know that we have to get into the muck now.”

Even with these reforms, chronic problems remain. Many laborers still work illegal overtime and some employees’ safety remains at risk, according to interviews and reports published by advocacy organizations.

But the shifts under way in China may prove as transformative to global manufacturing as the [iPhone](http://topics.nytimes.com/top/reference/timestopics/subjects/i/iphone/index.html?inline=nyt-classifier) was to consumer technology, say officials at over a dozen electronics companies, worker advocates and even longtime factory critics.

“This is on the front burner for everyone now,” said Gary Niekerk, a director of corporate social responsibility at Intel, which manufactures semiconductors in China. No one inside Intel “wants to end up in a factory that treats people badly, that ends up on the front page.”

The durability of many transformations, however, depends on where Apple, Foxconn and overseas workers go from here. Interviews with more than 70 Foxconn employees in multiple cities indicate a shift among the people on iPad and iPhone assembly lines. The once-anonymous millions assembling the world’s devices are drawing lessons from the changes occurring around them.

As summer turned to autumn and then winter, Ms. Pu began to sign up for Foxconn’s newly offered courses in knitting and sketching. At 25 and unmarried, she already felt old. But she decided that she should view her high-backed chair as a sign. China’s migrant workers are, in a sense, the nation’s boldest risk-takers, transforming entire industries by leaving their villages for far-off factories to power a manufacturing engine that spans the globe.

Ms. Pu had always felt brave, and as this year progressed and conditions inside her factory improved, she became convinced that a better life was within reach. Her parents had told her that she was free to choose any husband, as long as he was from Sichuan. Then she found someone who seemed ideal, except that he came from another province.

Reclining in her new seat, she decided to ignore her family’s demands, she said. The couple are seeing each other.

“There was a change this year,” she said. “I’m realizing my value.”

**An Inspector’s Push**

“This is a disgrace!” shouted Terry Gou, founder and chairman of Foxconn, the world’s largest electronics manufacturer and Apple’s most important industrial partner.

It was March of this year and Mr. Gou — seen by activists as a longtime obstacle to improving conditions inside his factories — was meeting with his top deputies in Shenzhen, China. In 2011, The New York Times began sending Apple and Foxconn extensive questions about working conditions in factories manufacturing Apple products. [The resulting articles](http://www.nytimes.com/interactive/business/ieconomy.html) in late January detailed problems ranging from excessive overtime and under-age workers to sometimes deadly hazards, such as workers’ using a poisonous chemical to clean iPhone screens at another manufacturer, and an explosion in Ms. Pu’s Foxconn plant that killed four workers.

In January, Apple publicly released the names of many of its suppliers for the first time. Additionally, the company made the unusual move of joining the [Fair Labor Association](http://www.fairlabor.org/), one of the largest workplace monitoring groups. Auditors from that association were soon inspecting Apple’s partners in China, starting with Foxconn.

Now, Mr. Gou was learning the results of those examinations. Foxconn was still failing to stop illegal overtime, the association’s lead inspector told Mr. Gou and his lieutenants, according to multiple people with knowledge of the meeting. The company was failing to keep student interns off night shifts. Foxconn had not put sufficient safety policies into practice and had exposed potentially hundreds of thousands of workers to at least 43 violations of Chinese laws and regulations.

“The world is watching!” Mr. Gou yelled, according to multiple people. “We are going to fix this, right here!”

But the inspector was not done.

He turned to the only Apple executive in the room, the senior vice president for operations, Jeff Williams. Apple needed to change as well, the inspector said. Apple, to its credit, had been working for years to improve conditions in overseas factories, but the company was treating such problems too much like engineering puzzles, the inspector said.

“Long-term solutions require a messier, more human approach,” that inspector, Auret van Heerden of the Fair Labor Association, told Mr. Williams. Instead of concentrating on writing more policies, Apple needed to listen better to workers’ complaints and advocacy groups’ recommendations.

Some of those suggestions surprised Mr. Williams, say people who worked with him. Since 2007, Apple had built one of the most extensive auditing programs in the electronics industry, inspecting over 800 facilities. It was a point of pride for both Mr. Williams and the company’s top leadership.

When Mr. Williams, who declined to comment for this article, returned from that March meeting to California, changes began. Among them, say people with firsthand knowledge, was the hiring of roughly 30 professionals into Apple’s social responsibility unit in the last year, which tripled the size of that division and brought high-profile corporate activists into the company. Two widely respected former Apple executives — Jacky Haynes and Bob Bainbridge — were recruited back to help lead the unit, reporting ultimately to Mr. Williams and the chief executive, Timothy D. Cook.

“Everyone knows Bob and Jacky,” said a former Apple executive. “It sends a message that Jeff and Tim expect everyone to get on board.”

Moreover, the company has reached out to advocates it once rebuffed. In late April, Apple allowed the first in a series of pollution audits by [Ma Jun](http://www.fastcompany.com/most-creative-people/2012/ma-jun), a Chinese environmental advocate who works closely with dozens of other multinationals but whom Apple had refused to speak with until last year, according to Mr. Ma. In September, the company joined the [Sustainable Trade Initiative](http://www.idhsustainabletrade.com/electronics-news/apple-joins-idh-electronics-program-1), an advocacy group based in the Netherlands.

“They know now if they don’t participate, it is the same as saying nothing,” Mr. Ma said.

Foxconn has also shifted. After the meeting with the Fair Labor Association, Foxconn announced that by July 2013, no employee would be allowed to work more than an average of 49 hours a week — the limit set by Chinese law. Previously, some Foxconn employees worked schedules that approached 100 hours a week. No other major manufacturer has pledged to abide by China’s work-hour laws in such a public manner. Foxconn, which is based in Taiwan, also promised to increase wages, so employees’ total pay would not decline despite fewer hours — the equivalent of a 50 percent raise for many workers, analysts say.

With 1.4 million employees in China — the most of any private company — Foxconn is setting a bar that all manufacturers will be judged against, say executives at other companies.

“When the largest company raises wages and cuts hours, it forces every other factory to do the same thing whether they want to or not,” said Tony Prophet, a senior vice president at Hewlett-Packard. “A firestorm has started, and these companies are in the glare now. They have to improve to compete. It’s a huge change from just 18 months ago.”

Foxconn, in a statement, said that it was “committed to ensuring that we provide a safe and healthy working environment for all our employees,” and that the company had regularly increased wages over the last three years.

**Secrecy and Transparency**

Despite those reforms, however, worker advocates inside Apple and with outside groups say the electronics industry’s problems will not genuinely diminish until Apple — the world’s most valuable company — starts filling a public leadership role similar to that of companies in other industries with overseas problems, like Nike in footwear manufacturing and Patagonia in apparel.

Such public leadership and transparency can run counter to a culture of secrecy that pervades Apple. Employees often don’t know what their lunch companions or next-door office mates are working on. This secrecy has helped Apple stay ahead of competitors, but has been a problem when it spills into the broader corporate culture, say past executives.

“It’s remarkable how the paranoia in Silicon Valley prevents companies from cooperating, even on something like corporate social responsibility,” said Mr. van Heerden of the Fair Labor Association, who added that his work with Apple, Foxconn and other companies was confidential.

While Apple is the only electronics company to join Mr. van Heerden’s monitoring group, it has not opened up in some other ways. Apple has declined to release audit reports on the hundreds of facilities the company has inspected. After two factory explosions last year, Apple did not share investigative reports with other companies so they might avoid similar accidents. Apple does not, in general, publicly identify terminated suppliers or factories that have violated Apple’s supplier code of conduct.

Moreover, Apple’s growing team of safety and corporate responsibility experts are typically prohibited from sharing their findings at conferences, in academic journals or other forums where their insights could be absorbed by other companies, according to former members of that team.

“Apple is scared that if we open the kimono too wide, it will ruin what has made Apple special,” said one former company official. “But that’s the only way to really improve things. If you don’t share what you know, then no one else gets a chance to learn from your mistakes and discoveries.”

Apple declined requests for interviews. In a statement, it said the company embraced its “unique position to lead” and had taken working conditions very seriously for a long time. “No one in our industry is doing as much as we are, in as many places, touching as many people as we do. Through years of hard work and steadfast commitment, we have set workplace, dormitory and safety standards, sought help from the world’s leading experts, and established groundbreaking educational programs for workers.”

“We have been upfront about the challenges we face and are attacking issues aggressively,” the statement continues. “We believe deeply in transparency and have demonstrated this through reporting our shortcomings and exposing violations.”

At a conference in May, Mr. Cook, the chief executive, said that the company was “going to double down on secrecy on products.”

He added, however, that “there’s going to be other things that we do that we’re going to be the most transparent company in the world on. Like social change. Supplier responsibility. On what we’re doing for the environment. We’re going to be the most transparent, because we think that transparency is so important in these areas, and that if we are, other people will copy what we’re doing.”

This year, Apple began publishing [monthly summaries](http://www.apple.com/supplierresponsibility/code-of-conduct/labor-and-human-rights.html) of suppliers’ compliance with overtime standards. In October, Apple hosted other technology companies for a private discussion on responses to excessive work hours overseas. While Apple’s [annual supplier responsibility reports](http://images.apple.com/supplierresponsibility/pdf/Apple_SR_2012_Progress_Report.pdf) do not contain details on specific factories, they are still among the most thorough in the electronics business.

But Apple has not sought the high-profile leadership opportunities that have set off transformations in other industries. Nike, for instance, has convened public meetings of labor, human rights, environmental and business leaders to discuss how to improve overseas factories. The clothing retailer Gap Inc. has invited outside organizations to critique its purchasing practices and publish their findings. Patagonia shares its factory audits with competitors and has been a vocal supporter of a centralized audit report clearinghouse that lets companies share information.

“That’s the standard Apple has to meet,” said a former Apple executive. “That’s how a leader transforms an industry.”

**A More Human Touch**

Almost 200 miles southeast of the factory where Ms. Pu received her new chair is another plant that is experimenting with improving workers’ quality of life — and shows the trade-offs of such gains.

The factory, in Chongqing, makes computers for Hewlett-Packard, a company with little of Apple’s glamour. It is operated by Quanta, a little-known Taiwanese manufacturer.

Inside the plant, amid thousands of workers in bright white uniforms, are occasional flashes of pink worn by people like Zhang Xuemei, a bubbly 19-year-old with glinting earrings whose sole job is to chat with co-workers.

For eight hours a day, Ms. Zhang collects complaints about the factory’s free meals and dorms. She listens to workers who are divorcing, homesick or arguing with managers. When she finds someone suffering, she refers them to the company’s full-time doctor or professional counselors.

Quanta’s 10-story dormitories feel like a college campus. There is a free movie theater, television rooms, a large martial arts gym, two spacious karaoke bars, a huge cafeteria and an aerobics hall playing a Chinese remix of “Gangnam Style.”

Neither Quanta nor Hewlett-Packard claims it has solved every labor woe. And the amenities are partly selfish: one of the biggest problems for Chinese factories is that workers are constantly leaving. Hewlett-Packard hopes that by improving living conditions, turnover and training costs will fall.

“You can tweak the line and get one second out of the process, but if the people turn over every three months, think what that does to your quality,” said Mr. Prophet, the Hewlett-Packard executive.

Last year, a worker advocacy group criticized another Quanta plant, in Shanghai, for harsh working conditions found at many factories, including extensive overtime and poor food. In Chongqing, Hewlett-Packard has agreed to pay slightly higher prices initially so that Quanta can offer workers a better quality of life. Such payments are the price all companies should bear for more humane factories, say Hewlett-Packard executives.

There are costs for workers, too. Quanta’s employees earn slightly less than their peers at Foxconn. What’s more, Quanta’s emphasis on hours that are easier on employees means they are prohibited from overtime shifts that advocates say are abusive, but which some workers insist they want.

Zhang Jiang, a slim 21-year-old, previously assembled laptop computers at another company in Shanghai. Each week, he sent the bulk of his pay home so his younger brother could stay in school. Overtime was like a blessing, he said.

But last summer, fed up with the 25-hour train trip to see his family, Mr. Zhang moved to Chongqing and joined Quanta. He enjoys the better facilities and dorms. He frequently visits his parents’ home. But his take-home pay has fallen by nearly a third and the thought that his brother may have to drop out of school so he can help the family gnaws at Mr. Zhang. Instead of working in the factory each night, he spends hours playing an online game, Dungeon Fighter.

“I’d like to work 80 hours a week,” he said.

**Change Is Hard**

Hewlett-Packard also makes products at Foxconn factories, as does almost every major electronics firm. Foxconn, more than any other company, has proved that Chinese plants can deliver obsessive attention to quality. The company has helped make China into a manufacturing juggernaut through strict discipline that is visible everywhere, even in the salutes managers give visiting executives.

That discipline, say former Apple executives, is one reason every iPhone is put together so well.

It is also one reason the reforms enjoyed by employees like Ms. Pu — who received the new chair — have not spread quickly. Though Foxconn has trained managers to treat employees more gently, foremen still use profanity and intimidation, workers say.

“The managers speak in a manner that often feels like a threat,” said Mou Kezhang, who works in iPad quality assurance at the Foxconn factory in Chengdu.

Foxconn, in a statement, said it had “always been among the fastest to adopt change and reform.” Its policy, the company said, is “to treat employees with respect and if we find any transgressions, they are immediately investigated and addressed.”

In the last two years, Hewlett-Packard has increasingly moved its manufacturing to Quanta. Foxconn has not fought particularly hard to win that business back, according to Hewlett-Packard officials. Often, the quality-of-life improvements requested by Western electronics executives come at the cost of a supplier’s bottom line. Even within Apple, tensions erupt because executives often believe improvements should be financed by suppliers, whereas suppliers say changes are not feasible unless Apple pays more.

And ultimately, some workers themselves resist reforms. In March, when Foxconn announced that workers’ hours would be reduced to China’s legal limits, employees began complaining. “Absolutely I’d like to do overtime to work more than 60 hours, but now there’s a ceiling on it,” said Ma Changqiao, a 23-year-old at Foxconn’s Chongqing factory.

Change is hard, say officials at multiple companies. Reforming labor conditions in a country as large as China will probably take decades, and labor abuses are an ever-evolving problem without just one right answer.

In September, six months after Foxconn agreed to a Fair Labor Association request for new internship rules, two worker advocacy groups found that students in nonmanufacturing courses were being improperly forced to work at a Foxconn plant in north central China. One student studying preschool education said she was prohibited from quitting her internship and was compelled to work night shifts. Afterward, Mr. Gou of Foxconn issued apologies to wronged interns and the responsible official was fired.

Today, Foxconn’s internship program continues — a testament, executives say, to Foxconn’s commitment to a program that can benefit thousands of students, even when making improvements is hard and stumbles are inevitable. Changing the company’s culture is slow going. But the needed reforms, executives at Apple and Foxconn hope and believe, are falling into place.