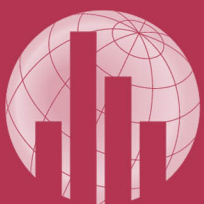


Made in China: Challenge and Innovation in China's Vocational Education and Training System

International Comparative
Study of Vocational Education
Systems

January 2015



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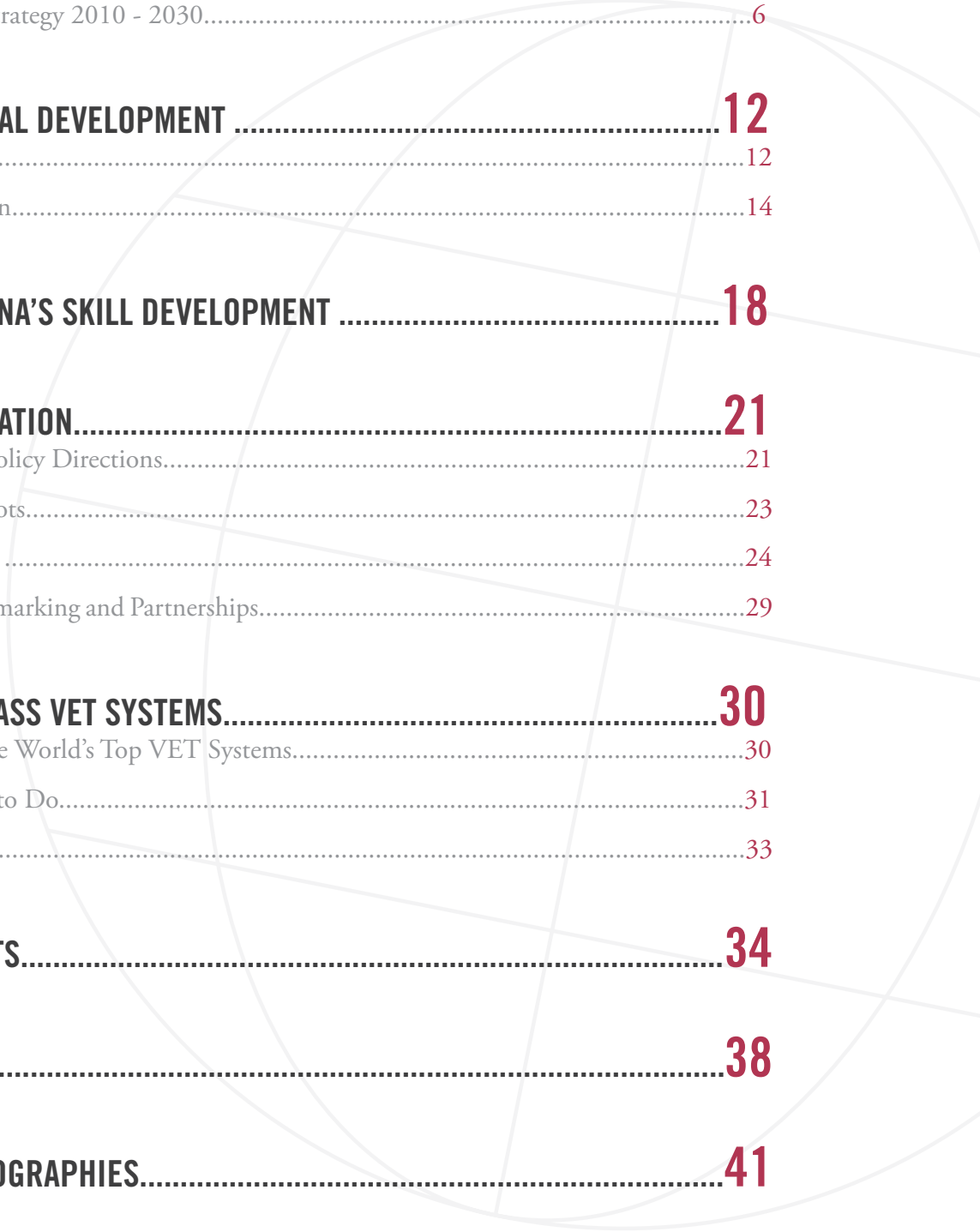
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**Made in China:
Challenge and Innovation in China's
Vocational Education and Training System**

**International Comparative Study of Leading Vocational
Education Systems**

Vivien Stewart, Asia Society

January 2015



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INTRODUCTION

In the less than forty years since Premier Deng Xiaoping opened up the People's Republic of China to the outside world in 1978, China has leapt from being a poverty-stricken rural society to the second largest economy in the world. And it is only a matter of time and the subject of intense speculation as to when it will become the largest. The “Made in China” label has become ubiquitous as China has become the *de facto* manufacturing workshop of the whole world, fueling three decades of high rates of economic growth. China also now has some of the world's most modern infrastructure: from the spectacular skyscrapers of Pudong to high speed Maglev trains, to the world's most modern airports to thousands of miles of new highways. More than 500 million Chinese have moved into the middle class over the past twenty-five years, with all the accouterments of middle-class life —homes, televisions, computers, and cars. Yet just ten years before Deng Xiaoping's momentous move, China had utterly destroyed its education system during Mao's Cultural Revolution (1966-1976), closing schools and sending thousands of teachers and educated people to the countryside. From a standing start after the Cultural Revolution, China has powered three decades of spectacular economic growth. Where did the skills come from to build this economic juggernaut?

Fast forward. The Chinese economy is now at another inflection point. The astounding economic growth of China over the past thirty years has been substantially built on low-cost, low-skill manufacturing for export. But the United States banking crisis of 2008, which shook the whole world, revealed the dangers of China's overreliance on an export-dependent growth model. And the rising cost of labor in the great eastern cities has made this model increasingly unviable. Moreover, this frenetic pace of development has come at great cost in terms of economic imbalances, regional and social inequalities and environmental destruction. China needs to transform its economic model and the government has, in fact, announced that it wants to move from an economy based on low-cost, low-skill exports to one based on services, consumer demand, agricultural modernization, higher value-added products and innovation. But does China have the skills necessary to build this new economy?

China has the largest population and largest labor force in the world. It has been highly successful in rapidly expanding both secondary and higher education to a significant fraction of the youth cohort. Indeed, Shanghai topped the world in the reading, math and science achievement of fifteen-year-olds on the Programme for International Student Assessment (PISA) in 2009 and 2012. But the success of fifteen-year-olds in Shanghai masks the fact that the overall level of knowledge and skills in the Chinese labor force is extremely low. In 2010, only four percent of the adult Chinese labor force was considered highly skilled (Shi 2012a) and only half of the 140 million workers in urban enterprises can be classified as skilled (Yan 2010). Moreover, educational opportunities and standards across China are highly uneven. China has abundant labor power, but it will need a far more skilled and productive labor force to meet its goals of developing an advanced, high-

income economy and society. China is therefore now designing a new approach to human capital, including a major focus on developing a modern vocational education and training (VET) system.

This report is part of an international comparative study of vocational and technical education systems undertaken by the Center on International Education Benchmarking (CIEB) of the U.S.-based National Center on Education and the Economy (NCEE). It builds on NCEE's long track record of analyzing the critical connections between education and economic growth. According to human capital theory, knowledge and skills have become the most important force driving modern economies. Therefore, countries are investing increasing amounts of their GDP in education. Many countries have focused on expanding higher education to increasing segments of the age cohort while vocational education and training, often associated with an older industrial era, has been relatively neglected. But slow economic growth, high unemployment, including among college graduates, and rising inequality has made developing a modern VET system—as a vehicle for meaningful career preparation for a more demanding labor market—an issue of increasing urgency around the globe. This CIEB international study, which also includes case studies of Australia, Denmark, Singapore, Switzerland and the United States as well as China, is an effort to assess what are the world's best practices in vocational and technical education in the 21st century.

This case study of China is the result of several visits to China in 2013 and 2014 by the study team of Marc Tucker, Vivien Stewart, Betsy Brown Ruzzi and Nancy Hoffman (see biographies on page 40). The team spent time in secondary vocational schools and tertiary vocational education colleges and visited with chambers of commerce, foreign-invested firms, and Chinese private and state-owned enterprises. We also met with economic and education researchers and government policymakers at the national, province and city levels. We are grateful to all the people who took the time to meet with us and share their perspectives on China's economic and educational development. We are especially indebted to Dr. Zhang Minxuan, then President of Shanghai Normal University and a member of the Center on International Education Benchmarking's International Advisory Board, and to Liu Yufeng at the Central Institute for Vocational and Technical Education (CIVTE) in Beijing, who set up a number of visits. The American Chamber of Commerce was also extremely helpful in facilitating meetings with employers in the four cities we visited: Shenzhen, Tianjin, Shanghai, and Beijing. Dr. Lin Qin of the National Institute of Education Sciences in Beijing arranged the school visits in Tianjin. A full list of the people we met with and of selected key materials on China's economy and education system can be found at the end of this report.

Generalizing about China writ large is dangerous. It is a vast country of 1.35 billion people (World Bank 2013). It is both an advanced industrial society and a third world economy. It is a country of enormous contrasts, with prosperous rapidly growing mega cities abuzz with new cars and high-end department stores, but simultaneously of vast poor rural areas from which millions of people seek escape by moving to the cities. Our study focused on



the most advanced provinces, where the future of China's skill development and innovations in technical education can most easily be seen. But away from the advanced coastal cities, much of China's vast rural hinterland is still primarily devoted to low productivity agriculture.

This study examines the success of China's unique dual-track, export-led economy from 1978 until 2009 and explains where the skills came from to build this economic juggernaut. It describes the turning point it now faces and the reasons China's economic model going forward will require far higher levels of skill and productivity. This is the context in which China is trying to develop a modern VET system. We compare China's current vocational education and training system to the best practices of the world's most advanced systems to which it aspires. While we find the VET system lacking in many respects, China's recent history has shown that when it decides to tackle a problem, it has the determination and drive to accomplish it. We therefore hope the report's recommendations will be a helpful contribution to China's educational reform discussion. China has some unique circumstances, but many of the problems it faces are similar to those of other countries that are trying to create new economies for the 21st century. We therefore hope the report will be of broad-ranging interest to other countries that are interested in creating 21st century VET systems.

CHINA'S ECONOMIC DEVELOPMENT

For much of recorded history, China was one of the most advanced countries in the world. Economic historians have estimated that in the early 19th century, the Chinese Empire may have accounted for as much as one-third of global GDP (Lin 2012). It had been responsible for several breakthrough inventions such as gunpowder, the compass, and paper and printing, and the accounts of European visitors in the 17th and 18th centuries marveled at its large and prosperous cities. But the discovery of the New World and the Industrial Revolution in Europe led Europe to far outpace China, and by the mid-19th century it was seen as a backward, agrarian society. In fact, from the mid-19th century on, due to the Qing dynasty's internal weaknesses and inability to adapt to modern times and external invasions of China by European powers (starting with the Opium Wars of 1840), China suffered a century and a half of economic decline, humiliation and exploitation by foreign powers. China was forced to sign "unequal treaties" with twenty other countries and was reduced to a quasi-colony.

During this period, generations of Chinese thinkers and leaders dreamed of and wrestled with different ideas about how to overcome China's backwardness and poverty, to catch up with the west, and to restore prosperity and strength ("fuqiang") to China (Schell 2013). In 1911, Sun Yat-sen overthrew the imperial Qing dynasty and the next forty years were marked by political instability, civil war between the Nationalists and the Communists, and invasion and occupation by Japan. Eventually, in 1949, Mao Zedong defeated the Nationalists, and established the People's Republic of China. He threw out the occupying foreign powers and united the country. However, Mao's economic policies of prioritizing

heavy industry and collectivizing agriculture were disastrous. More than forty-five million people are estimated to have died during the “Great Leap Forward” in the 1950s, and during the Cultural Revolution (1966-1976) schools and universities were closed and millions of educated people were sent to the countryside. At that point, China’s share of global GDP had dropped to less than five percent (Lin 2012). Finally, since 1978, after more than a century of decline, civil war, occupation, socialist revolution and isolation, China has experienced 30 plus years of extraordinary economic growth. How did this come about?

The Thirty-Year Miracle 1978-2010

In 1978, Mao’s successor, Deng Xiaoping initiated a period of “reform and opening up”, hoping to lift China out of its poverty and backwardness by learning from more advanced countries such as Japan, the United States, and European nations. Realizing that China was at least 40 years behind the world’s most advanced countries, he called on China’s leaders to “emancipate their minds” and “seek truth from facts.” The more pragmatic approach to economic development embraced by Deng Xiaoping had no master strategic blueprint. Instead, over a period of three decades, China slowly shifted from a solely state- and centrally-controlled economy to a dual-track economy with an increasing role for the market.

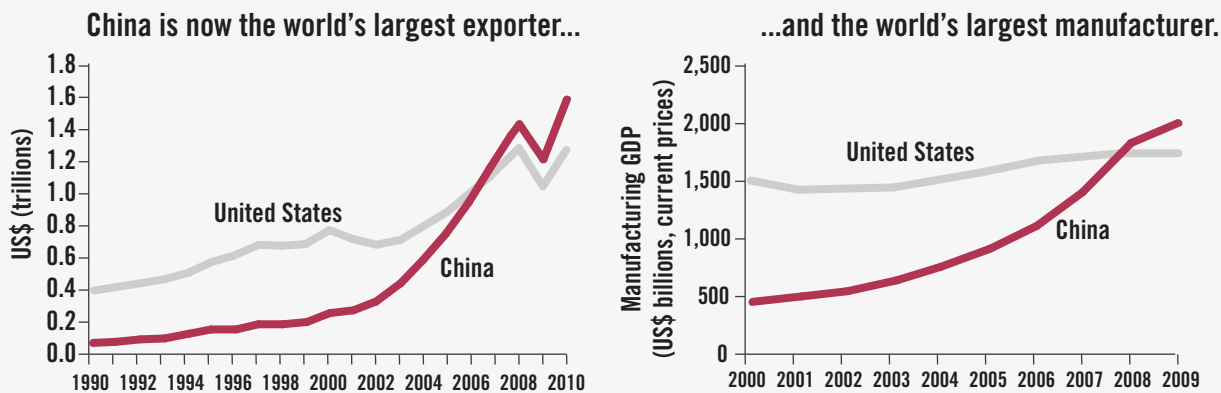
The first developments were in agriculture, where the control of agriculture was gradually returned to households from the collectives that had been created under Mao. The result was a big increase in agricultural production and the availability of food. Inspired by the success of the rural reforms, the government began to introduce market-oriented reforms in other areas. Managers of what at that time were all state-owned enterprises were given more autonomy to make decisions and to keep a part of the “profit” from the successful running of their businesses.

In the early 1980s, Special Economic Zones were piloted in Shenzhen (near Hong Kong), Zhuhai, Shantou and Xiamen (across the Straits from Taiwan). These opened up China to foreign direct investment through the vehicle of joint enterprises. Joint enterprises benefited from special legal regulations and tax incentives. For example, to encourage processing of goods for export, joint enterprises were allowed to import raw materials duty free. These initial zones were so successful that the concept was expanded. In 1984, 14 cities had Special Economic Zones; by 1993, there were 2,000 of them. Hong Kong, Taiwan, Korea and Japan were particularly important investors and managerial partners in the early zones. In 1994, fiscal reforms decentralized much greater responsibility to local governments. Provincial and local governments were given incentives and resources to compete with each other in developing infrastructure and businesses suited to their very differing local circumstances. Local officials were rewarded for their performance in delivering key goals: growth, foreign direct investment, employment and social stability. Also in the 1990s, the government, which owned most of the urban housing stock, sold it to its residents at a discount. Home ownership in cities shot from 9.7 percent in 1963 to 80 percent in



1998 (Lardy 2011). In 1998, another expansion of the market took place with the reform of many of the state-owned enterprises. These reforms led to large-scale unemployment but workers were quickly absorbed by the growing export-oriented industries and by government-financed major infrastructure development. Roads gradually connected the coast to the interior and allowed a huge integrated domestic market to develop. Firms were able to expand and achieve economies of scale.

In 2000, China's accession into the World Trade Organization was a critical point and further expanded China's economic integration into the world economy. It brought large and rapidly increasing foreign investment, advanced technologies, and international management expertise. It also further opened international markets to Chinese goods. Chinese goods were low-cost and highly competitive because of its low-wage structure but also because of government support for infrastructure, energy, and capital, etc. (Compare China's growth with India, for example. India also had low wages but lacked these other advantages). China's low-cost foreign trade strategy was so successful that foreign trade rose from 9.9 percent of GDP in 1978 to 44 percent of GDP in 2008 (Lardy 2011).



Source: World Bank 2013

However, in 2008-2009, the global financial crisis caused a huge shock to Chinese exports. Twenty million jobs were lost due to the global recession. Exports fell by about 17 percent (Lardy 2011). China weathered the global recession more successfully than the west due to the government's early and large stimulus measures which, among other things, accelerated the development of the high-speed rail network and electricity grid. In fact, China's continued strong growth during this period helped the world economy to recover. Although China's growth rate dropped in 2008-2009, it was back to 10.4 percent in 2010 (World Bank, World Development Indicators). But Chinese leaders and economic advisors had learned that its high dependence on exports made it very vulnerable to global economic recessions. Further growth of the export strategy was also limited by the weak recovery of global demand in Europe and the United States.

Throughout this whole period from 1978-2009, China adopted a strategy of what Deng Xiaoping called “crossing the river by feeling the stones”. Local areas were encouraged to undertake pilot projects and, if they were successful, the ideas were spread to other areas and tried on a larger scale. This trial-by-error evolution allowed workable and localized transitions from one stage of economic development to the next.

This gradualist approach also enabled the best use of limited skills. When Deng Xiaoping took power, China had a vast supply of unskilled and hard-working labor but a very limited supply of people with education. Formal education had only reached a small fraction of the population in the initial years of the People’s Republic and most educational institutions had, in any event, been closed for the preceding ten years during the Cultural Revolution (1966-76). In the early days of developing the Special Economic Zone in Shenzhen (Guangdong province), the only people with the skills for infrastructure development came from the army. Foreign-invested firms brought managers from their home countries and also invested significantly in training for their Chinese workers. China’s limited pool of university graduates was also concentrated in the newly developing enterprises, especially in the coastal cities. Gradually education was expanded as government resources grew (see later section on China’s Educational Development) but this economic model was substantially built on low-wage, low-skill workers.

Despite the dire predictions of conventional economic theory, China’s unique dual-track development model, a “socialist market economy” in which the government allowed state-owned enterprises to continue in old priority areas while allowing development of private enterprise in others, has been spectacularly successful for three decades. Annual growth rates have averaged 9.9 percent for 30 years and China’s foreign trade has grown annually by 16.3 percent (Lin 2010). China is now second to the United States as a destination for foreign direct investment and it has amassed gigantic foreign reserves. Over this 30-year period, more than 500 million people were raised out of poverty, the largest anti-poverty program in world history (World Bank 2013). State-owned enterprises, which accounted for three-quarters of output in 1978, now account for one quarter. China has two of the world’s top ten banks, more than sixty companies on the Global Fortune 500 list, the world’s second largest highway network, and six of the ten busiest container ports (World Bank 2013).

In 1978, China was one of the world’s poorest countries. Today it is considered a middle-income country. In 2010, it overtook Japan as the world’s second largest economy and overtook Germany as the world’s largest exporter. If things continue as they have been, it is projected to become the world’s largest economy before 2030 (World Bank, 2013).

A New Economic Strategy 2010-2030

No economic strategy can last forever. Deng Xiaoping created a fundamental turning point in the Chinese economy. Now China is at the point when another significant transformation is needed. Three decades of extraordinary economic growth averaging nearly



ten percent per year brought significant benefits to China's people but this achievement came with tremendous costs and has produced significant imbalances.

Costs and imbalances

These costs include appalling environmental damage. A pall of health-damaging pollution hangs over Beijing and many other Chinese cities and there is substantial water and soil pollution, much as there was during the Industrial Revolution in Europe and North America in the 19th century. There is also substantial pressure on resources. Supplies of energy, food, raw materials, and water are all being depleted. Social strains are equally strong. There is a three to one disparity between urban and rural wages. According to the World Bank (2013), China is home to more than a million millionaires while 170 million people live on less than \$2 per day. The cities have rising wages and better public services in education, health, and social security. Hundreds of millions of Chinese have migrated to the cities but because of the internal barrier of the household registration system (the *hukou* system), many live in cities but do not have access to urban services while millions more farm families, unable to move, are trapped in low-wage, low-productivity agricultural work.¹

China's economy is also significantly imbalanced in a number of ways, especially in the weight given to manufacturing. Encouraged by low wages, an undervalued currency, and state subsidies of land and energy, manufacturing climbed to 48 percent of GDP after 2003 while agriculture declined to ten percent of GDP. Farming is conducted on small plots by individual farmers who have no buying power in the market, and with food prices kept low and a shortage of arable land, agriculture is a low-productivity and low-income sector. Meanwhile the services sector, which is more labor-intensive and less energy-absorbing than manufacturing, is small relative to other countries at China's stage of development.

China's growth has been driven primarily by manufacturing and by huge national and local government investments in construction and infrastructure. By contrast, private consumption makes a relatively small contribution to GDP growth. Chinese families save heavily because of the lack of health care and social security systems until recently. And because bank interest rates are kept very low, families have invested heavily in property, causing a housing boom (some say bubble). Because of its enormous exports, China has also amassed large foreign exchange reserves that are invested in low-yield U.S. Treasuries (Roach 2014). There is a lot of debate among economists as to the meaning of these imbalances. Pessimists argue that the economy is likely to crash while optimists argue that the imbalances are being dealt with. Meanwhile, Cai Hongbin, Dean of Guanghua School

¹ *Hukou* has its origins in the household registration system of ancient China, but it was revived and enforced in the 1950s by the Chinese government to limit mass migration from rural areas to cities. The economic development of China's eastern cities from the 1980s has, in fact, encouraged millions of migrant workers to move to these cities, but, lacking an urban *hukou*, they have not had access to urban education, health and welfare services. The system is widely seen in China as unfair and discriminatory and it causes tremendous "churn" in the labor market. The system is gradually being dismantled to allow rural migrants to obtain a residence permit and access services in the cities in which they work.

of Management at Peking University, argues that Chinese services and consumption are undercounted in national statistics and that while China's services sector, calculated at about 42 percent, is low compared with developed countries' 70 percent, China's services are closer to 55 percent, which is comparable to Japan and South Korea in the 1960s (Yang 2014).

Overall, however, economists seem to agree that the Chinese economy at this point is dangerously imbalanced with low private consumption, an overweight manufacturing sector, small services sector, too much foreign exchange, a property boom, and too much reliance on government investment and manufacturing to drive growth. Reducing these imbalances will require significant reforms, especially in the currency exchange rate, financial sector, and pricing of energy, land and water.

The middle-income trap

China also faces a potential middle-income trap. Over the past 50 years, a number of countries, for example, in Latin America and the Middle East have entered the middle-income category, as China has, but then have experienced a sharp deceleration in growth and have been unable to grow into high-income countries. In this so-called middle-income trap, the strategy that enabled these countries to grow fast initially—labor-intensive, low-cost products using technology developed abroad—is lost when they reach middle-income status. Rising wages and the limits of what can be achieved through imported technology make them less competitive.

In urban China, real wages in the formal sector have been rising steadily. In 2010, nominal annual wages for formal sector workers were RMB 36,540, almost seven times those of 1995. Taking all sectors into account (formal employment, migrant workers, and self-employment), the average real wage in urban areas rose ten percent per year from 2000-2010 (Lardy 2011). Some of this, according to the International Monetary Fund, was offset by increases in productivity of 9.3 percent between 2000 and 2008 in the tradeable goods portion of the Chinese economy. Although the lower wages in China's western provinces will make China competitive globally on wages for many years to come and while China's global competitiveness is also a function of its government-induced lower costs of capital and energy and its artificially low currency, it is clear that the "China price" phase of low-wage, export-led growth is nearing its end. An export-led strategy can also no longer rely on nearly insatiable demand from the United States as the Asian tigers did at the end of the 20th century. Stagnant economies in Europe and Japan limit global demand even further. As the Asian tigers demonstrated, moving from a middle-income to a high-income economy requires more complex economic policy, in which nations gradually move up the value ladder by producing more complex industrial goods and services. Accomplishing this requires an effective strategy for producing highly skilled talent across a range of advanced industrial and service sectors.



Towards a modern, harmonious, and creative high-income society

China's leaders have recognized that the current economic model is unsustainable. As early as 2007, then premier Wen Jiabao said, "China's growth is unsteady, imbalanced, uncoordinated and unsustainable." Under President Hu Jintao and Premier Wen Jiabao and now under President Xi Jinping and Premier Li Keqiang the Chinese government has enunciated the dream of becoming a "modern, harmonious and creative high-income society" with more inclusive growth, reduction in inequality and economic insecurity, higher priority to development in west and central China, and an emphasis on innovation. The ideas encapsulated in this phrase include:

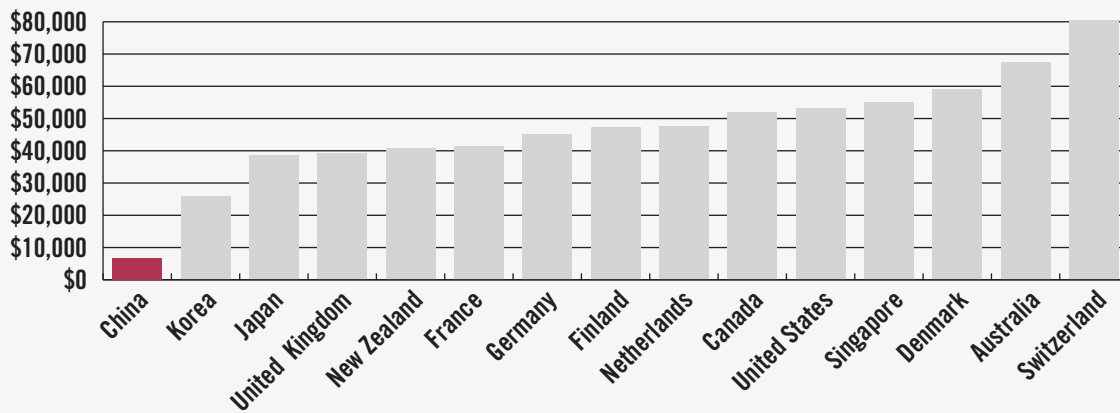
- Modern: industrialized; urbanized; quality of life on par with developed countries
- Harmonious: inclusive; common stake; rule of law; in harmony with nature; equal and accepted partner among nations
- Creative: innovation; high-value-add; competitive with advanced nations
- High-income: on par with advanced countries; elimination of poverty; large middle-class; reduced inequality

The government's 12th Five-Year Plan (2011-2015) embraces the theme of rebalancing. The Plan calls for scaling back the government role in production through further shrinking the state-owned enterprises and reducing its role in resource allocation through financial reforms that allow a greater role for the market and society to drive economic growth. The government is also changing the incentives for local leaders to a broader mix of social and environmental goals (the "green index") in addition to economic growth. It also calls for modernizing agriculture, for increasing expenditures on scientific R&D, and for promoting innovation.

China has many opportunities as it seeks to move from being a middle-income to a high-income country. It has a high savings rate and a large and growing middle class that will want consumer goods and better health and education. China is also urbanizing rapidly and it is estimated that it will grow from one-half to two-thirds urban by 2030 (the equivalent of adding a Tokyo or Buenos Aires every year) (World Bank 2013). Cities tend to be engines of growth, allowing economies of scale in production and distribution and encouraging technology spillover. The emerging global middle class, two-thirds of which is in Asia, also provides a large market for China's goods and services. So the economic model is moving from "Made in China" to "Made and Sold in China and Asia". Some of its firms such as Ali Baba, Haier, Baidu, and the Shanghai Construction Company are already going global. And China's new focus on services coincides with the fact that, thanks to information technology, services previously considered untradeable (like health and education) are being provided across national borders and trade in services is now the fastest growing component in world trade.

But it also faces significant challenges. Because of its one-child policy, from 2015 on China's labor force will have more retirees than workforce entrants with a concomitant need to boost labor productivity. Rising labor costs in the eastern cities and the increasing enforcement of environmental standards will erode its global competitiveness in low-cost manufacturing. There is a general consensus that China's growth rate will slow. (The official target for 2014 is 7.5 percent). While China's economy has been booming for 30 years, its average per capita income is only \$6,807 (World Bank 2013), still only a fraction of that of developed countries so it does need to keep growing faster than developed countries. And any sudden slowdown in the economy could precipitate a financial crisis. Many of the important changes proposed in the 12th Five-Year Plan also face significant constraints and domestic opposition. For example, coastal provinces benefit from an undervalued currency and local officials everywhere derive income from land sales and pirated goods (hence the lack of local enforcement of China's intellectual property laws).

China's 2013 Per Capita Income Compared to Selected Countries



2013 nominal GDP per capita USD
 Source: World Bank 2013

Perhaps China's most ambitious goal is that of becoming an innovation-oriented society by 2020 and a world leader in science and technology by 2050 (Medium- to Long-Term Plan for the Development of Science and Technology, 2006). China is already investing significant funds in R&D and plans to increase expenditures to 2.5 percent of GDP annually. China's pool of scientists and engineers devoted to R&D is now second only to the U.S. (Cao, Suttmeier, and Simon 2006). The government has designated 20 pilot cities as "knowledge centers" and incubators for innovation, for example, opto-electronics in Wuhan, aviation in Chengdu, and financial and engineering services in Shanghai. It has also designated 20 strategic research areas and is already an emerging global innovator in fields such as green tech. But although China has some top-ranked universities in global terms (Shanghai Jiao Tong Index 2014), the quality of tertiary education more broadly is problematic and, despite an increasing number of patents, the government research institutes are not well-connected to industry and their work has not yet translated into new products (Simon and Cao 2009). Innovation conferences are being held around the



country to identify barriers to innovation which include lack of enforcement of intellectual property laws, the lack of large private sector firms which account for a lot of innovation in advanced economies, and a critical shortage of the right skills at all levels.

Does China have the skills to become an innovation society?

There are many different perspectives on the current human resource situation in China depending on the region of the country, the type of industry, and the level of skill required. There are huge skill gaps but at the same time rapidly increasing skills.

Overall, the current adult workforce reflects the lower educational provision of a previous era, and is substantially unskilled. For those businesses that rely on low-skill manufacturing, there is a plentiful supply of unskilled but highly-motivated workers. But as costs in the eastern cities rise, businesses will increasingly automate their processes or move inland and the more than 260 million migrant workers (Chinese National Bureau of Statistics 2013), who make up one-third of the entire labor force, will either have to move inland or face massive structural unemployment.

For industries needing higher skills, there are substantial shortages. According to National Industry Development Plans: In the electronics and information industry, of the 8.5 million employees, only 50 percent are classified as skilled; in equipment manufacturing, 60 percent of the 16 million workers are classified as skilled; in the steel industry, more than 25 percent of workers are junior high school leavers without additional training (Shi 2012a).

The lack of qualified workers affects the economy in many ways. It is estimated that 30 percent of Chinese products cannot pass quality tests. Many advanced equipment lines can't operate at full capacity due to lack of qualified technicians or maintenance workers. In fact, "Made in China" has become mostly synonymous with low quality compared with "Made in Japan, Korea or Germany". Cities lack skilled technicians and service providers, such as mechanics to repair the rapidly increasing number of automobiles. And in the service industry, workers in hotels and restaurants, except those at the very highest end, by and large are not up to common international standards.

At the management level, the American Chamber of Commerce in China (AMCHAM), in its 2014 16th annual Business Climate Survey said that human resources are the second biggest challenge to American businesses operating in China. Thirty-six percent of their members said that the shortage of qualified Chinese managers is a risk to their Chinese operations. Young skilled workers are at a premium and move around a lot so that high employee turnover is an additional problem for companies of all sizes.

Over the last thirty years, Chinese public authorities at the national, provincial and local levels have been investing increasingly in education. How far has the Chinese educational system come towards meeting the needs of a modern and increasingly skill-intensive economy?

CHINA'S EDUCATIONAL DEVELOPMENT

While the current adult workforce in China may not be very well-educated, the next generation will be much more so. China's economic rise is the stuff of countless newspaper articles. What is much less well-known is that its educational growth has been equally spectacular. At the founding of the People's Republic of China in 1949, more than 80 percent of the population was illiterate (Guo and Lamb 2010). But from the start of Deng Xiaoping's "opening up and reform" or "open door" policies, education has been a major focus. In discussing the importance of education to China's modernization, Deng famously said, "Education should be oriented towards modernization, the world and the future."

General Education

With the world's largest population and extremely limited resources at the beginning of the People's Republic, it was a significant challenge to expand China's education system, but decade-by-decade, China has done just that. In the 1950s, primary education first expanded but then declined during the economic crisis caused by the Great Leap Forward (1958-62) and most schools were shuttered during the Cultural Revolution (1966-76). As late as the mid-1970s, only one in four students actually graduated from primary school.

The most rapid development has come in the decades of the 1980s, 1990s and since 2000. This has been, in fact, the most rapid period of educational development in Chinese history. In the 1980s, schools reopened and both primary and junior secondary enrollments rose gradually. In 1986, a new law guaranteed children nine years of compulsory education as a right, six years of primary and three years of junior secondary, with the target of achieving this by the year 2000. By 2004, primary schooling had become a universal system and 74.4 percent of students were enrolled in junior secondary. Today, more than 92 percent of students graduate from junior secondary school (2013 Statistical Bulletin of Education Development, Ministry of Education).

From the 1990s on, senior secondary education, which is after the end of compulsory education, also expanded significantly—rising from a gross enrollment rate of 42.8 percent in 2002 to 84 percent in 2011 (Yuan 2013). Access to senior secondary schools is by examination and senior secondary schools are primarily academic in orientation, aimed at university entrance. To increase participation at the senior secondary level, senior vocational schools were also developed. Unlike academic secondary schools, vocational secondary schools are primarily terminal institutions, leading directly into the workforce. In China as a whole, about 50 percent of senior secondary students are now in vocational schools.

With respect to higher education, there was little enrollment from 1949 up through the Cultural Revolution. After the "open door" policy began in 1978, demand for places grew. Because of the limited number of available places, access to higher education was highly competitive and the government controlled admissions through a unified national university entrance examination system, the *gaokao*, which was restored in 1977 (Guo and Lamb



2010). In the late 1990s, there was an enormous and rapid expansion of higher education, with gross enrollment going from less than 10 percent in the late 1990s to 26.9 percent in 2011 (Yuan 2013). The number of students enrolled in higher education rose from under a million to 30 million. The number of tertiary institutions grew from 442 in 2000 to 1,147 in 2006 (Yan 2010.) China has thus moved swiftly from the phase of elite higher education to mass higher education.

Another important aspect of China's education development strategy has been sending students abroad for graduate and undergraduate education. Deng Xiaoping began to send students abroad in 1978 as part of his modernization drive and since then nearly 2.25 million Chinese students have studied outside of China. Today China is the largest supplier of students to universities in many countries, with approximately 194,000 students on American campuses in 2011-2012 (IIE 2012).

After three decades of effort and many milestones, China reached its goal of allocating four percent of its GDP to education (Yang 2013). Education has evolved organically from the expansion of primary education, then secondary, then higher education. Access has expanded enormously and China now runs the biggest educational system in the world. Looking to the future, the 2010-2020 National Medium and Long-Term Educational Reform and Development Plan calls for senior secondary education graduation rates to be at 90 percent by 2020, which, if achieved, would put it ahead of the U.S. high school graduation rate—but with millions more students. The plan also calls for the development of world-class universities. There can be no doubt about China's ambition for and commitment to education.

Challenges in education expansion

As might be expected from such a huge and rapid expansion, it has not been without its problems. In higher education, there has been a widely recognized decline in teaching standards and high unemployment of college graduates. As new graduates rose from one million per year in 2000 to over six million per year in 2011, the unemployment rate among graduates rose to 16.4 percent (McKinsey 2013). Although the employment rate of college graduates rose to 90 percent in 2012, according to the Chinese College Graduates Employment Annual Report of the Chinese Academy of Social Sciences and MyCOS Research Institute (MyCOS 2014), half of all graduates reported that their jobs did not make use of their degrees.

Large-scale educational expansion has produced significant quality and equity problems in elementary and secondary education as well. One of the reasons education was able to expand so rapidly initially is that responsibility for basic education was devolved to the local level (within a national framework of standards and curriculum). But because of the uneven economic development of China, this led to great regional disparities in educational funding, quality of facilities and teachers, availability of technology and access to higher education. The quality of education is significantly lower in western and central China than

in the highly developed cities of the east coast. There are also quality gaps in urban areas between schools for middle-class families and those for disadvantaged social groups such as migrant children.

Over time and as resources expanded, the central government has devoted significant resources to trying to remedy these regional disparities, for example, through funding additional teacher positions in rural areas, establishing boarding schools to replace one-room rural schoolhouses, subsidizing fees for compulsory education and eventually abolishing them, and providing scholarships and loans to students from rural areas for upper secondary and higher education. Also, in many cities, high-achieving schools are expected to pair with lower-achieving schools to improve teaching and management. And as part of the professional learning system of Chinese schools, the lead or master teachers in each school in a district work together to try to share best practices and make standards more consistent across all the schools in the district.

From the 1990s on, there has been increasing attention to quality rather than just quantitative expansion of Chinese schools. In particular, a major curriculum reform tried to modernize the curriculum and teaching methods of schools. The goals of the reform were to encourage more enquiry-based methods and practical hands-on experiences, to put more focus on applied skills, to offer students more choices and optional modules beyond the core curriculum in math, science and languages, and to leave room for more local and school-based additions to the curriculum. Implementation of this curriculum has been difficult for teachers trained in traditional pedagogy and the reform has also been hampered by the *gaokao* (national university entrance examination), which is seen as a guarantor of fairness, but which restricts curriculum innovation and turns much of upper secondary education into an extended and intensive exam preparation period—to the exclusion of other learning. Recent reforms of the *gaokao* in some provinces are intended to try to address some of these challenges. (Tiantian 2014)

Overall, the expansion of China's general education system over the past three decades has been breathtaking by historical standards. And the world-beating results in Shanghai show that China is aiming towards very high standards. But students and parents increasingly complain about the examination pressure and the rigidity and lack of choice in subject matter. Employers view the system as unable to produce students who can apply their knowledge. And the huge regional inequalities mean that students from poor rural backgrounds have relatively low chances of getting to university.

Vocational Education

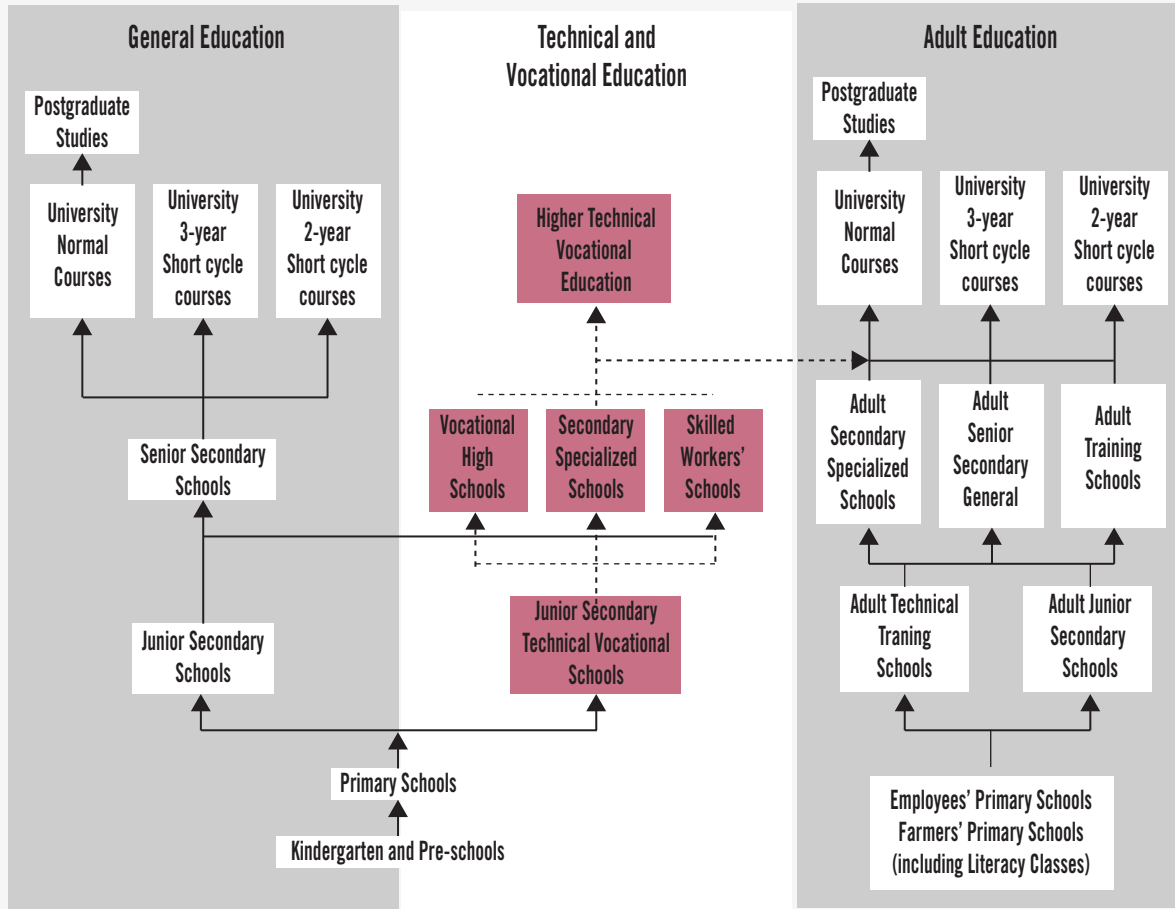
Vocational education has grown along with general education but has lagged behind. Vocational secondary schools were introduced in the 1960s but this policy was reversed in the 1970s because of the view that these structures promoted social differentiation and elitism. During the 1980s, the emphasis on vocational education was renewed, and since the 1980s, VET has expanded substantially. In China, vocational education is provided



through separate secondary schools and tertiary institutions rather than through vocational programs within a general secondary school or community-type college.

Junior secondary vocational schools are found today primarily in rural areas where the economy is less developed. Graduates of junior secondary vocational schools become farmers and lower-skilled workers. Students in junior secondary vocational schools can take the examination to move on to upper secondary schools, but most students who enter upper secondary school come from the junior secondary general school.

The Contemporary Structure of Education in China



Source: Guo and Lamb 2010

At the upper secondary level, there are four types of vocational schools: (a) Specialized high schools provide three-year certificate courses. This is the most popular type of VET. Students then enter the labor market directly. (b) Vocational high schools that have been transformed recently from general senior high schools. After graduation, students either enter the labor market directly or go on to tertiary vocational colleges. (c) Skilled worker schools provide three-year certificate courses for state occupational licenses. (d) Adult specialized high schools provide full- and part- time and short-form courses that can be either academic or technical. For the country as a whole, in 2009-2010 about 22 million

students or roughly 47 percent of all secondary students were in vocational institutions. In 2011, 60 percent of students were in one of the top four specialties—information technology, processing and manufacturing, agriculture and fishery, and finance and trade (Zhang and Jinjie 2013).

Tertiary vocational education mainly enrolls graduates from general high schools and secondary vocational schools. It started in the 1980s but developed mainly from the mid-1990s onward. There are four types of VET institutions at the tertiary level: (a) Vocational-technical colleges or polytechnic colleges provide two- or three-year diploma courses; (b) Specialized junior colleges provide two- or three-year diploma courses, mainly for capacity building rather than technical training (Yan 2010); (c) Technician colleges provide two- or three-year certificate courses for state technician licenses; (d) Adult higher educational institutions provide full-time and part-time certificate courses for knowledge enrichment and self-improvement.

The proportion of students in tertiary education who are enrolled in vocational institutions varies enormously across the country. In Beijing, less than 25 percent of students in post-secondary education are in vocational institutions, whereas in provinces like Guangxi, Fujian, and Sichuan, it reaches 40-50 percent.

Other VET providers

Beyond the diploma programs of the formal VET education system, there is a range of non-diploma programs provided by secondary and tertiary vocational schools and colleges as well as other providers.

As was discussed earlier, since 1978 industry has played and continues to play an important role in vocational training although it is hard to find data on the extent of this training. Chinese State-Owned Enterprises (SOEs), for example, ran their own schools and provided training to their workers in a way that provided an automatic connection between training and jobs. This sector of VET is now being phased down and responsibility shifted to the Ministry of Education as the role of SOEs in the economy is being reduced. Foreign employers in joint enterprises also played an important role in the early years in bringing training and expertise to China while its education system was developing.

The army provides a lot of technical training (Yan 2010) as do some industry associations, labor bureaus and NGOs. In some fields such as Chinese opera, medicine and martial arts, traditional apprenticeships continue the tradition of passing the craft on from one generation to the next. And in recent years, there has been a significant growth of commercial VET providers. According to Yan, there were 21,811 such providers in 2008 (Yan 2010).

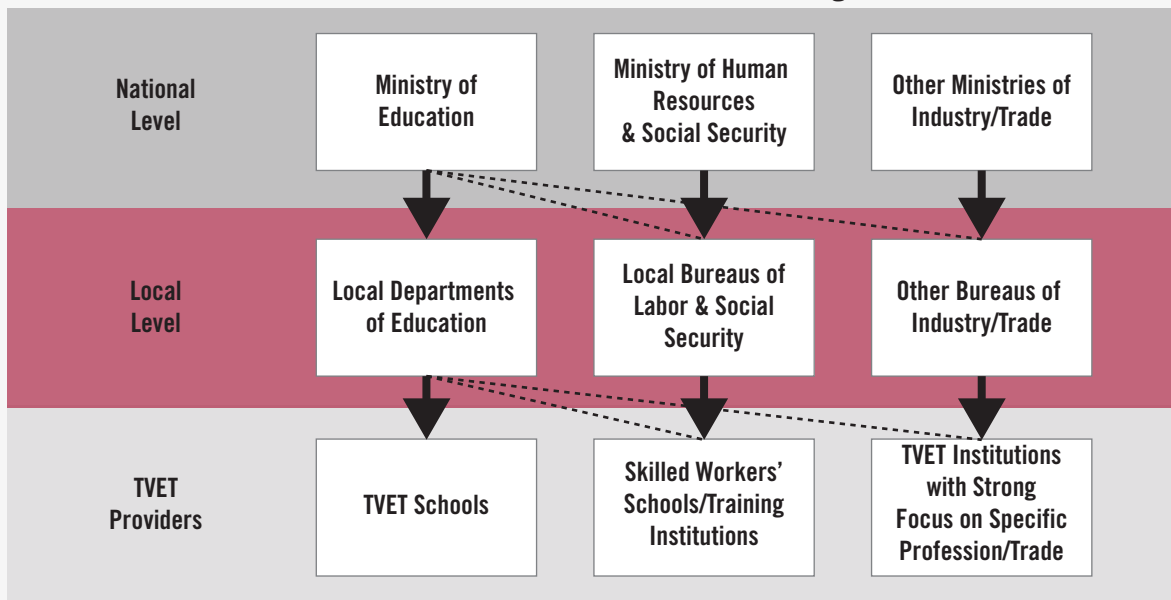
Vocational Education and Training is administratively complex. It is divided primarily between the Ministry of Education, which focuses on occupational and technical education,



and the Ministry of Human Resources and Social Security, which focuses on skills training, but there are other government entities involved as well. Within the Ministry of Education, VET is divided between the Department of Higher Education and the Department of Vocational and Adult Education. The Central Institute for Vocational and Technical Education, attached to the Ministry of Education, provides policy advice to the Ministry. The Ministry of Human Resources and Social Security's Department of Occupational Capacity Building is responsible for administration of VET programs in technician colleges and skilled worker schools. They are also responsible for developing occupational skills standards, assessing skill qualifications and issuing occupational licenses. They partner with the Department of Employment Promotion to run short-term skills training programs in job centers around the country. In 2004, the Chinese government established an inter-ministry mechanism to try to better coordinate activities of the seven ministries related to VET: The Ministry of Education, the National Development and Reform Commission, the Ministry of Finance, the Ministry of Labor, the Ministry of Personnel, the Ministry of Agriculture and the Poverty Alleviation Office.

Each of these administrative entities is mirrored at the province and local level. It is said that the administrative structure is so complex that nobody understands it! (Zhang and Jinjie 2013).

Administration of Vocational Education and Training in China



Source: Guo and Lamb 2010

China now runs the largest VET system in the world. There are more than 15,000 vocational institutions at the secondary and tertiary levels combined, more than 22 million students in secondary VET and almost 10 million in post-secondary VET. This equals 47.6 percent of total tertiary education enrollments and 47.6 percent of secondary (Zhang and Jinjie 2013). The VET system has developed enormously in a relatively short period of

time, providing skills for the economy and opportunities for millions of students, especially those from lower income or rural backgrounds. But the system has significant problems as we uncovered during our study.

CHALLENGES IN CHINA'S SKILL DEVELOPMENT

As the earlier discussion of the challenges facing China's economy made clear, China is at a turning point. All of the interrelated challenges it faces: the need for an alternative to the low-wage, low-skill export economy, the need to address its environmental challenges, the need to improve its agricultural productivity, the need to raise living standards for poorer Chinese, and the declining size of its labor force and growing size of its elderly population—all require dramatic changes in the skills of its workforce.

As we attempted to assess how well China's VET system is addressing these challenges, we visited secondary vocational schools, tertiary vocational colleges, Chinese and foreign employers, and Chinese government officials and academic experts in four cities—Shenzhen, Tianjin, Shanghai, and Beijing (a list of interviewees can be found on page 34). We saw both relatively strong and relatively weak examples of VET institutions, but compared with top performing VET systems in other parts of the world, overall China's VET system is in need of major restructuring.

There are, in fact, many strengths in China's VET system. Historically, expenditures on VET have been substantially lower than expenditures on academic education but this is changing and expenditures have grown significantly. This has enabled VET to expand enormously to the point where about half of secondary school students are in VET schools. It is thus absorbing and educating children from lower-income backgrounds who previously were not in school and enabling a far higher proportion of younger age cohorts to graduate from secondary school. Increased resources have also been poured into handsome modern buildings and sometimes equipment. Many of the schools we visited had developed connections to firms, albeit with the caveats discussed below. In places like Shanghai, which have high educational standards, the mathematics scores of VET students far exceed those of academic students in many other countries, creating a strong foundation for advanced technical training.

But VET in China has many challenges:

1. *The curriculum design of VET programs is narrow.*

Many of the programs we observed seemed to be focused primarily on the entry-level skills students need for their first job and did not provide the depth and breadth of skills that would be needed to move up in a career. This partly reflects the manpower planning model that had underpinned the development of some of the schools. But as the lifetime of work skills gets shorter and shorter and as China's economy changes, VET will need to include more general education so that workers can be more adaptable and able to learn new skills. Although there have been efforts to broaden



VET curricula, the skills are generally not high enough for a rapidly changing economy or to enable individuals to move up in the economy. Further, curriculum development does not seem to be designed with the most advanced companies or leading edges of the economy in mind. Nor was there the strong focus in the curriculum on innovation and entrepreneurship, features that are increasingly prevalent in the world's strongest systems.

2. *Connections to industry are weak.*

Although there are connections between VET schools/tertiary institutions and industries, they are weak compared with those in the best systems. Some VET institutions have modern buildings but not modern equipment, for example, so graduates are not being prepared adequately for the current job market. Organized work experiences typically consist of only a few weeks of working at the end of a course. They rarely incorporate the kind of sequenced and supervised interplay of learning and work that characterize the world's best systems. VET institutions do not seem to be connected to foreign-owned companies that often incorporate the most advanced industries and international standards. And many employers do not even pay attention to the certifications provided by VET institutions in their hiring. One of the strongest examples of integrated work and learning experiences we saw was in a state-owned company, the Shanghai Construction Company, which ran both a secondary vocational school and a college. It trained students on the most modern equipment, provided significant supervised work experience in the second and third years and provided opportunities for upward mobility through the company, accompanied by more advanced training. But since many state-owned enterprises are out of date and unproductive and their role is being significantly reduced in the economy, this tradition of industry-run schools is being phased out. Overall, there is a huge disconnect between the VET system and employers and there are few incentives for employers to cooperate with VET institutions. Given the high rates of labor mobility in eastern cities, there is indeed little reason for employers to invest in helping to train someone who won't stay with a company for very long.

3. *VET has low status in the public mind.*

Beyond the weak connections to industry lies a cultural problem. In China, the idea that “those who do mental labor can govern those who do manual labor” has deep roots, going back to the Analects of Confucius, and has influenced the Chinese view of knowledge and education. These status distinctions between academic and vocational education exist in most countries but are deeply rooted in China. Whereas Dewey, for example, advocated working with both hands and brain, in China, education has come to mean “academic reading”. Consequently, vocational education is perceived by the public as low-status.

4. *Structural barriers.*

Compounding this cultural problem are structural ones. Until recently, there has been no real pathway between vocational education and academic education. While the national university entrance examination system, the *gaokao*, can theoretically be taken by any student, only students in the general academic curriculum are well enough prepared

to be successful. For most students in vocational education schools, education finishes at the end of secondary school. Vocational education is literally an educational dead-end. Add to this the fact that blue-collar salaries are far lower than white-collar ones. Cultural, structural and economic reasons therefore suggest that there is no good reason why Chinese parents should encourage their one child to go into vocational education if they have the option of taking the general (academic) path. This is beginning to change as specialized technical post-secondary institutions are expanding and as pilot efforts begin to create pathways between vocational and academic education (see experiments and pilots below) but these are small at present.

5. *Mismatch between employers needs and graduates capabilities.*

Employers we interviewed, both in foreign-owned and Chinese firms, complained of new employees' inability to apply their knowledge. "Students know bookwork and nothing else" was a widespread complaint. Graduates were also seen as lacking the kind of general employability skills needed in modern settings—the ability to work in teams, think critically and solve problems without having to be told what to do. Childhood in China is for studying; there is little of the formal or informal work experience through which students in other countries acquire some of these general skills. With respect to engineers, for example, managers at Boeing and Walmart said that after hiring Chinese tertiary graduates from engineering programs, it takes them another two years to get them up to a United States bachelor's level standard in engineering, primarily because of their lack of applied experience and their reluctance to undertake hands-on work. The annual AMCHAM surveys of U.S. employers reveal similar concerns about graduates at all levels (AMCHAM 2014).

6. *Faculty have limited experience in industry.*

Another aspect of the disconnect between the VET system and industry is the background of most VET faculty. The main role of teachers in China is to provide academic content and guidance on students' moral or character development. Consistent with this, most VET faculty do not come from industry, have industry experience or ways to keep up-to-date with technical and scientific advances in industry. There is an urgent need to upgrade the industry knowledge of VET teachers as well as to find ways of hiring a higher proportion of faculty with industry backgrounds.

7. *Standards and qualifications systems need development.*

Occupational standards and qualifications systems are essential to the functioning of VET systems because they provide a means to establish quality and consistency across institutions and allow worker mobility. Vocational colleges in China have certificates and diplomas but the existing five levels of skills standards are only for some of the highest demand, lower skill occupations. The world's best occupational standards are broad, are linked to the leading edges of industries so that they are constantly updated, and integrate academic and vocational skills within an overall qualifications framework. Such a standards and qualifications system does not yet exist in China.



8. *Adult education is undeveloped.*

The VET system is designed primarily to provide initial training for young people to enter employment. But as the life cycle of skills gets shorter and as China transitions from a low-skill to a higher-skill economy, the need for skills training of adults will greatly expand. There are some mechanisms for upskilling the current workforce, for example adult schools and contract training with employers, but lifelong learning is relatively undeveloped in China. It exists but there is not an overall system with a comprehensive policy and legal framework. The role of technology in training adults, for example through online courses, also appears to be relatively undeveloped.

9. *Bureaucracy of VET hampers innovation.*

Split as it is between two ministries, other national entities and a host of province and local levels of government, the complex and bureaucratic administration of VET makes it hard for VET institutions to adapt to the changes in the economy quickly. The Chinese economy is becoming more market driven while VET remains government planned. It will be important to create mechanisms, such as local industry associations to swiftly communicate the changing needs of business to VET institutions and different governance mechanisms to enable local institutions to respond.

These problems appear to be pervasive in China's VET system. The immense diversity in levels of development between different parts of the country, for example between the coastal cities of Shanghai, Tianjin, Shenzhen, Beijing and poorer provinces like Yunan need to be taken into account in fashioning solutions. But as China seeks to modernize agriculture, move up the value-added chain in manufacturing, and expand its service and science- and innovation-based industries, it will need to address these major deficiencies in the design and functioning of the current VET system if it is to succeed.

REFORM AND INNOVATION**New Government Policy Directions**

All this may be about to change as China enters a period of intensifying focus on and experimentation in VET. In the 1980s and 1990s, VET schools and colleges expanded enormously in scale but had major problems of quality. From 1996 to the present, the government has adopted a series of policies and measures to both further expand VET and try to improve its quality. However, as the analysis above suggests, these have met with mixed results so far.

In 1996, the first national vocational education law among other things expanded tertiary vocational education alongside the expansion of universities that also took place in the late 1990s. However, while expenditures increased, they never matched the levels of general or academic education. For example, in 2005, academic secondary schools received 89.46 percent of the total budget for secondary education while secondary VET schools received

only 10.34 percent. So the infrastructure and equipment of most VET schools was very old (Xinhua News Agency 2014).

Then in 2005, after three national conferences on VET, the State Council, China's cabinet, issued a new policy document: "Decision on Accelerating the Growth of VET" (He 2009). Students in rural areas were exempted from upper secondary school fees and one hundred key or model secondary and tertiary vocational schools and colleges were established to pilot new approaches. The government also began to encourage "dual certificates" for VET teachers to attract more industry expertise into VET programs.

The global recession of 2008-2009 caused massive unemployment in China and created a renewed sense of urgency about both the social and economic purposes of VET. Premier Wen Jiabao's 2009 annual report to the National People's Congress designated VET as "the next key target of education promotion". VET was seen as a weak link in the education system compared with the successful development of nine years of compulsory education and the huge expansion of higher education. Critical shortages of qualified technicians and skilled workers, mass unemployment in the economic downturn, and the higher employability of VET graduates compared with university graduates all led to a greater focus on the role of technical training in meeting the country's economic and social goals. A series of measures were taken to try to strengthen the quality of VET, including the creation of the inter-ministerial coordination mechanism for formulating overall strategies and policies at the national level, while at the local level, provincial governments were held responsible for planning, resource allocation and supervision of VET institutions. Many of the measures undertaken at this time were focused on increasing rural participation in education and reducing unemployment, with various promotion targets spelled out.

Most recently, and perhaps most significantly, in November 2013, the new President of China, Xi Jinping, at the Third Plenum of the 18th Central Committee of the Communist Party, committed the country to further economic reforms, calling for "comprehensively deepening economic reform by centering on the decisive role of the market in allocating resources" (China.org.cn 2014b). The Central Committee went on to discuss the imperative of narrowing the gaps in education and "quickening steps in the development of a modern vocational education system" (Decision of the Central Committee, articles 42 & 43). The State Council confirmed the centrality of VET in China's national strategic and talent development and called for: (1) more innovation in VET models, especially with respect to stronger cooperation/integration between VET institutions and companies; (2) strengthening the quality of VET to include more "comprehensive competencies" including soft skills; and (3) reducing the national government role from managing the VET system to providing significant financial support but decentralizing more authority to the province level, to schools themselves, and to the market in the actual running of VET institutions. Premier Li Keqiang's government work report to the National People's Congress in March 2014 underscored the need for the development of a "modern employment-oriented vocational education system".



Experiments and Pilots

The general direction and high-level policy principles have been enunciated. But how can China achieve this massive transformation from a primarily planned economy and education system to a market-oriented VET system—and in a country with such vast regional differences in economic level? One of the characteristics of China’s development has been its pattern of starting pilots or models at the local level, allowing them to test out what works or does not work and then scaling up the most successful aspects of the models to a whole region or even the whole country. Pilots are seen as useful learning tools: “Small steps can produce big things.”

In the general education system, the idea of key or model schools (which receive more resources than other schools) is being downplayed compared with the past because of concerns about the inequities they created, but the idea of key schools is an important part of China’s strategy for improving the quality and relevance of VET.

We visited a number of these key schools and colleges. The section below sketches the origins of some of these key secondary and tertiary institutions in four different cities and the “reforms and developments” they are pursuing. In 2006, the Tertiary VET 211 Initiative also focused on upgrading 100 tertiary vocational colleges. In addition to these national models, there are several thousand key vocational education institutions designated by local governments.

The institutions we visited were all different because of the circumstances and period in which they were founded, the nature of the local economy and their technical fields of focus. But all were trying to address at least some of the key problems identified as challenges in the earlier section, i.e., updating the curriculum, creating connections to industry, attracting teachers with more experience in industry, and developing some pathways between vocational education and higher education.

Beyond these experiments in individual institutions, there are broader developments in some cities and provinces. In Shanghai, for example, a leading province in both economic development and education, several consortia exist to promote cooperation between companies and education institutions in particular sectors such as nursing, IT, transport, tourism, and finance. The goal of having teaching staff with dual capabilities is also being pursued through requiring traditional VET teachers to spend one month each year in an enterprise, while also recruiting part-time teachers from industry. A more applied version of the university entrance exam is also being piloted to build bridges for students from vocational education to reach higher education. To promote greater equity, Shanghai has opened its VET schools to the children of migrant workers and 90 percent of students in secondary vocational education receive fee subsidies. Shanghai has also paired some of its VET institutions with their counterparts in more rural provinces such as Yunan and Xinjiang to strengthen curriculum, teacher training, and to develop cooperative enrollment schemes through which students can begin in one institution and finish in another institution with higher-level courses (Zhang and Jinjie 2013).

INNOVATIONS IN VET

Shanghai Institute of Health Sciences

The Shanghai Institute of Health Sciences is a model for China in allied health fields. It educates 4,000 students in a large new campus in the Pudong area of Shanghai and its physical infrastructure includes simulation environments for many health fields. It receives half its funding from the national government and half from the Shanghai Municipal Education Commission and it offers both upper secondary and tertiary (diploma and associate level) programs. Students pay tuition but poorer students and those from rural areas receive their education free. Rural students are encouraged to go back and provide much-needed care in their home communities after training.

The training of nurses is a particularly important area. Nursing in China has been below international standards; nurses are closely supervised by doctors and have not been expected to exercise much independent judgment. The psychiatric aspects of nursing are also less developed. The college's goal is to raise the status and quality of nursing by changing the curriculum, the amount of clinical experience, and nursing standards. Students work for eight months in hospital after they finish their course. Every three years, college faculty members spend three months in a hospital and some of the faculty work at a hospital but teach at the college half time and are jointly paid. One hundred percent of the students pass the Chinese nursing exam and some take the U.S. nursing exam (in English) too since there is a need for international nurses in Shanghai and potentially abroad as well.

Internationalization is key to the College's reform strategy. The College seeks faculty from many countries, aiming to introduce modern curricula and teaching methods. They also send many of their own faculty and some students abroad for periods. Their long-term goal is to develop an AA degree that is comparable to international levels. (The government does not think it realistic for most nurses in China to obtain a BA, and only 25 percent have an AA now. Most have a diploma). The College's Dean of Nursing is also Chair of the National Nursing Education Committee so the College provides a model for how China as a whole can gradually move towards international standards for all nurses. The school is, in fact, visited by delegations from all over China.

Tianjin Sino-German Vocational and Technical College

The Tianjin Vocational and Technical College is part of an enormous Tianjin educational park that includes several other universities and technical colleges. Tianjin is an area of extremely rapid economic growth because of its proximity to Beijing and to a very large port. The programs of the college have developed as the local economy has changed.

The institution was founded as a training center in the mid-1980s, shortly after the opening up of China. It was a joint venture between the German and Chinese governments in which Germany provided funds and technical assistance to help to develop German-style



dual system VET in several cities in China. This is the biggest cooperative project in education between Germany and China. The college was linked to a Chinese state-owned enterprise in steel production, which also had German experts. It provided mechanical and electrical technicians and language training for the firm. The college still has a wing of offices for German experts but has now expanded beyond its Sino-German origins as the economy of the area has grown to include relationships with many industries and countries. The college now has specialty cooperation programs with Spain, Canada, Australia and Singapore, and an Italian-based European network on lifelong learning.

The college offers nine fields of study including advanced manufacturing, automation, aeronautics and astronautics, new energy and new materials, automobile technology, ICT, economics and business management, applied languages and culture, creativity and design. The head of the college has also visited the U.S. to study community colleges, which are of interest because of the close connection between community colleges and local economies, and the flexible system of transferring credit, which enables students to go back to school for further study or to move on to a university.

Tianjin Institute of Mechanical Technology

Sharing the same giant educational park in Tianjin is the Tianjin Institute of Mechanical Technology, a Tianjin City Demonstration Secondary Vocational School. It started in the 1950s as part of a state-owned factory, the Tianjin First Machinery Factory, to meet the factory's own needs for labor. Now, the school has 7,000 students and 15 majors in numerical control, automobile systems, information technology, and electronic and mechanical systems. And the school is connected to a large industrial group made up of a lot of different companies. Automobile repair, agricultural equipment production, and mold making are particularly important specialties. Students who attend this school have graduated from junior secondary school and will attend for three years. A small proportion will stay on for two more years to obtain a higher certificate. The curriculum is closely linked to the entry-level demands of the local labor market.

Most students come from the local area or nearby provinces and a sizeable number are from disadvantaged backgrounds, especially the children of migrant workers. These students attend free of charge. Students come to the school at very different levels academically. Teachers regularly stay after school to provide help to students who are weaker academically – exemplifying a Chinese saying, “Who loves his children is human and who loves other people's children is a god.”

Beijing Business School

Beijing Business School is an upper secondary model school. Funded by the Beijing Municipal Government and the national government, it is run under the auspices of the Beijing Education Commission. Students come from Beijing but also other provinces. And it offers courses in business and a wide range of other subjects..

The school plays a number of roles more broadly in the reform and development of VET. For example, it provides teacher training for faculty in other VET schools in the field of hotel management. The school works with Chinese hotels and VET research experts in the development of the training. It also took responsibility for a reform of the accounting curriculum based on analyzing the positions in accounting and the skills and competencies needed. This curriculum is now used broadly in VET schools. In addition the school is developing digital resources in accounting and e-business that will be made widely available throughout China. Also, as a key school, it has an obligation to work with VET in a less developed province to improve VET there.

A particular challenge for the Beijing Business School is that since the national government has recently announced that it wants to limit the growth of Beijing, focusing Beijing on its political and cultural roles but reducing its roles in manufacturing and finance, the school will have to significantly change its course offerings.

Beijing College of Finance and Commerce

Beijing College of Finance and Commerce (BCFC) is one of 27 tertiary vocational colleges in Beijing. It was founded 56 years ago as an adult school. Then, after the Cultural Revolution, it played an important role in training cadres for government and state-owned enterprises. About 60 percent of the managers in the Beijing government and Beijing area state-owned enterprises were trained at BCFC.

Today it has 8,000 students and trains people for a wide variety of occupations in Beijing. It also trains teachers for other VET schools in finance and business. Graduates are primarily employed as frontline supervisors, not managers. Only ten percent of BCFC graduates have the opportunity to go on to get a BA, often through online learning or self-study. College officials are interested in learning more about U.S. community colleges, recognizing the need for better bridges between educational levels and institutions.

BCFC also has a small school of international studies, which organizes joint programs with colleges of further education in other countries. About 100 students have finished three years at BCFC, then gone to the United Kingdom or New Zealand for a year and completed a BA. Students then try to get work experience abroad before returning to China because employers prefer people with international experience.

Shenzhen Polytechnic

Shenzhen is in the heart of Guangdong province, a province of 100 million people and the earliest of the special economic zones. In the early stages of the opening up of China, the joint ventures were in basic manufacturing, most workers had very low educational and skill levels, and companies had to invest internally in whatever training was needed to run their businesses. At that time, Shenzhen had a secondary VET school and a university but no tertiary VET institution. In the early 1990s, new types of businesses came in and there was



a growing need for higher technical skills. Shenzhen Polytechnic was created in 1993 as a tertiary VET institution with 24 students.

Today, it has 30,000 students studying 80 specialties on five campuses in the following schools: electronic and communication engineering, computer engineering, mechanical and electrical engineering, economics, management, media and communications, art and design, animation, applied foreign languages, construction and environmental engineering, applied chemistry and biological technology, automobile and transportation engineering, medical technology and nursing, and humanities. Shenzhen is designated as a top VET model by the national government.

Collaboration between Shenzhen Polytechnic and local industries began right from the start, especially in the design of curriculum. In the first ten years, as the college was growing very fast, the curriculum was very focused on skills for immediate application on the front line. Now, there is an effort to broaden the curriculum towards a more comprehensive education to ensure that students have a stronger basis for future development, although this sometimes runs up against the national and provincial occupational standards. Although there is close collaboration between Shenzhen Polytechnic and industries in the design of the curriculum, work experience consists mainly of a work placement in the last semester. Training of faculty is an important need as is creating more pathways for students to move on to degrees. In fact, Shenzhen Polytechnic would like to become a university of applied sciences.

Shanghai Dianji University

Shanghai Dianji University sits on a gigantic new campus that is being built in what will be the new Shanghai free trade zone. Begun in 1953 as the Shanghai Electrical Machinery Manufacturing School, Shanghai Dianji was raised to university status in 2012 and a second campus added. It has 12,000 students, 70 percent of whom are studying engineering at the three-year diploma or the four-year BA level. Students who graduate from the diploma program can go on for another two years to get a BA. Shanghai Dianji has 26 undergraduate majors and 15 diploma programs. Its goal is to cultivate field engineers with a focus on energy equipment manufacturing (for wind, solar, and nuclear). Graduates have a 100 percent employment rate.

The university has pioneered relationships with state-owned and Chinese private enterprises in the Shanghai area. Each major has a board of ten people drawn from industry and other vocational schools to advise on the curriculum. Some of their schools have “double deans”, with one dean being drawn from the school and the other employed by industry, but seconded part-time to the college. College faculty spend time in industry and students have internships. Company officials also become part-time teachers, run short courses and supervise students when they intern in companies. These practices are not common but are of increasing interest in China. All these school-enterprise connections are financially subsidized by the Shanghai Municipal Education Commission. Companies can also send employees to the college for specific training.

The Shanghai Construction Group.

The Shanghai Construction Group is a state-owned enterprise that was founded in 1953 as the construction bureau of the Shanghai government. Today, it is the 16th largest construction company in the world. It has built the most modern skyscrapers in China and now does work outside China too. It works with the world's most famous architects and employs 20,000 people at the corporate management level who have strong technical skills in engineering and architectural design. It also employs 9,000 construction site managers as well as innumerable semi-skilled and unskilled laborers.

The company recruits 1,500 people per year, 60 percent from universities and 40 percent from the vocational track. The company has its own vocational secondary school and vocational college (we visited Shanghai Jianfeng Vocational College and spoke with representatives from both the secondary and upper secondary levels). These charge tuition but poorer students receive free tuition. In the first year, students study math, Chinese, English, engineering, computer-aided design, and mechanics. In the second year, courses relate to construction engineering: costing, construction techniques, and design. In the third year, students do practical work onsite; they rotate through departments and get paid their expenses. Nine hundred students graduate each year from the secondary school and six hundred from the college. Thirty percent of the secondary school graduates will go on to the college and ten percent of diploma graduates go on to get a degree at a local university. The Shanghai Construction group employs about one third of the graduates and 100 other companies come to the college to recruit.

The school has the most up-to-date equipment for tunnel construction and construction simulations. Construction managers from the company teach in the school as well as teachers with more academic engineering backgrounds, who are also sent to work in the construction company in the summer. The curriculum is constantly adjusted to follow new developments in construction and the company houses a research center on innovation in construction. Many of their senior managers have studied or had work experience abroad. A Shanghai association of construction companies sets the standards for various educational certificates, such as safety, costing, materials, interior design, and landscaping, but there are not yet unified standards for China. The company believes in lifelong education and graduates of the secondary vocational school can rise through the ranks and may eventually be sent by the company to get a BA and MBA.

The Shanghai Construction company school and college seems like a strong VET model but as China seeks to reduce the role of state-owned enterprises in the economy, this model of schools run by state-owned enterprises will disappear.



International Benchmarking and Partnerships

Since the beginning of the open door policy in 1978, China has used internationalization as a way of driving internal reform. In the field of VET, China has conducted international benchmarking reviews and created partnerships with a number of countries, in particular Germany, Japan, Singapore, UK, and Australia but also Sweden and, more recently with U.S. community colleges.

In some places, models from other countries are being directly introduced. For example, Singapore has joint projects with institutions in Tianjin and Hanzhou. Warwickshire College in the UK has partnered with a counterpart in Qingzhou, Shandong province. Known as the China-UK National Skills College, it will offer British-style VET emphasizing hands-on experience and entrepreneurship. The Tianjin Sino-German Technical School (see section on page 24) has been developed with help from the German government from its inception, and some German firms that operate in China, such as Siemens, VW and BMW, are providing a small number of German-style apprenticeships. Since 2008, the China Education Association for International Exchange has worked with the American Association of Community and Junior Colleges on leadership development and training, market-oriented curriculum design, and network building practices for Chinese administrators. And more recently, there have been proposals to develop 100 community colleges in China.

So there is a wealth of experimentation going on. But none of these international models can be adopted wholesale; they will need to be adapted to the Chinese context. For example, although the German dual system model is much admired, it is hard to make this work in China. There are large cultural differences between the Chinese veneration of academic learning and the traditional German respect for vocational education. China also lacks the long tradition of close cooperation between VET institutions and private companies that underlies the German apprenticeship system. In Germany, a vocational certificate is required to get a job, whereas in China, it is possible to get a job without one. And in Germany, vocational education starts after general education, not in parallel. With respect to the Singapore model, China lacks the close and easy collaboration between ministries that has enabled Singapore's economic development and educational planning to work hand in hand. And while the market orientation of U.S. community colleges is attractive in China, China is still transitioning from a planned to a free market economy, so it will be some time before this local market approach to VET will be able to work effectively.

China is in a period of intense reform. On March 26, 2014, Deputy Education Minister, Lu Xin said that China's aim is to offer a world-class education system by 2020 to improve labor quality and increase employment (Xinhua News Agency 2014). There are many opinions in China about how to improve VET—from abolishing secondary vocational education and moving all vocational education to the tertiary level to creating a separate vocational pathway from basic education through to degree level to blending vocational and

general education for everyone and at all levels. Particular attention and debate is currently being focused on the need to reform the university entrance examination—to give more opportunities to people from lower-income and rural areas and to students with special abilities, not just high general test scores.

TOWARD WORLD-CLASS VET SYSTEMS

There are several different national models of VET systems. Some, such as Singapore, are education-based; some, such as Switzerland are employment-based, and others are hybrid. But no matter what the overall model, from our studies of VET systems in different parts of the world, and in particular, Australia, Denmark, Singapore, Switzerland, Germany, and the United States, we have identified what we believe to be the key characteristics of successful VET systems in the global knowledge economy of the 21st century:

Characteristics of the World's Top VET Systems

A top VET system:

- Provides students with a broad education designed to prepare them to easily gain additional skills and knowledge needed as their career goals, technology and work organization change over their employed lifetime
- Provides opportunities for students to learn and to practice necessary cognitive and non-cognitive skills in an authentic industry setting
- Provides opportunities for students to learn the theory behind the practice
- Creates learning environments in which students can learn and practice on state-of-the-art equipment
- Provides opportunities for students to move from vocational track to academic, university track and vice-versa
- Provides opportunities for students to move up from the lowest levels of occupational preparation to the highest levels of academic and professional preparation with career guidance along the way
- Provides standards and qualifications widely recognized in the labor market and continually adjusted to the leading edge of industries, including the increasingly global nature of occupations
- Adapts to the level of economic development of the economy in which the student will work and to the level of technological advancement and work organization characteristic of that economy



- Provides a distribution of training slots that is reasonably related to the demands of the economy, in terms of occupations and levels of qualifications needed to operate the economy
- Provides instructors who have industry experience and whose knowledge of the industry is fully current with state-of-the-art practice
- Provides incentives adequate to attract the necessary number and quality of instructors for each occupational group and qualification level
- Provides incentives adequate to attract qualified students to each level of the skills training system
- Builds on a basic education system that provides students entering the vocational education system with the skills and knowledge needed to engage productively with the vocational education system
- Creates a brand that makes vocational education an attractive opportunity to young people who have options (CIEB, 2014)

What China Needs to Do

These principles of international best practice could be used to analyze and improve VET systems in any country. They would need to be adapted to the context of particular countries before being adopted. Historical influences, value systems, concepts of industry involvement, and models of collaboration all vary between countries and need to be taken into account.

From our research, we offer the following broad recommendations about what China needs to do:

1. *Create models of systems at different stages of economic development.*

Any VET system needs to be matched to the level of economic development. China is so large and has so many stages of economic development that a single unified model is probably not feasible. Rather VET systems should be substantially designed at the province or city level. Programs, institutions and skill standards should all be matched to the stage of development of the city/province but these different levels should be nested within a broader national framework, allowing some students in each province the opportunity to move up the national ladder.

2. *Build a governance system that is substantially employer-driven.*

It is critical to build a governance system at every level — national, city/province and institutional — that engages employers more effectively in the design and implementation of VET. Employers, especially private employers, need to be centrally involved in assessing current and future skill demands and the types of equipment and

training needed in a rapidly changing market. For example, at the local level, mayors, employers, industry associations, and economic development and education officials could constitute the VET governing board. Government also needs to encourage business recognition of vocational degrees and incentivize businesses to improve the quality of the work-based part of VET.

3. *Redesign the programs and curricula of VET institutions.*

Use industry committees to redesign the curriculum, creating new structures of experience for students either in real apprentice or “sandwich” type situations or in simulated industry environments in VET institutions. In either model, goods and services could be produced and sold at market rates while students are paid at a substantial discount to adult rates. Key positions in VET institutions should be held by people with joint appointments in industry or industry associations.

4. *Create incentives for employer participation and increasing standards.*

All firms, including state-owned enterprises, should be taxed a training fee which is used to support the VET system. This tax would be waived for firms that offer youth apprenticeships and a substantial program of continuing education for their adult workers. The waivers would be granted by local boards based on national criteria. VET institutions should also be given subsidies to align themselves with the most globally advanced, highest productivity firms in the industries in which they offer programs and to continuously upgrade their programs to international standards.

5. *Build bridges between VET and academic and higher education.*

Education and training need to be conceived of as lifelong pursuits that enable individuals, enterprises and nations to continually adapt to rapid change. Bridges and pathways should be built between VET and general/academic education and higher education. There are many different models for doing this, for example, creating applied universities as the capstone of the VET system or developing community college-like institutions that provide students both technical and academic options and flexible credits towards adult education. These could be tried out in different parts of China to see what works best. Whatever the model, the principle should be “no dead ends.”

6. *Address the low public perception of VET.*

The measures above would contribute substantially to this but there may also need to be an accompanying explicit campaign to modify the traditional Chinese emphasis on academic learning and diplomas towards a broader conception of people’s comprehensive abilities of “hearts, hands and minds.”



In Conclusion

As China pursues its dream of becoming a “modern, harmonious and creative high-income society,” many changes will be necessary—in the economy, in the legal system, in the financial system—and certainly in the education system. China is on the verge of a transformation as profound as that initiated by Deng Xiaoping in 1978. The bottom line is that virtually everything that China wants to accomplish depends on a dramatic improvement in the productivity of the Chinese worker, which, in turn, depends on a dramatic improvement in their education, skills, flexibility and ingenuity.

China has a history of using international benchmarking to drive internal reform. We hope this report will contribute to that tradition and will be useful in Deng Xiaoping’s phrase “to learn truth from facts.” We thank our Chinese interlocutors for their willingness to candidly share their concerns and ideas, without which this report could not have been written. At the same time, many countries share similar challenges to China in redesigning their education and skill-formation systems for the 21st century. We therefore hope this report and the larger VET study will be helpful to other countries as well. We have much to learn from each other.

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CUI Liquiang, Shanghai Department of Human Resources and Social Security and Center
Director for Vocational Skills Testing Authority

QIAO Gang, Researcher for Vocational Education from Shanghai Business College

ZHAO Qianghua, Manager General for HR in Shanghai Construction Group

LI Hui, Macro Economist

LIU Jianghui, Economist, Finance

XU Jinjie (Maggie), Center for International and Comparative Education

BAI Xinyue, Teach for China

HU Guoyong, Professor

XIA Huixian, Dean, School of Education

YANG Xiuying, Professor and Director of Electronic Communications College

Shanghai Municipal Education Commission

LAO Xiaoyun, Director, Division of Vocational and Adult Education,

LEI Song, Division of Vocational and Adult Education

Shanghai Academy of Environmental Sciences

YANG Guo, Director of the Institution of Vocational and Technical Education

East China Normal University

WEIPING Shi, Professor, Director, Institute of Vocational and Adult Education

Shanghai Dianji University

RUOFAN Yang, Party Representative of Shanghai to the National Congress and Vice
President of the University

WUDON Wang (Kevin), Director International Affairs Department

JUN Kiu, Assistant Dean of School of Mechanical Engineering

TIANYU Liu, Associate Professor School of Electrical Engineering



Shanghai Institute of Health Sciences

WANG Charles, Director, International Exchange Office

TANG Lei, Vice President of Academic Affairs

Shanghai Jianfeng Vocational College, a Shanghai Construction Group school

HUI Xu, President

XIUFAN Yang, Headmaster

Education Reporters

SHAOXIAO Dong, Shanghai Station, China Education Daily

FENG Zhao, Director, Shanghai Education, an Education News Journal

Beijing

Ministry of Education, Central Institute for Vocational and Technical Education (CIVTE)

WANG Jiping, former Director General

LIU Yufeng, Director, Division of International Cooperation and Comparative Education

Beijing Business School

XIAOHE Shi, General Secretary

GUOCHENG Liu, Deputy Principal

LI Ji, Director, Institute for Vocational and Adult Education at the Beijing Academy of Educational Sciences

DAYONG Yuan, Assistant Research Fellow

Beijing Vocational College of Finance and Commerce

WANG Changrong, President

TENG Long, Vice President for the School of International Education

LU Yizhong, Vice President in Charge of Teaching

YONG Pan, Director, Foreign Affairs Office, School of International Education

QINGYING Xu, Teacher, School of International Education

National Institute of Educational Sciences

QIN Lin, Research Center for International Comparative Education

LI Ji, Head of Institute of Vocational and Adult Education, Beijing Academy of Educational Sciences

JIAN Zheng, International Education Cooperation and Benchmarking Research Division, Vocational and Technical Education Research Center, Ministry of Education

Economists

WANG Qian, Director of Research, China Investment Corporation
LI Hongbin, C.V. Starr Professor of Economics in Tsinghua University

American Chamber of Commerce China

WANG Patrick, Vice President, Government Affairs
JIN He, Senior Program Officer for Education, Ford Foundation
David Tulloch, Economic Officer, U.S. Embassy
Jonathan Ostroff, Abacare Group
GONG Sherry, Hogan Lovells LLP
Ira Cohen, Executive Director, China Programs, University of Maryland

Beijing Normal University

LIU Yufeng, Director, Division of International Cooperation and Comparative Education
QIDING Yu, Professor, Faculty of Education, Institute of Vocational and Adult Education,
National Academy for Vocational Education, Executive Director

Tianjin

Tianjin Business Leaders

HE Amanda, Assistant Chapter Manager, American Chamber of Commerce Tianjin
LI Anna, Chapter Manager, Tianjin Chapter, American Chamber of Commerce Tianjin
LUO Rossi, Senior Associate, TriVista Business Services Co
Eelco Van Kuilenburg, Business Development Manager, Euro-Com International
Ruth Lycke, Chief Executive Officer China, InVision
Olivier Rochefort, General Manager, Hotel Nikko Tianjin
WEI Chen, Vice President, China Site Manager, Xerox
LIU Catherine, Director Sales and Marketing, Hotel Nikko Tianjin
Jeff Foster, Operations Manger, Boeing
Michael Hart, Managing Director, Jones LaSalle, Tianjin

Boeing Tianjin Composites Company

Jeff Foster, Operations Manager
Doug Gisselberg, Production Support Department Manager
LIU Rayman, Production Manger
ZHANG Harry, Quality Manager
HUAN Zhang, Assistant General Manager



Tianjin Sino-German Vocational and Technical College

LI Dawei , President and Board Chairman

ZHANG Xinghui, President

Tianjin Institute of Mechanical & Electrical Technology

SONG Chunlin, President, Secretary of the Party

ShenzhenDahon Technologies

HON David, Chief Executive Officer and Governor of American Chamber of Commerce
South China

Lenovo Electronics

MO Tony, Human Resources Director

SUN Summer, Senior Human Resources Manager

Walmart Global Sourcing

LIM David, Senior Human Resources Director

ZHOU Ellen, Senior Human Resources Manager

Shenzhen Polytechnic

RUNHUI Yang, Vice President

FAN David, Associate Professor, Deputy Director, International Office

SHEN Tong, Manager, International Office

WU Nian Xian, Deputy Director, The Education Department of Guangdong Province

LEE Ricky, Professor, Education Research Center Guangdong Province

XIDONG Wen, Professor and Vice President

ZHIMING Dou, Professor of Teaching

LANPIG Liu, Professor, Center of the VET Research Center

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RESEARCH TEAM BIOGRAPHIES



Marc S. Tucker is the President and Chief Executive Officer of the National Center on Education and the Economy in Washington, DC. He is an internationally recognized expert on academic and occupational standards and assessment, and has also been among the leaders in researching the policies and practices of the countries with the best education systems in the world. Tucker served in the 1970s as the Associate Director of the National Institute of Education, in charge of the nation's government-funded research on education policy. He then created the Carnegie Forum on Education and the Economy at Carnegie Corporation of New York, and authored its report, *A Nation Prepared: Teachers for the 21st Century*. He led the Carnegie Forum team as it created the National Board for Professional Teaching Standards and served as the Board's first president. Tucker then founded the National Center on Education and the Economy and, in that role, created the Commission on the Skills of the American Workforce, the *New Commission on the Skills of the American Workforce*, the New Standards Consortium, America's Choice (a comprehensive school reform program), the National Institute for School Leadership and *Excellence for All* (a high school reform program). Tucker was appointed by President Clinton to the National Skill Standards Board. He is a Visiting Distinguished Fellow at the Harvard University Graduate School of Education and was the recipient of the ECS 2014 James Bryant Conant Award for outstanding individual contributions to American education. He has also served as author, co-author or editor of many articles and several books and reports, including, *America's Choice: high skills or low wages!*; *Standards for Our Schools: How to Set Them, Measure Them and Reach Them*; *Thinking for a Living: Education and the Wealth of Nations*; *The Principal Challenge*; *Tough Choices or Tough Times*; and *Surpassing Shanghai: An Agenda for American Education Built on the World's Leading Systems*.



Vivien Stewart is Senior Advisor for Education and former Vice President of Education at the Asia Society. For the past ten years, she has been responsible for its programs to promote the study of Asia and other world regions, cultures, languages, and global issues in America's schools and for building connections between U.S. and Asian education leaders. In the U.S. this has included working with a network of state education leaders, creating a national initiative to expand the teaching of Chinese and developing a model network of internationally oriented schools. Internationally, she developed a series of international benchmarking exchanges to share expertise between American and Asian education, business and policy leaders on how to improve education to meet the demands of globalization. Stewart writes extensively on education internationally. Her book, *A World-Class Education: Lessons from International Models of Excellence and Innovation* describes what the U.S. can learn from high-performing education systems around the world. Prior to Asia Society, Stewart directed the children, youth and education programs at Carnegie Corporation of New York, where she led the development of reform agendas in early childhood education, urban school reform, science education, teaching as a profession, and healthy adolescent development. She has also served as Senior Policy Advisor to the UN High Commissioner for Refugees and has been a Visiting Scholar at Teachers College, Columbia University, New York. She is a trustee of a number of national and international organizations including the National Center on Education and the Economy.





Betsy Brown Ruzzi is Vice President of the National Center on Education and the Economy and Director of its Center on International Education Benchmarking. Since 2011, Brown Ruzzi has directed the Center's effort to help countries around the world understand the principles, policies, and practices that top-performing countries use to drive their education systems. She oversees a grant program supporting scholars from around the world to study the practices of countries whose students regularly top the PISA league tables. She helps states redesign their primary and secondary education systems to match the performance of the world leaders in education. Brown Ruzzi also manages the National Center's outreach and public relations work including its web site, newsletter, blog and other social media. Most recently she managed the research, publication and outreach for the Center's studies: *Strong Performers and Successful Reformers* for the OECD; *Surpassing Shanghai* (Harvard Education Press); *Fixing Our National Accountability System*; *Chinese Lessons: Shanghai's Rise to the Top of the PISA League Tables*; *The Phoenix: Vocational Education and Training in Singapore*; and *What Does it Really Mean to be College and Career Ready?* During her career at the National Center she helped create the National Institute for School Leadership, the National Skill Standards Board, the Commission on the Skills of the American Workforce, and the National Board for Professional Teaching Standards, all initiatives to improve the academic performance of our nation's students and strengthen the skills of our workforce. In addition to working at the National Center, Brown Ruzzi worked on Capitol Hill, in the British Parliament and in the Governor's Office in Massachusetts.



Nancy Hoffman is a Vice President and Senior Advisor at Jobs for the Future, a national non-profit in Boston, Massachusetts focused on improving educational and workforce outcomes for low-income young people and adults. Dr. Hoffman is the co-lead of the eleven state Pathways to Prosperity Network with Bob Schwartz (Harvard Graduate School of Education). The Network seeks to ensure that many more youth complete high school, attain a postsecondary credential with currency in the labor market, and get launched on a career. Hoffman has held teaching and administrative posts at a number of U.S. universities including Brown, Temple, MIT, and UMass, Boston, and currently teaches a course on non-profits, philanthropy and education improvement at Harvard Graduate School of Education. Boston She has served as a consultant for the education policy unit of the OECD and is engaged in studying strong VET systems. Her book, *Schooling in the Workplace: How Six of the World's Best Vocational Education Systems Prepare Young People for Jobs and Life*, is a result of that work (Harvard Education Press, 2011). She writes and speaks on the topic of college and career preparation, and is an editor of three JFF books: *Double the Numbers: Increasing Postsecondary Credentials for Underrepresented Youth*, *Minding the Gap: Why Integrating High School with College Makes Sense and How to Do It*, and most recently *Anytime, Anywhere: Student-Centered Learning for Schools and Teachers*, all three published by the Harvard Education Press. Hoffman is also author of *Women's True Profession: Voices from the History of Teaching* (Harvard Education Publishing Group). Hoffman holds a B.A. and Ph.D. in comparative literature from the University of California, Berkeley. She serves on the Massachusetts Board of Higher Education.



The Center on International Education Benchmarking's international comparative study of vocational education systems is a four-part series and includes the following titles which can be found online at <http://www.ncee.org/cieb/publications/#VET>:

The Phoenix: Vocational Education and Training in Singapore

Made in China: Challenge and Innovation in China's Vocational Education and Training System

Gold Standard: The Swiss Vocational Education System

And a forthcoming report on vocational and technical education in the United States

For more on the world's leading education systems including what can be learned from their success, please see the following works also published by the National Center on Education and the Economy:

Chinese Lessons: Shanghai's Rise to the Top of the PISA League Tables

Surpassing Shanghai: An Agenda for American Education Built on the World's Leading Systems

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2121 K Street, NW
Suite 700
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202-378-1800

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