MAKING THE CONNECTION

The Peaceful Rise of China's Telecommunications Giants

DAVID WOLF
MAKING THE CONNECTION

The Peaceful Rise of China's Telecommunications Giants

by David Wolf
Table of Contents

PREFACE 1

TIMELINE HISTORY OF CHINA'S TELECOMMUNICATIONS EQUIPMENT INDUSTRY 1

1. INTRODUCTION 5
   THE UNSEXY BITS 5
   WHERE DID THEY COME FROM? 6
   SEEING THINGS CLEARLY 8

2. ARRESTED DEVELOPMENT 9
   IMPERIAL BEGINNINGS 9
   CIVIL WAR AND TELEPHONES 10
   PHONES FOR THE NATION 11
   THE INDUSTRIAL GOVERNMENT 14
   MONOPOLIES AND TELEPHONES 16
   AN INDUSTRY IS BORN 17

3. CATCHING UP 19
   THE ULTIMATE INFRASTRUCTURE 19
   COMPETITION WITH CHINESE CHARACTERISTICS 21
   PHONES FOR THE PEOPLE 24

4. THE COMPETITIVE CRUCIBLE 28
   THE MOBILE BOOM BEGINS 28
   THE INTERNET DISTRACTION 30
   SURVIVING THE DIP 31
   THE HYPERCOMPETITIVE CAULDRON 33

5. CHINA'S WINNERS - AND LOSERS 37
   GREAT DRAGON 37
   THE PEOPLE’S LIBERATION ARMY 38
   PUTIAN 39
   CATT/DATANG 39
   ZTE 40
   HUAWEI 41
   WINNING IS FLYING LOW 41
   HUAWEI, ZTE, AND 3G 43
   DIGITAL ECONOMY 45
   INNOVATION NATION 46

6. CONCLUSIONS 49
LIST OF ABBREVIATIONS 53

BIBLIOGRAPHIC ESSAY 55

ABOUT THE AUTHOR 57

ENDNOTES 58
Preface

As we enter the second decade of the new millennium, over thirty years after China began its economic and commercial journey from the doldrums of the Cultural Revolution, the first cohort of Chinese brands are emerging from the faceless mass of contract manufacturers and fly-by-night copycat houses to challenge global leaders both at home and around the globe. Were these Chinese companies simply selling toys, textiles, or commodified electronics, we might not be surprised. Indeed, China has been producing t-shirts and DVDs with major brand labels slapped on them for years: if we can save a few bucks buying the same products with a Chinese brand at Target or the local hypermarket, no harm done.

But it is hard for many of us in the West to understand, much less to accept, that a bunch of companies from a country where livestock remain a form of transportation suddenly can challenge the high-tech industrial champions of the developed world. From shipbuilding to supercomputers, from steel to mobile phones, all at once Chinese companies are competing with the West in industries where we were assured if not of our dominance, than at least our technical leadership. Dammit, we think to ourselves, WE owned that business ten years ago. How is it possible for these guys to be beating us?

Absent any ready evidence to the contrary, we jump to the most logical conclusion: so something fishy is going on here. We convince ourselves that no Chinese company could possibly grow to challenge us in these complex industries without hidden help from the government, from the military, or from simply taking shortcuts via industrial espionage. After all, we think, China is the country that suffers regular tainted food scandals, that has a reputation for producing poor quality, and that has an unparalleled track record of intellectual property theft.

But as the great skeptic H.L. Mencken once noted, the simplest, most logical solution to a problem is often wrong. For many of China’s rising global enterprises, the truth is more nuanced, more complex, and more discomfiting to American, European, and Japanese executives who prefer to believe the unspoken myth that no matter how big China gets, it will always be second-class. Yet just as Japan did in the late 1960s, China is slowly emerging from the "Wild East" days of its early development. And, just as it was with Japan, the first global Chinese companies are coming
from sectors that are not only surprising to us, but that are surprising to China's leaders as well.

If China's development continues on its present course, we can expect to see the country building global competitors in a wide range of industries, including those where we believed our own companies would remain leaders far into the future\(^1\). We have two choices in this process: simply assume that they are succeeding because of inscrutable sneakiness, or drop our prejudices and learn to understand these companies. The dangers of taking the first course are more dangerous for the world than for China. Incorrect assumptions lead governments to make poor policies and lead companies to make bad strategies. Worse, they make it impossible for global companies to correctly address the competitive threat, and for manufacturers, carriers, workers, and consumers to capture the opportunities that the emergence of these companies offer.

The second choice takes more effort, but it is absolutely necessary. It behooves us to understand these companies if for no other reason than to discern the difference between those that have come by their success "fairly," and those who have had the benefit of undue assistance. Only in this way can we start to separate the companies we want to work with from those we want to avoid.

If we were looking to understand a western company, we would learn its history, study its founders, and seek to discern the internal factors that make it special. This is the approach used by management scholars like Tom Peters in his seminal book *In Search of Excellence*, and business historians like Michael Malone used in in his study of Hewlett-Packard, *Bill & Dave*. For American firms, it is not necessary to go further: we understand the context that created the companies in question.

Most of us do not have the same appreciation of the conditions, history, and environmental forces that forged Chinese firms, so to understand them we have to go a bit deeper. We need an idea not only of what makes these companies different from the global brands of the West, but the unique processes that forged them and the cultural wind-shear they are experiencing as they step out into the world. Only then can we address them as brands, as suppliers, as competitors, and, increasingly, as investors in our countries and companies.

*Making the Connection* is designed to offer a first step in that process. We will take for our subject the Chinese telecommunications equipment industry, a business that has emerged from obscurity to challenge the global giants for leadership in the space of little more than a decade. It is a
textbook case of a business that most would not have associated
with China: steeped in technology, innovation-based, and
absolutely central to national competitiveness for every nation on
earth. As such, it is the first - but likely not the last - of China’s
industries to surprise and confound business and state leaders
around the world.

Making the Connection is, therefore, written for anyone who is
interested in one of the most dynamic industries in China, an
industry that has played a key role in China’s economic
development, and one that, I would argue, serves as a bellwether
for how Chinese business will develop in the future. Just as
important, it is written for someone seeking a point of view on
this industry that transcends the kind of broad-brush China-
baiting political spin that dominates our perspective on the
subject.

One last thought: read the endnotes, I pray thee. Some of them I
put there to satisfy those who want to see some documentation,
and the works that I reference are well worth reading for
someone who wants to dive deeper into the topic. But others I
use to put in asides that I think are useful and add some color to
the story that I flatter myself to think you might find valuable. As
readable as I’ve tried to make this, I recognize that everyone does
not share my passion about the topic, and I hope some of the
notes will lighten the journey a bit for you.
Timeline History of China's Telecommunications Equipment Industry

1881 Imperial Telegraph Administration (ITA) established to develop and oversee nationwide telegraph network.

1882 China's first telephone exchange installed in Shanghai foreign concessions

1900 Boxer Rebellion targets telegraph lines for destruction

1902 Empress Dowager nationalizes ITA and local telegraph networks

1906 ITA placed under new Ministry of Posts and Communications

1910 Telegraph lines in China reach 26,000 miles

1911 Qing Emperor overthrown. Republic of China established

1925 Phone network covers half of Nanjing

1927 Chinese Civil War begins

1931 Japan invades Manchuria

1936 Communist guerrilla leader Mao Zedong leads his forces on Long March

1937 Marco Polo Bridge Incident starts Anti-Japanese War

1945 Japan surrenders to Allies

1949 Chinese Civil War ends: People's Republic of China established

1950 Ministry of Posts and Telecommunications organized.

1951 USSR begins providing technical assistance to the MPT for the manufacture automated central office switches.
1957  Beijing Wire Communications Plant begins producing China's first locally-made automated central office switch.

1955-60  New phone line installations triple, but poor manufacturing and installation quality causes total number of lines to drop by half within three years.

1965-75  Great Proletarian Cultural Revolution

1978  Deng Xiaoping becomes paramount leader of China, begins reforming Chinese economy and opening the country to investment and influence from outside the People’s Republic.

1978  Cuts in defense budget force People's Liberation Army to go into civilian businesses.

1980  MPT groups all 127 of its telecommunications equipment plants under a new company, China Posts and Telecommunications Industry Corporation (PTIC).

1982  MPT announces that importance of the telecommunications industry requires China to purchase telecommunications equipment from foreign vendors.

1983  Shanghai Bell established as joint-venture between PTIC and ITT's Belgian Subsidiary, BTM

1985  Ministry of Aerospace Industries spins out a group of electronics companies into a single firm that becomes Zhongxin Telecom (ZTE).

1987  Alcatel takes control of BTM, becoming PTIC's partner in Shanghai Bell

1988  Siemens forms joint venture with Beijing International Switching Company (formerly Beijing Wire Communications Plant)

1989  Great Dragon Group formed

1990  NEC forms joint venture Tianjin-NEC with Tianjin Telecommunications Authority
Huawei selling enterprise-networking gear to hotels and factories

1991  Great Dragon develops HJD-04 automated switch, licenses production to six Chinese factories

1992  ZTE begins selling its first switch

1993  MPT's General Bureau of Telecommunications becomes China Telecom

   Huawei starts making and selling automated central office switches

1994  State Council approves establishment of China United Telecommunications Company, Ltd. (China Unicom), introducing competition in mobile networks in China

   Great Dragon's HJD-04 becomes leading locally-manufactured switch in China

1995  Shanghai Bell products pass 70% local content threshold

   Telecommunications boom begins in US and Europe

   Chinese government merges Great Dragon with five civilian factories and one army factory into Great Dragon Group

1996  PLA and MPT form Great Wall Telecom as third competitor in mobile networks

   China Academy of Telecommunications Technology (CATT) begins research on a Chinese standard for high-speed wireless (later TD-SCDMA)

1998  On the instruction of the MPT, CATT spins off its TD-SCDMA project into a separate company, christened Datang Telecom

   President Jiang Zemin orders PLA to divest itself of all businesses

2001  Telecommunications boom in US and Europe ends with "Dotcom Bust"

   Orders for new equipment in China plunge, even as growth continues
2002  China Unicom launches new CDMA-based mobile network to serve alongside its GSM network

2006  Chinese government announces the decision to award a license for China’s first 3G network to China Mobile, that network to be based on China’s locally-developed TD-SCDMA standard

2008  China Mobile launches initial trials of TD-SCDMA 3G network in time for the Beijing Olympics

2009  Government awards China Unicom and China Telecom licenses to launch 3G networks

2012  Huawei passes Ericsson to become the world’s largest supplier of telecommunications equipment.
1. Introduction

Along a busy boulevard a few hundred meters from Beijing’s tony shopping districts of Jianguomen and Sanlitun are the Landau and Bainaohui electronics markets. You walk into their dark yet inviting depths, invited by the cloying music, the teasing scent of cooking snacks, and the promise of a dizzying selection of mobile phones. Along the hallways of this neon-lit glass-and-tiled bazaar can be found a choice of over 700 different handsets and tablets from 80 different manufacturers, an offering that would cause a Best Buy merchandiser to hang his head in shame.

Phones aren’t the only thing on offer here. Don’t have an account with one of China’s three carriers? Buy one from the guy over in the corner with a smile and a leather shaving kit under his arm. He’s not looking for the bathroom: he is selling connectivity, access, bandwidth. For as little as fifty US dollars, Mr. Li will fix you up with an activated China Mobile SIM card, 3G connectivity, and a calling card with as many prepaid minutes as you might think you need. On your way out the door, buy yourself a case for the phone, a memory card, and some cute little dangly things to attach the handset to your wrist. Done.

What you won’t find amongst the electro-hawkers and thumping Chinese techno music, though, are the critical bits and pieces that make this whole mélange possible, and that connect nearly two-thirds of the population of the largest country on the planet. I’m talking about hardware.

The Unsexy Bits

In chronicling the remarkable story of China’s telecommunications industry and how it has powered the nation’s economic rise, coverage in the popular and business media over the past quarter century has focused largely on the three most visible parts of the business. First, the focus was on network operators, especially the foreign carriers who yearned to offer phone service to China’s unconnected millions, who were then forced after twenty years of effort to admit the prize would...
never be theirs. Then it was the domestic state-owned operators, three companies cobbled together from the privatized networks of three ministries and a handful of private startups, which have retained their protected and profitable market but in return have sacrificed their independence to the politics of national industrial policy.

The second focus was the mobile handset manufacturers, creating what were in late 1980s China rare but wrist-breaking totems of wealth and power for the select few, and by 2010 had become, like the car in Southern California in the 1950s, sleek, turbocharged expressions of personal identity and the centerpiece of a mobile lifestyle unimaginable a generation before. Despite moments of brilliance, valiant efforts by dozens of local manufacturers have been stymied by the technical and aesthetic dominance of the global handset giants, whose own waxing and waning fortunes are themselves engrossing stories.

And the third focus was the Internet, which for China was both a desperately needed channel to the world’s knowledge and markets and a feared conduit of prurience and seditious ideas. In 1996, China’s leaders slammed the door shut, afraid to grapple with the possible negative consequences of this twin-edged gift. In 2012, even after a decade of fits-and-starts reform, the nation’s leaders struggle to let in just the right amount of information, making for a drama that touches the ideological core of the nation and the passions of its half billion netizens.

But the un-sexy part of the business - the part of the business that made appliance-sized boxes just to have them strategically hidden, that made the unsightly antennae that cluster like techno-barnacles across the skylines of China’s cities and towns, the part that even the government treated as an afterthought - was the one that would in the end prove the most interesting of all. This was the business that made it possible for a developing nation to offer some of the world’s most advanced and reliable telecommunications services to hundreds of millions of people, and which has become the cradle of the future global telecommunications industry.

**Where Did They Come From?**

Today, China boasts a four major manufacturers of telecommunications equipment, Putian, Datang, Huawei, and ZTE, as well as a number of smaller manufacturers and companies making gear for the major global players like Cisco, Alcatel-Lucent, and Nokia-Siemens Networks (NSN). Huawei and ZTE in particular have become major players not only in
China, but worldwide. By some measures Huawei has become the largest manufacturer of telecommunications equipment in the world.

This is a significant milestone, one that passed unnoticed outside of the industry but has not escaped the attentions of global competitors and their home governments. Little wonder. Not only have companies like Huawei, ZTE, Datang, and Putian come seemingly out of nowhere, they appear to have grown at the expense of global manufacturers. France’s Alcatel and America’s Lucent have been forced to merge, as have the telecommunications equipment arms of Nokia, Siemens, and, ostensibly soon, Motorola. Canadian equipment maker Nortel, a giant of the industry a decade ago, is as of this writing in the final stages of liquidation.

Against such facts, questions arise. Why have the Chinese companies grown so quickly? Was it subsidies, favoritism, and protectionism at home, as was arguably the case with Japan? Was it part of a government plan to take over the global telecommunications business? Or were there other, less insidious but more discomfiting factors involved?

The truth is often difficult to separate from contention. There has been a lot at stake in the effort to build and upgrade China’s telecoms infrastructure, enough so that the participants hired PR firms, lobbied governments, and set China market access at the very forefront of the global trade agenda. There is even more at stake as the playing field between the Chinese companies and their legacy competitors grows beyond the booming market of the PRC to encompass the coming effort to upgrade the entire world’s wireless telecommunications systems to fourth generation (4G) technologies.

The result has been not only a battle for customers and markets, but a political row that has reached the highest levels of government in India, the United Kingdom, and the United States. Hidden beneath the surface of this politicized, high-stakes commercial battle is another, larger conflict, a struggle between China’s effort to take a role in the global economy, and the gnawing discomfort felt in the West over the rise of a competitor we simply do not know much about, much less understand. Our challenge is to step back from the emotion and rhetoric of that larger conflict and look for the truth.
Seeing Things Clearly

I have been watching this brawl since my first trip to China in 1985, taking a front-row seat when I moved to Beijing in 1995. Since 1998 I have been advising many of the major global companies in and around the telecommunications industry. What follows is the product of both research and the perspective that comes with having watched the undulations of the industry up close, of keeping notes, clipping articles, and building a perspective that will undoubtedly be somewhat different than might come from someone who had spent these years based in Washington, London, or even Hong Kong.

At the heart of that perspective is this single insight: the telecommunications industry we see emerging in the world today is proof that coddled champions do not global leaders make, and that it is the ignored, determined, street-smart scrappers who win the big fights, especially when giants stumble. But we are getting ahead of ourselves.

The purpose of this work is simple: to help the industry, the people who watch it for a living, and for the rest of us who want an idea of what is really going on in China to develop a more nuanced and informed viewpoint than is on offer in the current narrative about this business.

(A quick caveat: what this work is not is a comprehensive history of the industry, nor does it cover all of the telecommunications sectors in China. Our focus is on the equipment business, so the extent to which we address telecommunications operators, or the policies around the networks, the Internet, and mobile phones is limited to where those are relevant to our narrative.)

It is important that we do so now, because the telecommunications sector is the first of China's industries to step out and challenge the global giants. And it is important that we get into the habit of doing so, because by lumping all Chinese industries and companies together into a single mass and painting them all with a tarred brush would not only deprive us of opportunities to work with, learn from, and prosper with the best of these companies, it would also build a wall of intolerance between China and the West that the world can ill afford.

So let's start with the first bit: the telecoms business. And in order to do that, we have to go back to the beginning, when the Middle Kingdom first started laying wires across its ancient cities.
2. Arrested Development

Imperial Beginnings

In 1881, the Emperor of China was the 10-year-old Aisin Gioro Zaitian, a boy hand-picked at the age of four by his aunt, the Dowager Empress Ci Xi, to be the ruler of China. For her own purposes, Ci Xi chose well: she had no intention of loosing the silk reins by which she had controlled the Chinese state for two decades, and picking young Zaitian would give her eight years of regency to secure her control over the emperor before he attained his majority.

Ci Xi looked upon modern inventions with a mixture of fascination and dread: fascination because of their novelty and their potential to help China regain its stature in the world, but dread because of her fear that modern inventions would disrupt Chinese society and undermine imperial rule. After a brief flirtation with modernization in the 1860s, the Empress Dowager became increasingly insular and, over time, something of a luddite.

Not everyone close to the throne rejected such advances out of hand. A group of prominent officials with ties to the Imperial military and foreign relations establishments took a more outward-looking view. Rallying around the influential regent Prince Gong, these officials began to push for modernizations to the nation and its infrastructure, modernizations that specifically included telecommunications. This effort was made official with the establishment of the Imperial Telegraph Administration (ITA) in 1881. The ITA was an organization that would look in the west like a fish with legs, a forerunner of modern state-owned enterprises (SOEs) called a “government-controlled corporation,” overseen by the Imperial administration and splitting its profits between the royal house and the merchant-mandarins running the business.

The ITA was given the monopoly over the development of a national telegraph network in spite of Ci Xi’s opposition, and by
1910 administered or supervised a network of some 26,000 miles of telegraph lines. While a respectable achievement, during the same period the United States built a network ten times as large, Germany seven times as large, and even India’s telegraph network was triple the size of China’s. Clearly, something had already gone wrong.

War was certainly part of the issue. The Sino-Japanese war had wrought both physical damage on the nation’s vital northeast coast and fiscal damage to the Imperial treasury and to the merchants financing telegraph expansion. The damage from the war was still being tallied when unrest broke out. In their short-lived but bloody rebellion against foreigners and modernization in 1900, the Society of Harmonious Fists, or Boxers, struck out against the telegraph lines, which frightened them because the moaning sounds the wind made on the telegraph wires sounded like souls in torment.

But it was also politics. In 1902, Ci Xi had struck back at the modernizers, nationalizing the telegraph network and bringing construction to a halt. Ostensibly, the Qing government had taken the networks in order to capture the profits from services in developed regions and invest in telegraph services to distant provinces. In 1906, the Ministry of Posts and Communications (MPC) was established to oversee the process, and to subsume the provincial telegraph networks into the ITA proper. The MPC managed to complete this administrative process just in time for the 1911 revolution.

The ITA also took over management of a small public telephone network in Nanjing, before the MPC became part of the Nationalist government under Sun Yat-Sen.

**Civil War and Telephones**

The Nationalist government began its 38-year rule facing a list of problems that would discourage the leaders of far more developed - and more solvent - countries. In 1911 China had but 8,000 telephone lines. Extending China’s embryonic telephone network was important to Sun Yat-sen and his idealistic band of advisors, but it fell far lower on the list than feeding the nation, rebuilding the country’s administrative infrastructure for the first time in 500 years, and simply holding the fractious Republic together for long enough to get anything done.

The creation of a nation has to come before the development of a national telecommunications network, and the Republic’s decline into regionalism and chaos was too swift to allow that to happen. What took place instead was the beginnings of a series of small local telephone networks based in the central administrative
Making the Connection

districts of China’s major cities. By the mid-1920s, the network in Nanjing had grown to cover more of the city, and Beijing and Guangzhou both had networks, and Shanghai, where the foreign concessions had set up their own networks outside of the jurisdiction of the MPC, had been operating a local network since installing China’s first telephone exchange in 1882. Despite these early starts, the concurrent paroxysms of the Chinese Civil War and the Anti-Japanese War kept networks from growing, discouraged investment, and damaged what infrastructure that had been laid.

Worse, perhaps, was that the four decades of chaos from 1911 to 1949 prevented the establishment of a research and manufacturing base that could support the nation’s telecommunications needs and rival establishments like Bell Labs in the United States. While China had managed to build a handful of strong engineering schools at Tsinghua University in Beijing and Jiao Tong University in Shanghai, there was no mechanism to convert that engineering talent into innovation and hardware for a Chinese telecommunications industry. Dependent on overseas imports, yet with a national treasury depleted of gold and hard currency by the profligacy of the Qing emperors and constant conflict, China’s networks were throttled by the bleak economics of a devastated nation.

After World War II ended and national reconciliation failed, the Chinese Communist Party and the People’s Liberation Army liberated a ravaged and impoverished nation whose people spent much more time worried about survival than access to a telephone line. It would be left to a new government to try to accomplish with the Qing and the Republic had failed to do: connect a nation now sorely in need of a unified communications network, yet accomplish that task with empty coffers.

Phones for the Nation

Despite the upheaval that had followed the overthrow of the Qing, the Japanese invasion, and the Civil War, China had managed to grow its telecommunications network, albeit not by much, and the network remained highly localized. When Mao Zedong declared the establishment of the People’s Republic on October 1, 1949, China had 300,000 telephone lines, 30% of which were located in Shanghai. The most advanced networks were in the cities, but even Shanghai still operated the largest manual exchange in Asia, serving 6,000 lines, in an era when most advanced networks were already transitioning to automatic exchanges. Some 86% of the nation’s phones were in major cities. Outside of the cities, the general population didn’t even have...
access to phones: the only people with access were government officials.

Mao’s government did not make telecommunications an immediate priority, and in retrospect it is easy to understand why the newly established Ministry of Posts and Telecommunications (MPT) was not getting phones to the people as fast as it could. Getting the people food, housing, electricity, water, and sanitation were far more urgent priorities, as were public order, national defense, and healthcare. While these priorities drew the focus on national leaders, the Korean War intervened, putting the country back on war footing.

As the nation’s leaders soon discovered, however, telecommunications could not be pushed all the way to the back of the line. There was one phone line for every 18,000 rural residents, and bringing order to the agricultural reform process demanded that China’s newly established rural communes be linked with provincial Party leadership, and thence to Beijing.

After all, you can’t run a centrally planned economy if the Center speaks and the periphery doesn’t get the message.

In what must have been a brutal effort given the primitive conditions and the lack of trained telecommunications technicians, the MPT managed to double the number of rural lines in five years from 45,500 to 103,000. Yet in what we might call a burst of irrational exuberance, the MPT deemed 30% annual growth in rural lines to be inadequate. The ministry pledged to link every township and commune with a phone by 1960, implying an immediate doubling of the already-high growth rate.

State statistics suggest the effort met the goal, with 919,100 rural lines installed by 1960. State statistics also note, however, that the number of rural lines dropped by 420,000 by 1965. Searching for an answer, one historian notes that the numbers were probably inflated by exuberance. Many of the lines, installed by untrained technicians and using equipment and wiring of unknown quality, were likely removed in the early 1960s. China had learned a hard lesson about technical capability and quality, a lesson lost neither on Party leaders like Deng Xiaoping, nor on the new generation of telecommunications engineers at university in the 1960s who would lead the nation’s telecommunications industry two decades hence.

While the countryside went through its telecommunication boom, the number of urban subscribers tripled to over 771,000, which means that China still managed to add three times more phone lines in 15 years than it had in the 40 years prior. All of this was done during a period of time when telecommunications enjoyed a demonstrably low priority outside the MPT itself.
In the internal handbook of the PRC government published in 1958, a listing that ranks each ministry and other organ in government according to its relative importance to development goals placed the Ministry of Posts and Telecommunications 32nd out of a total of 41 government agencies, below not only the ministries of Interior, Foreign Affairs, National Defense and the State Planning Commission, but also below the Ministry of Textiles, all six Machine Building Ministries, and the Ministry of Aquatic Products. It must have been galling for the Minister of Posts and Telecommunications to realize that the largest nation on earth valued fish more than phones.

Public sources are sketchy about where China was able to source the equipment required to enable this kind of growth. The Revolution and China’s alliance with Russia left it unable to purchase telecommunications gear from major Western or Japanese suppliers, at least, not legally. Smuggling medicines into China was challenging enough during those years: smuggling large and heavy telecoms gear would have barely been worth the effort unless that equipment was destined for a high-priority installation. Hauling the gear for a million lines would have been challenging indeed.

The gear had to come from somewhere, though, and that means that most of it came either from the USSR, new domestic manufacturing, or both. Stalin’s Russia was China’s socialist elder brother from the 1920s, first patronizing the nationalist Kuomintang (KMT) under Chiang Kai-shek, and then later switching support to the Communist Party of China (CPC). The USSR had been selling telecommunications equipment to China starting in the 1930s, and was supplying the PLA with field telephone systems during World War II. Chinese technicians, especially with the CPC and the PLA, were thus familiar with the Russian gear, so adding more into China’s system would have been simpler than starting from scratch.

Following the end of the Chinese civil war, the USSR provided the CPC with a broad range of technical and commercial assistance, right up until the break between Beijing and Moscow during the Khrushchev era. Instead of simply selling China the equipment to build its telecommunications networks, Russia set about helping the Chinese build their own. Through technical assistance to the MPT and to the First Ministry of Machine Building (1MMB), the ministries charged with the manufacture of telephone equipment, the USSR essentially built the foundations of China’s telephone equipment industry.

This collaboration proved critical. Before the introduction of digital telecommunications, there were two ways to route a phone call from the caller to the receiver: manually, with the intervention of one or more human operators, which was still
common in China in the 1950s and into the 1960s; and automatically, with the call routed by an electro-mechanical switch in the central telecommunications office. As China began producing telecommunications equipment, it was producing telephones, wiring, and manual switchboards. The promise of a modern telecommunications industry, however, rested on China’s ability to master the mass production of automated central office switches.

After working with the Soviets for several years, the industry breached this technological barrier in 1957 when when one of the factories under the 1MMB, the Beijing Wire Communications Plant, began producing China’s first locally-made automated central office switches. It was just one factory, and the production capacity was limited, but it gave the industry a boost toward self-sufficiency that it had not enjoyed since China began laying telegraph cable in the 19th century. At this point, China should have been ready to start wiring the nation.

History once again intervened. While installations jumped during The Great Leap Forward, they were essentially flat from 1960 to the beginning of the 1970s. For much of that time, the nation had other priorities, and the build-out of China’s telecommunications industry and the potential for innovation were left to languish through the political upheavals to come.

\textit{The Industrial Government}

At this point, it would be useful to explain a few things about Chinese industry during the first thirty years of CPC leadership. As the narrative above suggests, China organized its industry during the initial post-revolutionary phase in a manner much different than it is organized now. After Liberation, the CPC organized a government made up of ministries and organs that were given both regulatory control over a given sector and the mandate to manage production for that sector. In other words, not only was the Ministry of Food required to regulate the conditions of food production, it was also required to oversee the harvest, processing, distribution, and sale of food to the public.

Such was the case with telecommunications as well. The MPT was not just the Chinese equivalent of the Federal Communications Commission, overseeing the proper conduct of the industry. In addition, it played the role of network operator and equipment manufacturer, similar to the role played by AT&T and the Bell System in the United States before 1984. So the MPT is the phone system, the manufacturer, and the regulator. Simple, right? Good. Because now it gets complicated.
In addition to the factories under the MPT, there were the telecommunications wiring and switch companies under the 1MMB, and the electronics manufacturers under the Fourth Ministry of Machine Building (4MMB). The PLA had its own telecommunications networks separate from the "civilian" net, equipped with a mixture of hardware from other ministries and that purchased from the Soviets. Naturally, the PLA also had factories of its own producing secure telecommunications equipment that also manufactured non-secure (civilian) telecommunications equipment as well.

Research and development were similarly aligned. Instead of having an independent system of universities and research institutes, before 1978 all universities were subordinate to one ministry or another. The 1MMB, 4MMB, MPT, and PLA each had their own separate and often redundant higher education institutions conducting education and research in telecommunications. On the positive side, this meant that the country was turning out scores of engineers. On the negative side, it meant that the central direction Beijing should have been able to provide to researchers was nonexistent. It was the worst of both worlds - not only did the system lack the advantage of market discipline, it eliminated whatever theoretical advantage a coordinated research effort might have provided China in its efforts to catch up with the west.

When Deng Xiaoping broke China out of its economic amber in 1978, the results must have been mind-boggling. Despite almost no additional lines laid in 15 years, the central government in Beijing directly controlled twenty-seven separate entities engaged in the production of telecommunications equipment. Provincial and local Bureaux of Posts and Telecommunications (BPTs) around China had over 100 separate companies making telecoms gear. Worse, many of these companies were struggling to reach economies of scale because their local BPTs preferred to buy from their own factories, meaning that China had in some cases huge redundancies in capacity.

Whatever the shortcomings of all of this redundancy, during the most tumultuous years of the People's Republic, China had built from almost nothing the ability to educate huge cohorts of telecommunications engineers, to conduct research and development, to produce vast quantities of telephones, wiring and switches, and to install and service that equipment.

But the education was stilted, innovation was non-existent, the technology nearly two decades behind the times, and the technicians had not of late been installing much equipment. As scientists, academicians, engineers, and students returned from the countryside to begin anew the effort to build China's telecommunications industry, some new ingredients were
required: capital, technology, and know-how to be sure, but just as important two ingredients lying dormant right in China that, three decades after the declaration of new China, were still waiting to be liberated: opportunity and entrepreneurialism.

**Monopolies and Telephones**

In 1986, eight years after Deng Xiaoping declared that China should reform its economy and open to the outside world, and two years after Great Britain had agreed to the conditions of Hong Kong’s return to China, a high school student sat in her parents’ apartment in Beijing and looked around. There was a refrigerator, relatively new, from a state-owned factory in Dalian. There was a radio and a small television set. There was a table, chairs, comfortable furniture, a small but complete kitchen, a private (rather than shared) toilet, and small piles of books.

It was a modest apartment, but one that befitted two PLA field-grade officers with over 70 years of combined service between them in the Army’s Political Department. The girl’s father was an popular character actor with the Army’s August First Film Studio. The girl’s mother was the head of an academic department in the PLA’s Performing Arts Academy, China’s equivalent of Julliard.

And yet, for all of the comforts these senior officers enjoyed, what could not be found in either the apartment or the entire building was a single telephone.\(^{36}\)

With the early years of China’s reforming an opening fading quickly into the fog of the past and the bustle of the present, we can be forgiven for believing that once Deng Xiaoping took his role as de facto paramount leader of China, everything began to change for the Chinese telecommunications industry. While Deng did initiate massive change in Chinese society, it happened more quickly in some sectors than in others. As MIT’s Yasheng Huang points out in his book *Capitalism with Chinese Characteristics*, the greatest and most important changes in the 1980s occurred not in the massive state-owned industries, but in township and village enterprises in the unlikely places across China where entrepreneurship bloomed.

For their part, the state-controlled telecommunications firms awoke as giants from decades of deep sleep: slowly, creakingly, and not altogether coherently. The nation desperately needed these enterprises to step up: as former Minister of Posts and Telecommunications Wu Jichuan recalled, when Deng came to power, there were more phones in Hong Kong than there were in all of mainland China.\(^{37}\)
The first step was taken by the MPT in 1980, when the ministry grouped all of its equipment manufacturing assets under the umbrella of a single new corporation, China Posts and Telecommunications Industry Corporation, or PTIC. Having the companies at arms-length from the regulators was a positive step for the development of the industry, and the step was a green light for the enterprises to begin behaving more like businesses rather than production arms of the government. 

While an important step, the change was limited. The individual firms still had to report to PTIC at the center. Not only did the mother ship select and vet all managers for each of the subordinate firms, it took on a central planning role that left little freedom of movement for the individual firms to innovate or begin offering new products. All of that had to come from above, a model that is, in western experience, anathema to robust innovation.

The puzzle is why the government took such baby steps with the telecommunications technology business when Deng’s policies gave an individual farmer in the countryside greater freedom to select what he grew and sold than these critical enterprises.

The answer to that question offers us the key to the entire future of China’s telecommunications equipment industry.

**An Industry is Born**

In early 1982, the central government and the CPC decided that in order for China’s economy to grow, expanding and upgrading the country’s telecommunications system was going to be a national priority. This was the first public acknowledgement that telephones were not just nice things to have: it was an admission that a mere four years into reforming and opening the nation was finding its development hampered by its small and outdated phone system. The entire country had less than three million phone subscribers. In the cities, only seven people in a thousand had a phone line, and in rural China only one in a thousand had a phone line.

China’s leaders had two choices: invest cash and time into PTIC to allow the domestic companies under its aegis to reap the benefits of the network expansion; or buy from foreign manufacturers, putting the network and the economy ahead of the interests of the 127 Chinese companies already in the telecommunications equipment business. In what became a major precedent for the telecommunications industry, Beijing chose to back the network, not the equipment factories. Minister of Posts and Telecommunications Wen Minsheng, whose ministry oversaw both the network and PTIC, announced that for
the nation to achieve its goals in developing a modern telecommunications system, China would spend precious foreign exchange and buy imported gear.\textsuperscript{40}

The choice made sense from an economic standpoint, but there was a silent slap at the Chinese equipment industry at the same time. PTIC’s rigid structure hobbled both innovation and production, and the cold truth was that the company and its subsidiaries were not nearly up to the task ahead. Yang Taifang, Wen’s successor as MPT chief, told the a reporter in 1984 that the economy was developing faster than China’s own telecommunication manufacturers.\textsuperscript{41}

As the effective monopoly carrier in China, the MPT and its regional branch companies focused on the network, shunting PTIC to a supporting role and beginning a buying spree that would last up to the turn of the millennium, and would prove a boon to the world’s major telecommunications equipment companies. Alcatel, Ericsson, Fujitsu, and NEC became the primary suppliers of imported digital switches, while ITT, after eight years of negotiations, started producing switches in a joint venture (JV) christened "Shanghai Bell" between its Belgian subsidiary BTM and PTIC.\textsuperscript{42}

Pleased with the results of Shanghai Bell - and concerned that it might grow to dominate the industry - the central government approved two more major joint ventures for producing digital switches, Tianjin NEC and Siemens BISC, and by the mid-1990s the JVs had grown to displace direct imports. In all, imports and joint ventures supplied the MPT with over 90\% of its equipment needs until 1995, the period of the fastest growth in fixed lines. The local manufacturers would not exceed 10\% market share until the mid-1990s\textsuperscript{43}, when global changes opened the door for a stunning reversal of fortune.
3. Catching Up

From the early days of reforming and opening, the ruling State Council had identified a series of critical bottlenecks that were hampering China’s development, and that deserved special focus. Those sectors, called "strategic foci,” were energy and transportation, agriculture, and education and science. Conspicuously, telecommunications was not on the short list.

The Ultimate Infrastructure

Undeterred, the MPT submitted to the State Council a carefully phrased and documented case that telecommunications should be regarded as a fourth focus for critical development. The MPT’s team built its case by comparing the development paths of countries around the world, and by demonstrating a direct correlation between GDP growth and the number of telephones per 1,000 population (called "teledensity"). Researchers were able to prove that every RMB in additional investment would yield 15.8 RMB in economic activity. Apparently, the MPT case was convincing: the telecommunications industry got its priority.

The telecommunications sector had won a major victory, but the way it won would have significant consequences for the PTIC companies and China’s nascent telecommunications equipment sector. For in essence, the priority given telecoms was not about building a robust domestic telecommunications equipment sector. The case made did not argue for domestic supplies: it argued that what China needed above all else - and the sooner the better - was a world-class telephone network, not for its own sake, but as an enabler of development in other sectors. This approach evolved into the prevailing view of communications among the nations leaders and, indeed, inside of much of the MPT. Telecom development was not so much an end in itself, as a means to accomplish wider macroeconomic benefits and enable the development of other, more critical sectors. The Party served the people, the economy served the Party, growth served the economy, industrial and agricultural development drove growth,
telecommunications networks enabled development, and somewhere down at the end of the line, telecommunications equipment formed the networks. Get the equipment, and everything followed: there was no imperative in the logic for the equipment to come from domestic suppliers.

As much as events and developments in China and in telecommunications changed both, they did not diminish the underlying truth of that formula - they made it truer. For this reason, throughout the 1990s and into the 21st century, China's leaders retained and regularly repeated their view that telecommunications was more for China than just an industry: it was essential infrastructure.

The priority, then, remained with the networks, not the equipment manufacturers. When an RMB spent on the network drove 15 RMB of growth, there was no implicit constraint on spending. It was a formula that continued to justify expenditures on network equipment, even when those expenditures far exceeded the profits in the sector.

While the CPC and the Chinese government went through some serious ideological acrobatics in order to justify economic reform and foreign investment in sectors of the economy, the government was wary of foreign ownership of transportation and utilities. Both ideology and China's own colonial experience offered ample grounds to reject foreign ownership of infrastructure. So if there was a second benefit to the MPT in establishing telecommunications as essential infrastructure, it was that the government became uncomfortable with the prospect of that network being owned or operated by companies not under the direct control of the State Council. As early as the mid-1980s, then, long before foreign investment restrictions were clearly codified in statutes, it was unshakable policy that no foreign firm should even have ownership or control over China's telecommunications network.

Naturally, many foreigners thought this was a severe mistake: one US Congressional report in early 1997 noted:

"Many observers are predicting that China cannot provide the financing, managerial talent, and technology without significant foreign involvement and equity participation in China's telecommunications infrastructure. If China's economy continues expanding at almost double digit rates over the next five years as many anticipate, it is difficult to believe that China can maintain this rapid expansion in telecommunications without foreign equity participation.""

As it turned out, Congress was listening to the wrong "observers." Not only did the networks not experience shortfalls in finance, technology, or, arguably, management talent, it does
Making the Connection

not appear these concerns crossed the minds of the nation's leadership. Minister Wu and his predecessors had discovered that the people who wanted a phone line were quite happy to pay - sometimes quite a lot - to get one. By 1995 the average price paid nationwide for the installation of a phone line was RMB 3,000 (around US$360 at the time) per line. This was more than the average factory worker in China made in six months, and RMB 3,000 was the price reported by the regional bureaus to the central government. In many cities, the price charged was higher, sometimes much higher. When applying for a fixed line for my (future) in-laws Beijing apartment in 1995, the Telecom Bureau (soon to be China Telecom) charged my in-laws RMB 7,000, and noted that it might take as long as six months to get the line installed.

It gets better. When, some years later, the State Council compelled the MII (successor to the MPT) to get the carriers to charge something closer to the actual capital cost of the line, the price dropped below RMB 1,000. Essentially, not only was the MPT charging a fee that was several times their capital cost to install a line in a home, they were getting paid in advance. In short, they not only had huge margins, they also had negative capital costs. The equipment was paid for in cash prior to installation. Such finances must have been the envy of the industry.

**Network expansion was virtually self-financing, so cost of gear was not an issue**

**Competition with Chinese Characteristics**

The effect of all of this was that while the operators were the champions, other parts of the business were left to fight for their survival. China could not close the doors to all aspects of the business. What it needed to support the networks were foreign equipment and foreign technology.

As noted in Chapter 1, the early solution was to simply import the equipment needed. In 1990, 71% of the equipment purchased by the MPT was imported, 23% was manufactured by Shanghai Bell and other Sino-foreign joint venture factories in China, and a bit under 5% was manufactured locally. By 1994, imports had fallen to 57%, joint ventures had risen to 38%, and local companies were now making 11% of the gear in China. None of the foreign companies were complaining: installations were up 950% over 1990, so all were prospering.

While it would be easy to see the hidden hand of industrial policy behind the shift away from imports, in reality a jump like this in orders was probably testing the capacity of the industry to supply China's demand, especially as demand was beginning to grow overseas as the Internet was just beginning to drive growth.
in equipment sales. Another aspect was cost: the joint ventures and local manufacturers were starting to substitute local suppliers for key components, making imports look increasingly expensive.

**Key Telecommunications Equipment Vendors in China, 1982-2011**

<table>
<thead>
<tr>
<th>Foreign (Country of Origin)</th>
<th>Joint Venture</th>
<th>Domestic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alcatel (France)</td>
<td>Shanghai Bell</td>
<td>Datang</td>
</tr>
<tr>
<td>Cisco (US)</td>
<td>Siemens-BISC</td>
<td>Great Dragon</td>
</tr>
<tr>
<td>Fujitsu (Japan)</td>
<td>NEC Tianjin</td>
<td>Huawei</td>
</tr>
<tr>
<td>Lucent (US)</td>
<td></td>
<td>PTIC</td>
</tr>
<tr>
<td>Motorola (US)</td>
<td></td>
<td>Putian</td>
</tr>
<tr>
<td>Nortel (Canada)</td>
<td></td>
<td>ZTE</td>
</tr>
<tr>
<td>NEC (Japan)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nokia (Finland)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Qualcomm (US)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Samsung (Korea)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Siemens (Germany)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Sources: Author records, Eric Harwit

Government policy at this point was to stoke competition between the overseas suppliers as a means of controlling costs and increasing leverage over the suppliers. At some point early in the 1990s, a decision was made to begin to allow competition in the provision of paging services. While the MPT was driving the growth of its network, there were those in government who began to resent the MPT and China Telecom’s monopoly on services. They pressured senior leadership to allow "experiments" wherein other ministries might begin developing networks and offering telecommunications services.

The most important of these was the Ministry of National Defense, via the PLA. Recall that in Chapter 1 we discussed how nearly all enterprises and educational institutions in China operated as the subsidiaries of one ministry or another. While it seems counter-intuitive in the west, where militaries draw a clear line between the profession of arms and commerce, that line disappeared in China from just after the Revolution until President Jiang Zemin and his State Council ordered the PLA to divest itself of all commercial enterprises in 1998. Starting in 1978, in the wake of a 25% cut in the defense budget, the military went looking for ways to feed itself. Entrepreneurial officers, many of whom had joined the PLA out of self-interest rather than selflessness, found a permissive atmosphere where, in return for part of the profits, an officer with the right assignment could utilize Army assets in the pursuit of commerce.
In some cases, this resulted in some notorious examples like the Northern Industries Corporation, or Norinco, which was found to be exporting large quantities of inexpensive military small arms all around the world, not least to the United States. But the PLA found itself in many more businesses that were rather innocuous. A taxi and bus transportation company, a film studio, nightclubs, sports and entertainment facilities, an airline, and clothing and outdoor equipment were but a few of the industries in which the Army engaged.

One of the most interesting businesses for the PLA, and potentially the most lucrative, was telecommunications. Throughout its history, the military had built its own communications infrastructure so as not to be dependent on civilian communications infrastructure in the event of overloading or an emergency. Indeed, given the backward nature of Chinese telecommunications for many years, the PLA was left without a choice but to build its own telecom networks. By the early 1990s, the PLA was sitting on a lot of unused or underused network capacity that it had build for itself, and in looking at the breakneck growth in China’s telecommunications business, detected an opportunity. The army began by leasing capacity on its 20,000 mile fiber-optic communications backbone to the MPT and its regional BPT subsidiaries. More worrying to the MPT was the way the Army chose to use some of its lower-frequency radio spectrum. Paging was, at the time, the hottest consumer-driven part of the telecommunications business in China, and the MPT wanted to keep it as a monopoly. The PLA, wielding sufficient political power to keep the MPT at bay among the arbiters in Beijing, started up regional paging services in Guangdong province and other areas where demand still outstripped MPT supply.

Having tasted success with these ventures, the PLA wanted more. It would take until 1996 for the PLA to leap further into the carrier business, and by then they would find that they faced a very different set of challenges than what they had found in paging.

The second rival, albeit less of a threat to the MPT, was the Ministry of Railroads. As with the PLA, the MoR had laid its own networks in order to support its operations. Nearly all of the MoR's backbone was run alongside railroad trackage where the MoR had right-of-way, used to support interline communications, track signaling, and the like. The MoR as well found itself with bandwidth to spare, and leased it out to the provincial branch companies of China Telecom.

For the telecommunications equipment industry in China, the emergence of these small competitors to China Telecom opened a small but critical door. Since the MPT had cast its lot with foreign
suppliers in 1982, domestic gear makers had become the rust belt in the nation's telecommunications boom, dismissed by MPT and China Telecom alike as outdated relics making second-rate hardware. While some were using their joint ventures to try and catch up with the foreign providers, others had been reduced to making components for joint ventures, or to turning out commoditized products like wiring, cases, and fasteners. As one Huawei executive said in 2011, "Chinese companies face many perceptual hurdles, largely driven by stereotypes." He was referring to the challenges his company faces expanding into North America, but he could just as easily have been referring to the challenges the company faced fifteen years prior when trying to win contracts with their own carriers.

Fortunately for the locals, many of the importers and joint ventures believed (not unreasonably) that their success in China depended upon the careful cultivation of their relationship with China Telecom, both at the national headquarters level and with the regional branch companies in the more prosperous, coastal regions of the country. None of the global firms were blocked from making deals with the PLA's carriers or with the other branch companies, but since the easiest and best opportunities lay with the biggest player, neither were they particularly encouraged.

The local players, however, were hungry, and went to the places to which the JVs and importers assigned a lesser priority, actively cultivating the familiarity and trust that are so essential to business in China. This active cultivation not only brought the domestic manufacturers more business, it also gave them critical insight into where - and how - the major global players were not addressing the specific challenges engineers faced in connecting subscribers in China's provinces. While the major players were not ignorant of these issues, neither did they need to address them in order to get business. This early detection of a division between what procurement engineers in Beijing thought the network needed versus what was needed in the field would give the locals their first opening.

**Phones for the People**

The second major opening for the local manufacturers was that between 1990 and 1995, the government's approach to telecommunications had gone from getting phones to the enterprises, offices, and officials who needed them, to getting phones to the people who wanted them. This change was, in one sense, good news for the MPT and China Telecom, but in another sense it placed both the ministry and its favored child under immense pressure. Just as the virtual-monopoly carrier was
rolling out a nationwide telecommunications network, the carrier was discovering that not everyone in China could afford to pay a year’s salary or more for a phone line. Complaints about the high cost and long wait for a phone line began to reach the Politburo and the State Council. If China Telecom was to hope to reach more people, much less offer universal service, it could no longer count on a business model that booked profits before even connecting the service.

If this were the only pressure on China Telecom, it might have managed, but technology complicated the operator’s picture. Pressure was beginning to build on the carrier to offer broadband connectivity, especially from highly profitable customers like multinational corporations (MNCs) operating in China, from universities, and from the government. Even more daunting, China Telecom’s new but already outdated first-generation cellular phone system was proving unable to keep up with demand that was so high that handsets were selling for upwards of US$3,000 apiece. Just as it was trying to offer all

\[
\text{Fixed Line Subscribers}
\]

Source: Eric Harwit “Spreading Telecommunication to Developing Areas in China: Telephones, the Internet, and the Digital Divide”
of China plain-old telephone service, the carrier was facing immense investments to keep up with technology and demand. The MPT understood that if China Telecom failed to do all of this, there were powerful voices in Beijing that could (and would) end China Telecom’s comfortable monopolies. China Telecom was going to have to make additional and massive investments in networks and technologies.

Cost pressures were profound, and the equipment manufacturers soon found that they were the first targets. The importers, suppliers who relied on equipment manufactured overseas for their sales in China, watched their business go into relative decline, falling from 71% market share to 51% market share between 1990 and 1994. By 1996, imported equipment was in absolute decline, falling to 16% market share and a third of the number of units of just two years before. The joint-venture manufacturers, who by 1994 made up 40% of the market, and growing, had taken up most of that slack.55

But by 1994-1995, China Telecom was under such serious pressure that even the joint-venture equipment makers were going to have to reengineer their own businesses. For the MPT had done its job well: because the regulator had licensed several JV equipment makers, China Telecom had a choice of sources for its equipment, and the carrier quickly learned to play the JVs against one another with each new contract. This, in turn, forced the JVs to start sourcing more and more components from local subcontractors. While some of the subcontractors were themselves JVs started by Alcatel, Siemens, and NEC vendors from overseas, most were local companies: startups like Great Dragon and Huawei; agglomerations of old state assets like Zhongxing Telecom (ZTE); and electronics manufacturers diversifying into telecommunications when they saw the opportunity.

Initially the contracts given to local manufacturers were small. The global players were not obtuse, after all: they had no desire to gratuitously build up companies who would turn into competitors. But in the face of rising cost pressures from China Telecom on the one hand and growing competence among the better local subcontractors on the other, the JVs seeking to hold or grow their relationships with China Telecom had a stark choice: bring procurement onshore, or lose the business.

The stakes were immense. A dozen years after the MPT had begun its effort to wire the nation, China was still laying telecommunications networks where there had been none before, and was trying to do it as fast as it could. China had tripled the number of phones in the country between 1980 and 1990. Then it got serious. Between 1990 and 1995, the number of phone subscribers in China rose nearly 600% from 7.1 million to 41
million, and plans were to add another 100 million subscribers in the next 5 years.

The JVs accommodated the change, and domestic content in Shanghai Bell’s switches passed 70% in 1995. At that point, there was no forestalling the emergence of local competitors. Not only had the global majors educated thousands of young Chinese in the technical and managerial arts necessary to run a global telecommunications business, they had unintentionally helped to plant the seeds for their own competition. Almost immediately, local manufacturers began to slowly siphon China Telecom business away from the international manufacturers, though at this early stage, though, the joint ventures helped the global brands remain competitive. Most of the business won by the locals manufacturers came from falling imports: the business of the joint ventures would continue to rise, albeit slowly, for years to come, and in sheer numbers of phone lines would grow for another decade.

But twelve years after they were deemed unsuitable suppliers by the MPT and all but written-off by a government more concerned about quality and speed of growth, a small number of local equipment manufacturers were beginning to step out from behind the long shadows of Alcatel, Siemens, Lucent, and NEC. Domestic content brought down costs, and the local manufacturers began to emerge.
4. The Competitive Crucible

In mid-1994, the State Council and the MPT agreed to allow the formation of China United Telecommunications Company, Ltd, known hence as Unicom. Growing resentment of China Telecom’s monopoly and the acknowledged importance of telecommunications to the growth of the country combined to cut short China Telecom's monopoly. Contributing to China Telecom’s demise was then-Vice-Premier Zhu Rongji, whose State Council portfolio included the reform of China’s industries and who believed that greater market competition rather than state coddling was the way to create national champion companies.

The Mobile Boom Begins

As an apparent sop to China Telecom, Unicom’s scope of business was limited to paging and mobile. Paging was no great loss: the business, while profitable, was mature and likely to decline as the cost of mobile and fixed-line phones fell in the coming years. Less comfortable was losing the monopoly over mobile: China Telecom had enjoyed monopoly pricing on its legacy and early GSM systems that brought massive profits. But Unicom, starting from scratch and needing to unify its independent regional branch companies into a single unified network, would not be ready to challenge China Telecom in the market for some time. The incumbent, for its part, alerted in advance, had already begun preparing its response: if China Telecom had to have a competitor, the carrier’s leadership vowed that the race would never be close.

Realizing the government was committed to competition, and wanting to keep any newer challengers close, China Telecom began watching the PLA. The Army had done well in its commercial telecommunications ventures, leasing its fiber-optic trunk lines and setting up popular regional paging services. But the PLA also understood that paging was on its way out, and
wanted a piece of a larger pie. Had it the facilities to do so, the PLA probably could have muscled its way into fixed-line telecommunications. But outside of the internal networks within army bases, the PLA lacked the financial wherewithal and regulatory clearance to start wiring up China’s cities and towns.

What the Army did have was a small but potentially lucrative chunk of bandwidth in the 800mhz spectrum. Fortunately for the PLA, the 800mhz band happens to be ideally suited for CDMA mobile phone signals, and CDMA made much more efficient use of the PLA’s bandwidth than GSM would have. The PLA was going into the cell phone business, but it could not muster the retail footprint to make a go of it alone. The government approved the plan by the PLA General Department to start a mobile telecommunications company, but to make sure everyone played nice the company would be a joint venture between the PLA and China Telecom. A company under the PLA General Staff Department, CESEC, formed a joint venture with China Telecom in 1996 christened Great Wall Telecom (GWT). Using equipment from foreign providers as well as some domestic companies, Great Wall began operations in soon after formation.

China now had three mobile telcos in a somewhat lopsided competition. China Telecom used its head start to ensure that the race between the three companies was never close during Unicom’s first six years of operation, and GWT, with its small spectrum allocation and its unfortunate pairing with a jealous and powerful competitor, never became a real player.

For the equipment providers, though, the battle among the three meant that all would fight to expand their networks as quickly as possible. In addition to the race to wire China, then, the equipment manufacturers faced an opportunity to help unwire the country at the same time.

While the technologies used for the new mobile networks - GSM and CDMA - were new and foreign equipment manufacturers arguably did not have as much of a lead on local companies, in fact the foreign manufacturers (especially the Europeans) had a significant head start. Qualcomm, the creator of CDMA, had started its own division to manufacture network equipment using its system, but quickly licensed it to a host of other manufacturers. Because Qualcomm wanted to license technology, not manufacture product, its own gear works were designed more to prime the pump for CDMA than to be a market leader. CDMA was more limited in its initial rollout than GSM, a rival technology backed by a group of European manufacturers. While CDMA caught on in the US and Korea, GSM nearly became a de facto global standard. Nokia, Siemens, Ericsson, and Alcatel had been involved in the early

The Military makes a foray into the carrier business

CDMA gave the local manufacturers a chance to compete with global players
development of the standard, and had been selling network equipment starting with the early tests of the technology. The locals were facing an uphill battle again. Despite an MPT edict to the carriers that they were to purchase equipment from the local manufacturers "whenever possible," there was no further guidance. What that meant, in essence, was that if the local gear companies were going to win any business at first, they would have to resort to the only weapon in their arsenals: price.

The Internet Distraction

Just as all of this activity around mobile was taking place, the Internet dropped into the laps of the telecommunications equipment industry. While the Internet was nothing new, the proliferation of popular services and sites in the mid-1990s, particularly in the developed world, meant that the world's carriers were going to need both more capacity and the ability to split twisted-pair wiring en masse into data and voice channels. The emergence of home broadband technologies like ISDN and ADSL soon had the developing world clamoring for more capacity.

For the multinational equipment manufacturers, the telecommunications boom that began in 1995 and ended in 2001 would be the absolute best of times immediately followed by a deep descent into chaos. But in 1995, what it represented was a siren call away from the politics and two-steps-forward-one-step back tango of dealing with the Chinese telecommunications industry. Aside from small clusters of geeks mostly hovering around the universities, few Chinese were excited about the Internet, and for its part the government viewed the online world with deep suspicion, if not fear. New account registrations were even closed for a year between 1995 and 1996 while the MPT and the security organs considered whether and how the Internet could be open to the public.

Against such a background, it is little wonder that the industry's focus began to shift back to the home country. While all of the major telecommunications equipment makers would remain in China for the coming years, the priority would be feeding the explosive growth elsewhere.

This decision would come back to haunt them. It was just at this moment that the real competition was beginning to form in China, and while the business for the JVs continued to grow, the locals were starting to eat into that growth.
Surviving the Dip

The first decade of the 21st century was perhaps the most difficult ten years on record for the telecommunications industry worldwide. The Chinese industry was not entirely spared the effects of the global downturn. Orders in 2001 and 2002 dropped precipitously from what they had been a year earlier, and there was concern from some quarters that China’s telecommunications industry was going to suffer the same malaise.

But as much as the dip in orders early in the new century seemed to echo the bloodbath that was taking place in the global telecommunications industry, in fact there were other factors at work in China that meant the dip was more of a pause than a crash. While the downturn in the US was the result of speculative construction of bandwidth that exceeded both demand and the economic case for its use, growth in China had been a matter of catching up with the rest of the world. After two solid decades of breakneck network construction, China could still only offer a phone to one out of every four urban residents, and only one in ten rural residents. While these numbers represented 100 times the number of lines that had existed two decades prior, there was still room to go just to deliver service to the Chinese people who wanted basic phone service.

What was more, in 2000 China was just starting to make broadband connections widely available to the public for homes and offices, and there was a long way to go. As of 2002, only 1 in 20 Chinese had Internet access. Despite seven years of headlong growth in the mobile telecoms industry, and 1 in 7 Chinese had a mobile phone, and those numbers were probably still high. The industry still had a long way to go before it had to worry about overcapacity.

So why the slowdown? Chances are good that the global telecom shock had some effect, but a greater dampening effect was probably coming from the government itself. For five years the government had been supposedly on the verge of announcing 3G licenses for the mobile carriers, an event that was expected to set off another boom for the equipment industry. But the government was determined that TD-SCDMA be at least one of the standards used when China upgraded to 3G. The standard had not been picked up in any other significant country in the world, and for China not to make some use of the standard would eliminate whatever credibility it - and China’s engineers - had earned by gaining International Telecommunications Union (ITU) acceptance of the standard in the first place.
The industry had somehow convinced itself that 2002 would be the year for 3G at last, and networks began putting equipment purchases on hold. After all, why buy 2G networking gear if the 3G announcement was in the offing? But TD-SCDMA was still not ready, experiencing growing pains that kept it confined to test networks, and that kept engineers from Datang and Siemens back in the labs trying to make the standard actually work in the field. There were other concerns as well. Minister of Information Industries Wu Jichuan expressed the concern of many in the Chinese government when he explained how the sight of European carriers almost going broke because of the cost of 3G so soon after the telecom bust had leaders questioning whether 3G was ready for deployment.

Despite a major restructuring of the telecommunications industry in 1999, rumors were again on the rise about another reorganization of the carriers that would even out competition in mobile. Few details were available beyond the fact that the government was considering the move, but it made operators more hesitant to lay out funds. After all, why spend money on a network you may have to give up at some point soon?

In 2003, with no timetable in the offing, the carriers realized they could not afford to wait: in the intervening two years, 100 million more subscribers had joined China's mobile networks, and with no signs of slowing, orders had to continue apace. China Mobile alone planned to spend RMB 293 billion on GSM upgrades, pumping over 25% of its revenues as the dominant market leader in mobile in China into capital expenditures. Whether 3G came or not, China would not be experiencing a telecoms bust. Not yet, anyway.
The Hypercompetitive Cauldron

The fight into which these companies leapt in the late 1990s was arguably the most competitive telecommunications equipment market in the world. Any company seeking to sell its equipment in the PRC would not only face every competitor it would face elsewhere in the world - Siemens, Alcatel, NEC, Fujitsu, Lucent, Nortel, Nokia, Motorola, Ericsson and Cisco, among others - but also would face the half dozen Chinese manufacturers. In the words of one longtime observer, China had become the new Great Game for business, and everybody was staking out their territory. The import channel was largely closed: the tariff holiday granted by the government from the early 1980s was ended in 1996, but the major global players had each established a manufacturing presence onshore. Not only were the multinationals competing with the Chinese, they were also onshore and had the opportunity to capture the same cost advantage. By all rights, they should have beaten the locals.

Yet that they did not was understandable. While the global majors had been primarily focused on building relationships with the carriers in Beijing and in the major cities, and continued to win a majority of orders from China’s carriers through the end of the century, they were still weak in the provinces and the countryside. This was a critical vulnerability, one which the
Despite an effort to extend their outreach, they could not match the depth of penetration that the locals established.

It did not make things easier that they were distracted. Orders in the United States and Europe to build the new information infrastructure demanded by the Internet boom had become the focus of each of the major global manufacturers. Suddenly, WorldCom became more important than Unicom, Verizon more critical than China Telecom.

The boom in other territories created an even greater issue for the global leaders: price. When the Chinese manufacturers had begun competing on the basis of price in the early 1990s, they were doing so with hardware that was also markedly inferior to what the multinationals were offering. The belief that this remained the case lingered until long after the local manufacturers had begun closing the gap. The result was an innovator's dilemma: at some point, your competitor will make a product that is "good enough" to substitute for yours, and at a much lower price. How do you respond?

For the most part, the multinationals responded by holding the line. With orders continuing to climb in China and booming elsewhere in the world, there was little incentive to drop prices - apart from the fact that the local manufacturers were approaching 50% market share. These numbers were obscured, however, by continued growth in absolute market size. Rather than focus on market share, then, the global manufacturers satisfied themselves with capturing profits and sustaining a modest rate of growth.

Modest growth, however, was not enough. One executive recalled a conversation in 1999 between a manager with a regional office of China Telecom and a representative of one of the global equipment suppliers. The China Telecom manager had come to buy enough switches and other equipment for ten million lines. The global equipment supplier had planned on selling one million lines for the entire year for all of China, and was pleased with the number as it represented a 25% increase over the previous year. There was no way his company could even begin to honor the request. "We are fully booked for the next 36 months," he told the China Telecom manager. "We would be more than happy to take your order, but it will take three years to get you the equipment."

In late 1999, this was not an uncommon story among the equipment suppliers, and the local operators, initially frustrated, became resentful. In addition to the growing price differential between the local manufacturer and the foreign providers and the shrinking differences in performance, many of the carriers really needed to economize. By the late 1990s, networks now...
covered most of China’s wealthier cities, and the carriers had to focus on connecting the poorer cities and provinces and China’s rural residents. Top-notch, high-quality, fully-featured equipment designed for the global market was not what the carriers needed: they needed equipment where the capital cost made sense based on the much lower revenue they could expect in the countryside. The global majors could not offer much in that regard.

Chinese manufacturers, however, did not have the same problem. They were not only prepared to deliver immediately and were also able to promise production in the following years that would match anticipated growth, they would do so at substantially lower costs. That the locals could deliver when the foreigners could not and do so at lower prices provoked some skepticism among carriers. Yet the manufacturers managed to do it. Between 1998 and 2001, the global manufacturers managed to double sales in China, but the local manufacturers tripled - and nearly quadrupled - their production.

The local manufacturers then made two major decisions that sealed their reputations and success for the long term. First, they resisted the temptation to raise prices to match the prices of the global giants when the problem was not price, but availability. In doing so they established tremendous goodwill with local carriers, and ensured that there would be no complaints to Beijing about profiteering. For the sake of the relationships with the carriers, this was a far-sighted move.

Second, each of the local companies, and in particular Huawei, increased investments in research and development, and began establishing labs in China, overseas, and with partners and customers. For the leading locals, every interaction seemed to be an opportunity to learn something new about the way a telecoms business ran, and the knowledge was dutifully absorbed, consolidated at HQ, and acted upon.

Yet amid all of this, and amid growing support for carriers to "buy local" when they could, the Chinese government continued to support the local joint ventures, offering Shanghai Bell credits for buying from local subcontractors. But the joint venture structure was proving tiresome to most of the companies that still used them. Not only was managing a joint venture an unwieldy process, it made the larger companies reluctant to transfer production of their most advanced products to China. At the same time, Chinese carriers wanted the most advanced hardware, and the cost of importing (which had to be resumed in 2000 for lack of onshore production of broadband equipment) was too high to sustain. Time was coming for a change. The question was, would it bring the results the foreigners had hoped, or would it open the door yet further for local
manufacturers who were now making massive inroads into the business?
5. China’s Winners - And Losers

As it happened, the answer was somewhere in the middle. Even as local made inroads into the business of the global manufacturers, the global firms adapted their businesses and began to push back on the inroads the local firms were making. And in what is perhaps the most remarkable part of this story, the government did not sweep in and award the locals with all of the lucrative contracts for China’s mobile and broadband networks. Instead, the Chinese telecommunications equipment industry experienced – if not a bloodbath – than a slow winnowing of the field. And it was the companies who had begun with the greatest government support that were left behind.

As we noted, in 1980 PTIC combined into a single entity all of the 127 factories and quasi-enterprises under the MPT and its regional bureaus that had been involved in manufacturing telecommunications equipment. What was initially a promising development was stymied by over-centralization and sheer mass. The various entities making communications gear under the other ministries - the 1MMB, the Ministry of Aerospace, the PLA - fared no better. Within two years, the MPT had decided with State Council concurrence that if China’s telecommunications networks had a hope for the future, it would not be by partnering with the moribund domestic equipment business.

The next twenty years would see a brutal culling of this herd against competition from Japan, Europe, the United States, and Korea. The winners surprised nearly everyone, not least the high-level government policy makers appointed to pick and back a government champion for the industry.

Great Dragon

If government support could make a difference in a company’s success or failure in China, Great Dragon should be the world’s largest telecommunications company today, surpassing even
Ericsson of Sweden. Begun as a project to develop a locally made switch at a minor engineering university in Henan province, Great Dragon was started by the son of a PLA general with what at the time was a generous cash horde of around US$800,000. The switch, christened the HJD-04, was licensed to six factories in 1991, and by 1994 was the leading locally manufactured switch in China. Great Dragon had scored a coup, and was positioned to lead the industry.

Then the government got involved. In 1995, all of the factories making the HJD-04 were folded into Great Dragon, including one army factory. Officials expressed the expectation that Great Dragon would defeat the global competition, and backed up their words with millions of dollars in cash and credits on an annual basis. On paper, it looked like a brilliant move, and some foreign executives expressed concern about this new government-backed juggernaut.

Unfortunately for Great Dragon, the government had proven itself less adept at the telecommunications business than many international executives and legislators had hoped. China had created a giant in digital switches for fixed-line networks just as the mobile boom was taking off and data was starting to displace switched voice calls as the primary use for telecommunications networks. Switch prices plunged, and Great Dragon went into a long, slow dive within two years of its formation and never recovered.

The People's Liberation Army

President Jiang Zemin’s 1998 edict requiring the PLA to divest their business interests largely ended military participation in civilian telecommunications. Jiang’s purpose was unequivocal: get the Army out of business, professionalize the officer corps, and get the military focused on the basics of national defense. To the extent that the PLA needed to make or acquire telecommunications equipment going forward, it would have to do so through a wholly military organization, CESEC.

For the industry, this came as something of a relief. Under the Chinese political system, the PLA operates as a force independent of civilian ministerial control. When the PLA is performing its national security function, this is right and proper, but when it ventures into areas outside that bailiwick - by getting into business, for example - it creates chaos and unfair competition. How do you explain to one enterprise that it must comply with the law, when a competitor is exempt from such regulations solely because it is owned by the Army? As the
narrative above should make clear, the PLA had occasionally been a force for positive competition, but it was largely a headache for those trying to guide the future of the industry.

The PLA’s big play in telecommunications equipment had been Great Dragon, and with the slow demise of that enterprise the Army was in steep decline as a force in the industry. When the MII reorganized the carriers, the PLA lost its holdings in the carriers during the ownership shuffles in the late 1990s.

**Putian**

China Putian Corporation was the only company of any size to survive out of the PTIC conglomerate, and indeed traces its lineage back to the formation of PTIC. In many respects, Putian is the living successor to PTIC’s legacy of the first. With the backing of the government and without the over commitment on a single product, Putian encompassed dozens of companies in various parts of the telecommunications equipment industry, many of which eventually were listed in Chinese stock markets independently of the central company.

While Putian survived the culling, it did so less on the back of innovation or development and more as a partner or subcontractor to global manufacturers. Unquestionably a success, it was something of a disappointment to policy-makers. At the same time, Putian never got the high-profile backing or assistance of Great Dragon, and its decentralized group structure proved too unwieldy for a generation of Chinese managers unaccustomed to the challenges unique to such a company. Putian survived, but it would never be the great hope of the Chinese telecommunications industry.

**CATT/Datang**

The third of the government’s great hopes for global leadership in telecommunications equipment was also born of a government project. By the late 1990s, China was facing the prospect of upgrading its mobile networks to one of the new third-generation (3G) standards, a change that would make broadband ubiquitous in a country that faced huge investments to replace legacy wiring to deliver wired broadband. China’s policymakers had decided that eventually China would have to adopt 3G. What worried the MPT (after 1998, the Ministry of Information Industries, or MII) was that given the rapid growth in mobile telecommunications and the not-inconsiderable licensing fees
Chinese manufacturers and networks would have to pay, adopting wireless broadband would see billions of dollars flowing out of the country in return for mere "rights" to use a technology. What was more, China had no say in which technologies it would be able to choose.

To avoid this situation, the MII instructed one of the research institutes under its aegis, the China Academy of Telecommunications Technology (CATT), to begin development on an all-Chinese standard for 3G. The project was spun out of CATT in 1998 as Datang Telecom, and with the financial backing of the MII started working with Siemens AG on developing what came to be known as TD-SCDMA. The project had a national priority: the government not only saw its importance to China’s telecommunications industry, but to China’s standing worldwide. If, the reasoning went, China could produce a global telecommunications standard, it would not only help keep some of the licensing money back home, it would also earn for China a place at the tables in Geneva where decisions about standards were made. China coveted that seat, and was willing to pay to get it.

Datang’s effort succeeded - in part. TD-SCDMA was recognized as one of the world’s three standards for 3G, the other two being Qualcomm’s CDMA-1X and Ericsson’s WCDMA. But in the process, Datang’s national mission had crippled its business, and was only able to survive with growing cash injections from the Chinese government via state-owned banks.

ZTE

Founded in 1985 out of a group of companies under the Ministry of Aerospace Industries, ZTE began as a semiconductor producer. The semiconductor industry in the late 1980s was going through a period of extreme competition, with U.S., Japanese, Korean, and Taiwanese companies all battling for supremacy, and all boasting technology far more advanced than ZTE. The company moved into telecommunications, determined to create its own switch. As with Dragon, Datang, and Putian, ZTE could rely on continued subsidies in its efforts, and was able to start selling its first switch in the early 1990s.

While its core switch business grew, ZTE, unlike Dragon, did not have to worry about consolidating disparate businesses, and it did not need to brook regular government interference once it was producing product successfully and had undergone public listing in Hong Kong. While not a private company in the classical sense, ZTE had earned its managerial independence.
through strong performance, through buy-out, and by locating itself in Shenzhen, far from the centers of government power. Investing heavily in R&D, the company began developing mobile networking products early, and worked closely with Qualcomm (and other partners) to develop its own mobile networking gear by the early 2000s.

Huawei

Founded in 1988 by Ren Zhenfei, a former researcher with a small military research center in Sichuan. Ren had been out of the army for over a decade, trying his hand at selling consumer electronics, before founding Huawei with Sun Yafang and other co-founders with US$5,400. Starting out as a sales agent for foreign telecom firms, Huawei started making enterprise networking gear for hotels and factories in the early 1990s, relying on lower prices to earn business. Unable to gain access to capital from government or banks, the company depended on bootstrapping and shrewd investment in R&D, and the company was making switches by 1993 and selling them in out-of-the-way cities and rural townships where the company was able to develop strong relationships. Ren and company learned early that while many companies in the equipment industry had manufacturing capabilities, R&D and sales would divide the leaders from the followers, and thus invested heavily in both ends of the process. These advantages, along with the distance from political centers and a dogged independence, ensured Huawei had the room to maneuver as competition heated up.

Winning is Flying Low

Clear winners were starting to emerge among China’s equipment manufacturers, as Huawei and ZTE, the former a privately owned, privately managed company, and the latter a hybrid of a state-owned and privately owned company (albeit with a lot of autonomy) pulled away from the rest of the local competition. Even though the government continued to urge the carriers to buy local, both were happy to be as far away from centers of power as possible. The results of one inspection of Huawei early in the decade reveal why. In a presentation to an inspection team from Beijing, the topic of Huawei’s employee stock ownership program came up: Huawei was and had been an employee-owned company from the very start.
The stunned inspectors immediately reminded Huawei that such arrangements were, under Chinese law, illegal. The company spent several months unsure whether it was going to be shut, fined, an/or closed permanently. It was a very near thing. Finally, someone in Beijing recognized that while the law was the law, shutting down the country’s leading telecommunications firm because it had a progressive human resources and compensation program would reflect miserably on the country and be a damper on both entrepreneurial behavior and innovation. Huawei was given a pass, but others might not be so lucky.

As Huawei breathed a collective sigh of relief, executives were once again grateful that policymakers remained focused on networks. The government wanted faster rollout of mobile, broadband, and digital cable television, yet the Beijing was worried that, unchecked, Chinese carriers would follow their US counterparts into an exuberant explosion of capacity. China had not yet built "redundant" networks, but the US telecommunications industry had gone from underbuilt to overbuilt in less than five years, and many other industries in China - automobiles, for one - were sitting on excess capacity unlikely to be taken up for decades, if not longer. Premier Zhu Rongji regularly warned the industry to avoid this trap, but the direction of his concerns were interesting: China may be the great game in telecommunications equipment, but no such unbridled and redundant capacity would be allowed in the networks.

The lesson was lost on neither Huawei nor ZTE: best to keep a low profile vis-a-vis the government, and just stick to business. Accepting government assistance was tantamount to granting every petty bureaucrat from the MII upwards to make decisions that would alter your business. Independence had brought them this far, and assistance had encumbered rivals. They would stick to an independent path.

At the same time, both began looking for ways to bring their product development and operations up to global standards: Huawei had been accused by Cisco of essentially knocking off a Cisco product all the way down to the typos in the instruction manual, and it wanted to distance itself from the "cheap imitator" monicker. The company hired IBM to help implement a professional RYD program, upgrade the company’s supply chain, improve its leadership development team, and streamline the financial management of the entire organization. Even though the firm was not listed overseas (and, given the employee ownership program, was unlikely to do so soon), it recognized that transparency was no longer just a good idea: it was imperative.
Huawei, ZTE, and 3G

As the companies were maturing, they were about to be handed their biggest opportunity since their founding, one that would push both firms to faster growth than even the past five years had offered: the upgrading of China’s mobile networks.

Foreign manufacturers had long dominated China’s mobile network infrastructure, and for good reason. The companies were the most experienced, in many cases had developed the technologies in question, and offered proven hardware. Motorola had dominated paging and first generation cellular service. When China upgraded to 2G (GSM and CDMA) service, foreign firms dominated. One estimate from 2000 suggested that the global players held 97% of the market in China for GSM network equipment. Against the domination and experience of Ericsson, Alcatel, Nokia, Siemens, and Motorola, local firms were unlikely to make much more than token headway. Little wonder, then, that negotiations between the China and WTO member companies on China’s accession to the global trade body included access for carriers but did not cover telecommunications gear: foreign telecom hardware companies were doing just fine.

Upgrading to 3G, on the other hand, offered the maturing local manufacturers an opportunity to even the score a bit. Foreign manufacturers were starting to learn how to produce 3G equipment at around the same time as Chinese manufacturers were. And, ironically, the longer the government delayed the decision on 3G, the more time the local manufacturers would have to catch up technologically and to figure out how to make the gear in a way designed to appeal to local needs.

In the meantime, the locals were preparing. Foreign partners like Qualcomm provided technical support for ZTE and Huawei in their effort to start manufacturing 3G equipment for export and for eventual use at home. The companies also joined the TD-SCDMA forum, making sure they would be ready to produce TD-SCDMA gear if that standard got the nod.

Despite the national focus on mobile, China’s fixed-line broadband business was also picking up. Local carriers were advancing plans to upgrade their fixed line services to ADSL in most cities, creating a national broadband network. Cable operators were getting approvals to upgrade their networks from analog to digital after a nearly ten-year wait. All of this played right to the strengths of the local gear makers.

As noted above, the foreign manufacturers stayed in the game, many adapting quickly to the inroads local competitors were making. Were it not for extenuating circumstances, their China
business should have driven those companies to the level of profits they had enjoyed globally in the 1990s.

Yet still reeling from the double-shock of the dotcom bust and the telecom collapse in the west, China had turned into the industry’s life raft, the only source of consistent business for the foreseeable future. The awful truth was that all of the telephones in China would not be enough to preserve the global giants from painful choices. Facing both shrinking order books and a mandate to cut costs, many companies chose to cut into areas that in better times might have been considered sacrosanct. Research and development were slashed, as were new products and any significant new businesses. Some of the global giants, facing harsh global prospects, began eating the very seed corn that could make them competitive in China - and beyond - in the years to come, doing so just as the Chinese competitors were doubling-down on research.

In an effort to regroup, the industry outside of China turned to consolidation. In the first decade of the millennium, AT&T and Bell Labs disappeared into Lucent, which then disappeared into Alcatel-Lucent. Siemens, Nokia, and Motorola have all pooled their telecom equipment companies into a single pool, and Nortel is...gone. The Chinese watched these moves with care, understanding what drove them but wary that the result would be global competitors so large that no company could compete against them.
**Digital Economy**

In 2007, Wang Jianzhou, CEO of China Mobile, saw an ad for Cingular wireless in New York. The ad boasted that Cingular had over 47,000 cell sites (base stations, in industry parlance), more than “any other wireless network.” At the time, China Mobile had over 230,000 base stations for a country of approximately the same size.

---

As early as 1998, amidst the growing global froth around the growth of the Internet, China’s leaders were determined that China would build a digital economy on a par with any country in the world. Few officials understood what that would entail, and more than one admitted as much privately. Yet if there was one aspect of the digital economy that the technocratic Politburo understood it was that a robust infrastructure would be needed to enable all of the profitable electronic activity.

Planners in Beijing saw value in “catching up” with the rest of the world, but preferred instead to push the telecommunications carriers (over which they exercised the kind of enterprise-level control all but expunged from China’s economy) to leap ahead, to anticipate where the economy would be a decade or more hence, and construct their networks on that basis.

Just as pressing was the need to offer access to the Internet to as many Chinese as possible. Several officials privately acknowledged that the “digital divide” was a latent social issue, but the matter went beyond that. China’s growth hid deep issues with productivity; migrant workers unable to stay in touch with families for months or years were a latent source of discontent; and China’s natural tendency toward regionalism demanded the glue of ties that transcended geography. In telecommunications and the creation of a digital economy that operated in a “placeless” manner, some saw ties that could help the nation rise above its political parochialism.

This ambition nearly assured global manufacturers a continuing share, provided that they could continue to offer innovations relevant to China’s market and the challenges facing operators. There were few sops offered to local manufacturers: as in the past, planners gave operators wide leeway in choosing suppliers. Once again, carriers were compelled to think five and even ten years ahead in their plans.

Wang Jianzhou may have come across to the *Forbes* reporter quoted above as relaxed and confident, but he undoubtedly
understood that he would need Wall Street’s help to finance a network that could keep up with demand. (Likely he was in New York seeking just that.) Even if the number of new subscribers declines as market penetration begins to match the overall population, bandwidth demand would not. Indeed, the prospect of shifting hundreds of millions of subscribers from ordinary mobile voice service to data services had some engineers wondering whether they would even have enough radio spectrum to service a population using their handsets as their primary point of internet access.

In short, for China’s digital economy to stay on track, innovation was essential. The global providers would deliver: local equipment manufacturers, however, would have to innovate to earn market share.

**Innovation Nation**

In 1978, Shenzhen was a fishing village on China’s fortified border with British Hong Kong, and the founder of Huawei was wrapping up his role as an army researcher to go and find more lucrative opportunities elsewhere. But today, Shenzhen is a vast city of opportunity seekers, and Huawei is based on an immense campus in the Longgang section of the city. When you look north, toward Beijing, from the Huawei campus, you see mountains, and a smile comes to your lips, remembering the old Chinese saying “the mountain is high, and the emperor is far away.”

The campus feels more like a newish California university than the headquarters of one of the world’s largest telecom companies. Trees are everywhere, and the buildings are all low-rises, separated by landscaped grounds and wide walkways. There are dining halls, lecture halls, offices, work areas, labs, and even dormitories. You walk into the buildings and you cannot help but think to yourself that the access control is far more relaxed than most technology companies in the United States. The last time I was at Qualcomm headquarters, I had to fill out forms and swear to my citizenship. At Huawei there are glass doors and escalators.

When you go down that long escalator into the cavernous exhibition hall, the sense of theater overwhelms you a bit. You realize you are about to drink from the corporate propaganda pump, so you load up your cynical side, put on a wry smile, and you prepare to greet everything with skepticism.

And then walking around and just asking questions, you start to hear things you did not expect. They’ve figured out a way to
make a base station that you can program to tell it what kind of network to serve - you don't have to make any hardware changes. They have base stations powered by solar, and base stations that don't take up the space of a refrigerator, but instead sit next to the antenna on a mast. For places where the power supply is really sketchy, they have a double back up system - a battery AND a generator - built into the base station.

They have created base units with cooling systems built in, so carriers don’t need to worry about installing industrial air conditioning in a huge room for just a couple of base stations. And they already have a base station that will do both kinds of fourth generation (4G) networks, long before 4G networks have been deployed. By the time you finish your stroll, you start to understand more about Huawei, but you also understand innovation in a way you hadn’t before.

Much is made in both the Chinese and the global media about innovation in China, or, more precisely, the lack thereof. China’s government has made it a national imperative to encourage indigenous innovation for the last two five-year plans, and yet the nations leaders seem to be at a loss as to how to encourage it. Meantime, wags both in China and outside like to talk about China’s “indigenous imitation” programs, suggesting that what Chinese companies pass off as innovative is really just an knock-off of something from overseas.

A knock-off is not innovation. A breakthrough is. But there is a grey area in between where more of China’s companies are living and learning to be innovative and creative in a culture and political system that has all but burned such instincts. These small innovations are a pathway to something bigger, and these need to be fairly recognized for what they are, if only to understand how these companies are starting to build genuine global competitiveness - and how they aren’t.

After walking through Huawei’s museum I was trying to put a word, a phrase, a description of what I had seen and how it differs from the sorts of innovation one sees going on at an Apple, a 3M, a Qualcomm. One Huawei executive helped me out with a story.

"Let’s say I am a winemaker," he begins, "and I am talking to a customer here in China. He likes my wine, but unlike people in the west he really doesn’t drink a whole bottle at a meal - in fact, he may drink a half or a third of a bottle at a meal, and then the rest of the bottle goes bad or gets wasted because I’m not a big drinker."
"He doesn’t need a new wine. What he needs is for that same wine to come in a bottle about 1/3 the size. Now, he goes to one of the big California wineries and asks them to change the bottle, they give him a whole bunch of reasons why they can’t. Then he comes to me. I really want his business. He asks me for wine in a 250ml bottle. My response? When would he like it?"

China's telecommunications equipment companies are starting down the innovation pathway by pursuing what we could call customer-based innovation rather than technology-based innovation. While you will see occasional technology innovations (the programmable base station really had me geeking - I know how important that technology will be as networks upgrade), the real breakthroughs come when the customer says, "hey, could you guys..." and the answer is not "yes" or "no," but "let's try."

This is innovation that focuses on the marketization of technology, on greater usability and on being able to offer an item at a lower cost, with more features, all while sustaining the high margins that will support deep R&D investments and growth.

This is not an isolated phenomenon. A recent report from McKinsey’s Gordon Orr and Eric Roth (“A CEO’s Guide to Innovation in China,” February 2012) suggests that we have been looking at innovation in China the wrong way. Chinese innovation is less of the basic breakthrough level than it is in commercializing improvements to existing breakthroughs. To put it another way, we see innovation as a great leap, while China innovates in a series of incremental steps. In this way China is not unlike Japan. Orr and Roth were talking about the automotive, semiconductor, and pharmaceuticals industries, but the point applies here as well.

This is the final secret of the success of China's telecommunications equipment providers, and one where they are establishing a model for other companies and other industries. The trick is not to sell the same thing for less by slashing your costs or your margins. The trick is to offer something that is genuinely a better, more relevant product for less than the competition, and still make a healthy profit.

This is what demonstrates how far these companies have come, and it hints at how far they will go. In a day and age when so many of the world's former leaders in telecommunications are retrenching just as the developing world is starting to build their information infrastructures, the upstarts seem to have figured out the key to success.

Innovate. Or lose.
6. Conclusions

In the development of China, each industry has followed a separate path, with the government taking on different roles, and market forces having greater or lesser effects. There is a danger trying to apply one’s understanding of the dynamics of one industry or sector to another without first taking the time to appreciate the differences, the context, and the history.

The history and the context of China's telecommunications industry offers us a range of lessons that we need to apply right now if we are to avoid costly mistakes in government policy and corporate strategy.

1. Circumstance, not capability or opportunity, placed China's telecommunications industry behind that of the West, and once circumstances favored technological development, China's industry thrived. The rise of China's telecommunications industry was put off until recently not because something was lacking in China's market, people, engineers or entrepreneurs, but because of the harsh vagaries of China's recent past. Once the tumult of the nation's great upheaval began to subside, once the creators and salesmen were allowed to get on with it, they caught up with surprising speed.

Granted, they did not work in a vacuum. First with help from the Soviet Union, then with the model of western giants and the technology that seeped into the system via joint ventures, the industry was seeded with knowledge from elsewhere. But once given that intellectual seed corn and the scantest opportunity to reap its fruit, these companies grew and flowered in competition with some of the world’s leading technology firms as well as each other.

To the dispassionate reader the above seems self-evident, and to the businessperson or engineer, it is agreeable enough when applied in the aggregate. It has been the author’s experience, however, that many of us have a blind spot vis-a-vis China when it comes to our own industries. Whether driven by hubris or wishful thinking, I have heard aerospace engineers question China’s ability to build competitive commercial jets and Indian software engineers expound at length as to why China will never
be a software power. It is time to set fire to such comforting conclusions. Indeed, the idea that China will rise to dominate every industry it touches seems to presume an unlikely degree of technological and commercial paralysis in America, Europe, Japan, and the other BRIC countries. Nonetheless, the time has come for a healthy dollop of strategic paranoia about China as a global competitor in even the most complex industries.

2. **Rapid growth, global competition, uncertain policies, deep investments, and aggressive customer relationship building built China's telecommunications manufacturers**, not some nefarious government plan to create competitors who would rule the world. On the contrary: the telecommunications industry in China is an object lesson that would warm the cockles of any Tory or Republican heart. The companies backed by the full support and assistance of the government in its effort to create national champions failed, imploding either of their own weight or melting at the first sign of true, unfettered competition. If anything, government connections and assistance appear to have inhibited the long-term success of the companies who "enjoyed" such benefits, while the companies that have succeeded appear to have done so at least in part because they have eluded bureaucrats bearing the dubious gift of government help.

Speak off the record to executives of China's most successful telecom equipment manufacturers and they will confess that the growth of their business in China is as much the result of governmental benign neglect as any other factor. It is a shame this point is not made more frequently in China. A myth has risen in the wake of China's reforming and opening that government action, industrial policy, and occasional micromanagement of industries is responsible for China's economic prowess. The telecommunications equipment industry suggests exactly the opposite.

If there is a lesson for China in this story, it is this: that national champions are created not by coddling them under the umbrella of protectionism, by second-guessing management, by even by opening the national coffers, but by simply getting out of their way.

If there is a lesson for us in the west, it is that the time has come to shake off our unspoken belief that we remain the best at everything we do, and that when somebody from an unexpected place beats us, they must be cheating somehow. Sometimes they are. But sometimes they aren't, and knowing which is which is the difference between responding appropriately to a new challenger and getting run over by him. Convincing ourselves that the hidden hand of a mighty government moves our rivals
when in fact better execution on business fundamentals is the key to their success, our response cannot be anything but inappropriate and ineffective, and will hasten our decline.

Worse, tarring with a broad brush a company that could be a lucrative partner endangers our future, shortchanges our shareholders, cheats our customers, and deprives our nation. The great promise of globalization lies in the value of honest commercial ties between innovative, capable, and transparent businesses. We owe it to ourselves to find those partners, not dismiss them out of hand.

3. **State capitalism has real limitations.** China’s economic rise against the background of a decade of economic upheaval in the West has provoked some economists to suggest that China is creating a new model of state-backed capitalism that seems to be a compelling approach for developing countries. Some have gone so far as to suggest that this mode, dubbed “The Beijing Consensus,” rather than Marxism, is the true nemesis of post-Bretton Woods capitalism, and that it may be time for the West to consider moving a ways down the statist road by implementing robust industrial policies.

The case of China’s telecommunications industry suggests that the early fruits of state involvement in an industry are not sustainable in the long term, and that at some point in the development of each industry the bureaucrats and policy-makers must step away and allow more entrepreneurial forces to take over. Beijing’s early involvement in companies like Great Dragon and Putian were essential boosters without which the China might still be trying to break into telecommunications. Within a decade, however, state involvement (and the inevitable meddling of aparatchiks that accompany it) became a suffocating albatross. It was only scrappers like the entrepreneurial Huawei and the spun-off-and-discarded ZTE that allowed the Chinese telecommunications industry to evolve beyond simple vendors of import substitutes.

The challenge for policy makers is on having the wisdom to decide when to step away and let commercial forces take over, and the political will to abandon presumptive champions in the name of greater future opportunity. They cannot do this alone: they need cases, models, and tools to help them overcome uncertainty, opposition, and inertia and shove the hatchling out of the nest.

This suggests a new direction for our debate about statism versus the corporate and entrepreneurial varieties of capitalism: perhaps state capitalism is a stage rather than a complete model of industrial development, and our focus should be on
understanding when an industry is ready to fly, and on providing leaders with the tools and support they need to let it happen.
## List of Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1MMB</td>
<td>First Ministry of Machine Building, PRC</td>
</tr>
<tr>
<td>4MMB</td>
<td>Fourth Ministry of Machine Building, PRC</td>
</tr>
<tr>
<td>BPT</td>
<td>Bureau of Posts and Telecommunications (Local or Provincial)</td>
</tr>
<tr>
<td>CATT</td>
<td>China Academy of Telecommunications Technology, MIIT</td>
</tr>
<tr>
<td>CDMA</td>
<td>Code Division Multiple Access, a second- and third-generation digital wireless telecom standard developed by Qualcomm in the United States</td>
</tr>
<tr>
<td>CPC</td>
<td>Communist Party of China</td>
</tr>
<tr>
<td>GDP</td>
<td>Gross Domestic Product</td>
</tr>
<tr>
<td>GSM</td>
<td>Global System for Mobile Communications, a second-generation digital wireless telecommunications standard</td>
</tr>
<tr>
<td>GWT</td>
<td>Great Wall Telecommunications</td>
</tr>
<tr>
<td>ITA</td>
<td>Imperial Telegraphic Administration</td>
</tr>
<tr>
<td>JV</td>
<td>Joint venture</td>
</tr>
<tr>
<td>KMT</td>
<td>Nationalist People's Party (Kuomintang)</td>
</tr>
<tr>
<td>MII</td>
<td>Ministry of Information Industries, PRC</td>
</tr>
<tr>
<td>MIIT</td>
<td>Ministry of Industry and Information Technology, PRC</td>
</tr>
<tr>
<td>MND</td>
<td>Ministry of National Defense, PRC</td>
</tr>
<tr>
<td>MoR</td>
<td>Ministry of Railroads</td>
</tr>
<tr>
<td>MPC</td>
<td>Ministry of Posts and Communication, ROC</td>
</tr>
<tr>
<td>MPT</td>
<td>Ministry of Posts and Telecommunications, PRC</td>
</tr>
<tr>
<td>NPC</td>
<td>National People's Congress, PRC</td>
</tr>
<tr>
<td>NSN</td>
<td>Nokia-Siemens Networks</td>
</tr>
<tr>
<td>PLA</td>
<td>People's Liberation Army</td>
</tr>
<tr>
<td>PRC</td>
<td>The People's Republic of China</td>
</tr>
<tr>
<td>PTIC</td>
<td>China Posts and Telecommunications Industry Corporation</td>
</tr>
<tr>
<td>RMB</td>
<td>Renminbi Yuan - the currency of the PRC</td>
</tr>
<tr>
<td>Abbreviation</td>
<td>Description</td>
</tr>
<tr>
<td>--------------</td>
<td>-------------</td>
</tr>
<tr>
<td>ROC</td>
<td>Republic of China</td>
</tr>
<tr>
<td>SOE</td>
<td>State-Owned Enterprise</td>
</tr>
<tr>
<td>TD-SCDMA</td>
<td>Time Division Synchronous CDMA, a third-generation digital wireless</td>
</tr>
<tr>
<td>USSR</td>
<td>Union of Soviet Socialist Republics</td>
</tr>
<tr>
<td>WCDMA</td>
<td>Wideband CDMA, a third-generation digital wireless telecommunications standard developed by Ericsson of Sweden in cooperation with other European companies</td>
</tr>
<tr>
<td>ZTE</td>
<td>Zhongxing Telecommunications Equipment Company, Ltd.</td>
</tr>
</tbody>
</table>
Bibliographic Essay

Making the Connection is meant neither as a journalistic or scholarly account, but does incorporate aspects of both approaches. In writing this monograph I have had the great good fortune to work not only from my own 19 years as observer, participant, or consultant in the Chinese telecommunications industry, but also from several hundred secondary sources and the ideas and interactions with a wide range of people. To the latter I am particularly indebted, and I want to take a moment to thank those people.

Most of the sources are self-explanatory, but there is one that I would like to note in particular. Scholarly writings on China prior to 1980 focused almost exclusively on wider issues of politics and economics, and almost not at all on industry. While the situation improved somewhat after 1980, focus has remained largely on wider questions and less on the specific industries. Writings on the history of the Chinese telecommunications industry would be thin indeed without the work of one outstanding scholar, Dr. Eric Harwit of the University of Hawaii, who has done us all a great service by publishing his excellent work China’s Telecommunications Revolution.

Jeanne-Marie Claydon Gescher, OBE, was my employer and mentor in the late 1990s and contributed greatly to my ability to express coherently much about China’s policy-making apparatus that I understood intuitively. I had engaged in policy analysis long before I met Jeanne-Marie, but her long experience in China and the barrister’s discipline she brought to my interpretation.

Duncan Clark of BDA remains one of most astute observers of the Chinese telecommunications industry and, as Eric Harwit as acknowledged, the closest thing we foreigners have to an institutional memory of the development of the Chinese telecommunications industry. Duncan has been client, ally, and friend, and it is always somewhat humbling to find myself quoted in the same news stories as he is.

Steven Schwankert has been both interpreter and participant in the Chinese Internet scene for as long as there has been such a scene. Over the past decade he has been my most regular sounding board for my thinking about the industry and how to write about it.

Sometimes one’s thinking is best tested in the crucible of dogged questioning, and for this I have had the good fortune of being grilled on my views by some of the best journalists in the business. Andy Browne, Loretta Chao, Gady Epstein, Charles Hutzler, Joe McDonald, Matt Pottinger,
Where I can attribute a fact or quote, I have done so, but where a fact is the result of my own knowledge or interpretation I have not noted it. In all else, any errors or omissions are strictly my own.
About the Author

David Wolf has been analyzing and writing about the Chinese telecommunications industry since 1993, and has lived in Beijing since 1995. In addition to serving in management roles in television, radio, and communications in China, he has served as an advisor in China to companies like Qualcomm, Motorola, Alcatel, PanAmSat, and Irdeto since 1998. He serves on the advisory board of the Research Center for Politics and Business at the University of Indiana, and on the editorial advisory board of the China Economic Quarterly. He is a frequent speaker and contributor to trade and business publications on issues in China, and blogs at siliconhutong.com.
Endnotes

1. Telecommunications equipment is just the first sector. More recently, we have watched China catch up in thin-film solar cells and wind turbines, and the world can expect challenges from China in the coming decade in new energy, civil aerospace, biotech, polymers, automobiles, and a range of services businesses.

2. Unlike in the USA or Europe, mobile phones are sold at full, unsubsidized retail price either by the carrier or at an electronics store. The downside is that you pay for your hardware in full. The upside is that with no subsidies, talk time is cheap.

3. AT&T had first begun to probe opportunities in China prior to its breakup in the early 1980s. The last real hopes for global carriers to capture a piece of China's domestic growth was China's accession to the WTO. While there were provisions in the accession agreements to allow foreign companies participation in some "value-added" services, ownership of actual networks was never really on the table. Carriers who had hoped to start "value-added services" as a nose under the tent soon had their hopes dashed.

4. Referring to China Telecom, China Mobile, and China Unicom, the three carriers left standing after the most recent round of government-forced consolidation and realignment in 2008.

5. That lasted about a year. By the beginning of 1997, it was again possible to obtain an Internet account without too much trouble, but it was expensive. I went through more bureaucracy to get an internet account in China than I did to get married in the U.S.

6. Lucent was born out of what was once the telecommunications equipment arm of AT&T.

7. As of this writing, the final merger of Nokia-Siemens Networks with Motorola Solutions is in abeyance waiting for final regulator approval in many of the markets in which the company would operate. One of those markets is China.

8. Contrast the relationship between, say, America and China today versus that between Britain and the United States as US businesses rose to supplant their British counterparts worldwide. That shift was not a happy one for Britain, but the shared culture, language, and struggle through the war just ended did much to ensure the shift would not engender animosities. Those advantages do not exist with the Sino-US relationship, a fact that
exacerbates the friction around each new triumph of Chinese enterprise.

9. And, equally important, the fears of many of the conservative advisors close to the throne.

10. Sit, Tony: "The Life of Empress Ci Xi," China in Focus, No. 10, Spring 2001, retrieved November 27, 2011 from http://www.sacu.org/cixi.html. Interestingly, the timing of the Empress Dowager's lurch away from modernization coincides with the Meiji Restoration in Japan. Her rejection of telecommunications and technology may be because she associated such things with the upheavals that turned Japan into a constitutional monarchy, a concept she opposed throughout her life.

11. Prince Gong is perhaps best remembered for his efforts to establish friendly relationships between the Imperial Throne and the western powers in the wake of the Opium Wars. See http://history.cultural-china.com/en/46History5505.html


13. The ITA is also known in some accounts as the Imperial Chinese Telegraphic Administration, or ICTA. For the purposes of brevity and clarity, we will use "ITA" in this account.


16. In his book China's Telecommunications Revolution, professor Eric Harwit notes that by 1900 the national network had reached 34,000 miles in length, suggesting that the Boxer Rebellion and other upheavals had shrunk the network by nearly a quarter of its length.

17. Chiba.

19. Even a brief recounting of the national politics immediately following the revolution would take us off on a dangeroud tangent. Suffice to say that progress on any of the issues facing the Republic was inhibited by nearly two decades of political maneuver that left the Republic as weak as the Empire it replaced. Advances in telecommunications were, then, localized.


22. The Japanese forces did lay communications networks during their occupation of much of coastal China between 1931 and 1945, particularly in Manchuria/Manchukuo, as a part of their effort to lay an Asia-wide telecommunications network. For a complete account of Japan's effort to wire Asia during this period, please see Daqing Yang's fascinating account Technology of Empire: Telecommunications and Japanese Expansion in Asia 1883-1945. What is hard to determine is the extent to which, for example, Shanghai's local phone network owes its relative advancement as of 1949 to Japanese occupiers, and how much of that capacity came on line as the city rebuilt itself after the war.

23. Not to mention the disruption that Japanese occupation brought to these schools.


25. ibid.

26. ibid.

27. ibid.

28. ibid.


33. ibid.

34. I use the term "Liberation" in this book in a purely apolitical sense, meaning to use it as a common reference point for October 1, 1949, when the CPC assumed control over the governance of China. This is the term most commonly used in Chinese, and the author apologizes in advance to anyone who is offended by or takes exception to this term.


36. Interviews with Sun Yushu, Sun Tong, and Cai Hong.


41. ibid.

42. ibid.

43. ibid.

44. Lu, Ding. "China's Telecommunications Infrastructure Buildup: On Its Own Way," in Ito, Takatoshi and Anne O. Krueger, editors. Deregulation and Interdependence in the Asia-

45. ibid.


47. Ding (2000)

48. Going back to the U.S. Congress for a moment, it would not have required the services of the Central Intelligence Agency to acquire this information: it was common knowledge. That Congress did not include the MPT’s enviable financial arrangements in their calculus suggests either incompetence or extraordinary selectivity in which information to consider when reaching their conclusions. Neither possibility paints a particularly flattering picture of Congress and its approach to telecoms in China.


50. The MPT’s General Directorate of Telecommunications began doing business under the brand “China Telecom” in the early 1990s, both at the center and each of the 29 branch offices around China.

51. Norinco was the company most widely credited for introducing the Type-56, China’s licensed version of the AK-47 assault rifle, to the United States. If I remember correctly, suggested retail price for a semiautomatic version of the weapon was just over US$300 at the time.

52. This is not unique to China. The United States armed forces also developed its own internal telecommunications network in parallel with the civilian network. While this had the clear advantage of being designed to withstand a nuclear attack, the other upside was that calls between and within America’s widely scattered military installations did not have to go through expensive civilian long-distance trunk lines. Thus economy as well as security were served.

53. So much so that some wags suggested after one of Motorola’s periodic near-death experiences in the late 1980s that pagers and China saved Motorola.

55. Harwit, China's Telecom Revolution


58. Mulenon, James and Thomas J. Bickford, "The PLA and the Telecommunications Industry in China," from James C. Mulvenon and Richard H. Yang, eds. The People's Liberation Army in the Information Age. Santa Monica: RAND Corporation. 1998. pp. 245-57. This is a superb resource on the critical question of PLA involvement in the telecommunications sector, in particular because it comes from the RAND Corporation. The research Mulvenon and Bickford conducted for their study was funded by the United States Air Force.

59. This approach was one that Qualcomm followed successfully in many areas: networking equipment, handsets, smartphones, and app-based handheld computing. Each of the divisions was sold off or re-absorbed into the company when the industry finally got going. The only manufacturing division Qualcomm retains today is their chipset business, Qualcomm CDMA Technologies.

60. Harwit (2004)

61. ibid.

62. In late 1999, at a field trial of a supposedly ready-for-prime-time TD-SCDMA, one carrier engineer, on seeing the technical results of the test, shook his head and said "Even if you gave me a TD-SCDMA network, I wouldn't want it."

63. In 1999, on the order of the MII and the State Council, China Telecom was ordered split into three entities: China Telecom, which would continue to offer regular fixed-line telephone service; China Satcom, which would take over the satellite communications business; and China Mobile, which would operate China Telecom’s dominant cellular network. The order was intended...
64. "Hypercompetition" is a term developed by Professor Richard D'Aveni to describe a situation in which competitive advantage is eroded almost as quickly as it is created, usually in an industry with highly aggressive competitors. I take minor liberties with D'Aveni's term, using it to describe an environment that is so filled with competitors that it is difficult even to create the perception of competitive advantage. Continued hypercompetition can lead to a perception of commoditization, even in the most innovation-driven industries.

65. My mentor and former employer, Jeanne-Marie Claydon-Gescher, OBE, who remains one of the most pithy and quotable observers of the Chinese business scene I have encountered in my quarter-century of doing business here.


67. Mulvenon and Bickford, "The PLA and the Telecommunications Industry in China."

68. It is interesting to note that in the reams of articles written about the Chinese telecommunications industry over the past 20 years that very little space is dedicated to the role of the PLA. Eric Harwit mentions the PLA but twice in his book. James Mulvenon and Thomas Bickford, writing for the RAND Corporation at the time of the PLA's forced divesture of assets that the measures had achieved "remarkable success" in getting the PLA out of the telecoms business.


71. It is a testament to the perceived size of the opportunity offered by telecommunications equipment as early as the mid-1980s when, despite competition from every major global company, PTIC, and others that ZTE still got into the business.

72. ibid.

73. ibid.

74. ibid.

75. I.e., Brazil, Russia, and India