



## When Technology and Policy Collide: A Case Study of LTE License in China

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### Abstract

China does not auction radio spectrum for wireless service but uses operations license granted by the government. The paper takes on LTE license to show how a flawed policy impairs adoption of LTE technology in China and how excessive interference hurts telecom operators.

LTE has two flavors: TDD and FDD. The Chinese government favors TD-LTE, a "minority" technology, to rescue struggling China Mobile from its failing 3G service, and to make China a leader in LTE. China does this by suppressing LTE FDD and China Mobile's rivals China Unicom and China Telecom that prefer LTE FDD. As the paper argues, the bad policy has turned a business decision to a politically charged issue that brings harm to LTE development. The high price China has to pay: delayed LTE deployment, eliminated competition, discontent public and a laggard behind many countries in a tight race.

The paper then traces the root of the bad policy, what can happen when technology is viewed with political bias, how extraneous factors influence directions of technology without challenge, and what China can learn from the mistake and prevent it from impairing a promising technology.

**Key words:** LTE; TD-LTE; LTE FDD; Business decision; 3G; Competition; Technology adoption; Government interference

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### INTRODUCTION

LTE (Long-Term Evolution, 4G in layman's term) is a new-generation wireless broadband technology that delivers higher data speed for user access to bandwidth-intensive content such as streaming videos, interactive games and large file downloads. LTE has also spawned a new line of smartphones (such as iPhone) that delivers on demand for high bandwidth and improves user experience.

Like any wireless technology, LTE requires radio spectrum to transmit signals from operator's RANs (radio access networks) to end users and back. In most countries, radio spectrum is treated as a natural resource with limited supply like water, electricity and oil, so the principle of "survival of the fittest" is adopted by allowing qualified operators to bid for radio spectrum (grouped in blocks) in exchange for the right to provide public service.

Since radio spectrum is scarce and whoever has it can make tremendous profit from public service, why the government does not want to sell radio spectrum as a source of state income but give it for free? Or asked in another way, can China auction radio spectrum like most countries?

The answer is no, because doing it could trigger a crisis in legitimacy of government ownership. In China, all operators are controlled by the government through management and financials. If they spend heavily on spectrum auction, in theory it is money lost on the government in the form of revenue and tax. Because of this, if China were to auction radio spectrum, it would mean the government spends its own money to buy its own asset! Clearly auction is not viable in China unless

fundamental changes take place in the very basis of telecom regulation.

China sees radio spectrum as a state asset in addition to its natural attributes (Post & Telecom News, 2006; MIIT, 2009, 2010), therefore, China takes a different approach to allocation through a licensing policy which does not involve any monetary transactions.<sup>1</sup> A license, among other things, specifies the type of service and which spectrum blocks (usually in pairs) are assigned for the service. In general, a licensing process begins when operators submit a proposal to the government which state what type of service they intend to provide and what kind of spectrum is required.

A license grants more power to the government in the deliberation and approval process, and leaves little bargaining room to operators. Compared to auctions, licensing is fast, simple, and a convenient means for regulators, it sets forth strict rules on what operator can and cannot do. If an operator is found of violating the licensing agreement, its license may be revoked and it will lose the right to providing the service.

An operation license can enables the government to: a) expedite adoption of a new technology through network construction and launching new service (license usually entails launch time as a requirement); b) delay or terminate a process the government deems premature regardless of the virtue of technology and/or market demand; and c) provide directions by suppressing certain aspects of technology or applications in favor of others. Clearly, all these are at the discretion of the government and it can change at anytime, despite criticisms that the power can be abused and turned against the market. The Ministry of Industry and Information technology (MIIT) is the mighty agency that regulates the telecom industry and is the authority for granting license (MIIT, 2001).

When a technology collides with policy as in the case of LTE, the latter often wins by way of licensing, but it is not mercenarily beneficial for the market. As discussed in this paper, a flawed policy can seriously stymie advancement in technology and a country's ability to compete on a global scale, a high price China has to pay in the race of LTE, and the impact will continue for many years.

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## 1. THE STORY

China Mobile, the country's largest wireless operator, began to work on LTE soon after the launch of 3G service based on TD-SCDMA platform in 2008 (Feng & Huang, 2009). The timing was odd because China Mobile had just spent RMB130 billion (US\$21 billion) to build massive 3G networks, the real reason was because TD-SCDMA, which was developed mainly in China (and only country that adopted the standard), was inferior to

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<sup>1</sup> Although the license is free, operators still need to pay a nominal fee for right to use allotted spectrum blocks on an annual basis.

competing technologies like WCDMA and CDMA2000 EV-DO. Customers of TD-SCDMA complained about slow speed, dropped calls, poor coverage and handset supply. Worse still, many TD-SCDMA subscribers found themselves were using GSM (2G) most of time because 3G coverage was sparse (Dai, 2010). Weakness in technology and bad user experience forced China Mobile to find a way to salvage hefty investment and restore its reputation against competition.

Under tremendous pressure, China Mobile began testing LTE in late 2010 with plans to replace the ill-fated TD-SCDMA. Specifically, China Mobile turned to LTE TDD (commercial name TD-LTE). Discussion of LTE technology is beyond the scope of this paper, but it is important to point out the main reason for choosing TD-LTE as 4G service is because it employs the same time-division transmission technique as TD-SCDMA, so that in theory, TD-LTE improves spectrum efficiency and is more adaptive to the pattern of mobile data traffic (Yang, 2011). Because of this common attribute, TD-LTE is chosen to be the optimal evolution path for TD-SCDMA with the benefit of less capital expenditure and network construction time (Jiang, 2011).

The downside of TD-LTE is that it is a less popular choice by most countries, so China Mobile may have faced the same quandary as it did in 3G, but the operator was compelled to make the plunge on TD-LTE and save itself from the 3G doldrums. The good news is TD-LTE did win wide support from network equipment manufacturers and handset/chipset makers so that handset supply would be less of a headache when commercial service began, a bad experience China Mobile had during 3G rollout (Guan, 2008; VoIPChina, 2009).

TD-LTE also received endorsement from MIIT with the belief that 1) China will be a leader in TD-LTE if more countries decide on TD-LTE and make it a popular standard in the world, and 2) it would save face of a state-owned company from the 3G debacle and put it back in the lead (C114, 2009). (MIIT has never admitted to its responsibility for largely doomed TD-SCDMA.)

And the timing looked good. LTE deployment was accelerating in North America and Asia, in which about 10% of LTE networks (commercial and trial) were using TD-LTE (Lie, 2013; ICCSZ, 2014). At home, China Mobile began TD-LTE trials in 2011 in selected cities that eventually upgraded to commercial grade (Chen, 2012). By now it was clear that TD-LTE would be the 4G platform for China Mobile and it would be the largest such platform in the world.

But MIIT felt the technology was not ready for commercial rollout and advised China Mobile to invest more time in what's called "N x N" paired tests including handset-to-BTS, software and chipsets made by different vendors and used in different handsets (TD-LTE Working Group, 2011). It may sound like a good reason, but anyone in the

technology knows that there is no such a thing as “mature” or “perfect” technology but a continual process of improvement and innovation, even after commercial service.

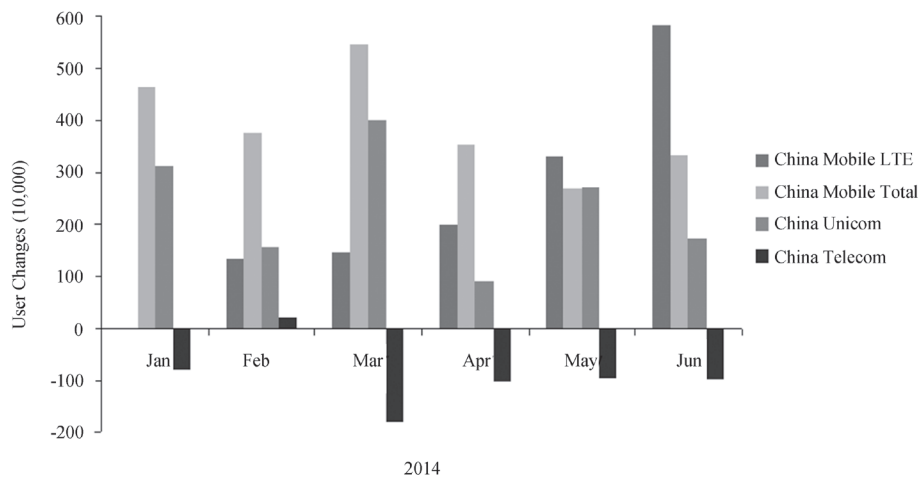
We never know if MIIT was aware of this or there was some other reason that prompted the decision to delay LTE licensing. After extensive trials, China Mobile was very confident about commercial launch and the public was anxious to experience the new service, MIIT was the only one stuck in the middle for at least another year (Su, 2011). When facing a government that is powerful and unyielding, technology suffers a setback and the country loses the best chance in a tight race like LTE where every country is trying to implement the technology that can benefit the entire telecom industry and the economy in general, according to an MIIT official, one RMB in LTE investment can generate 5.6 RMB in the economy, 1.2 times of that by 3G (Liu, 2014). The reality is China had to take a backseat while watching others passing by. And no one voiced criticisms of the policy.

Finally in December 2013, MIIT made a small step by issuing LTE license to all three operators, but it was only for TD-LTE not LTE FDD (People, 2013). Clearly it was designed to help China Mobile since China Unicom and China Telecom wanted to use LTE FDD (Lian, 2013; ChinaIRN, 2013). To them, a license for TD-LTE was a rejection to their decision; it is useless but made them a perfect scapegoat. In fact, the message from the license was to force China Unicom and China Telecom to develop TD-LTE as a condition for getting a license for LTE FDD later. If they should refuse, they could get punished by

fulfilling other imposed conditions or keeping out of LTE market for longer than expected.

China Mobile was the sole beneficiary of the LTE license which not only granted it the right to LTE service, but also cleared its competitors out of the way. The licensing policy discriminated LTE technology simply because it did not fit a hidden agenda, and China Unicom and China Telecom had to bear the casualties: the license effectively pushed back the technology of their choice and preempted their ability to compete with a good chance to win.

In a less perfect regulatory environment, operators have little recourse on their hands but accept defeat. And the result is staggering. In just six months (from January to June 2014), LTE customers reached 13.97 million, of which 99.8% went to China Mobile. As the Figure shows, LTE was the main driver for user growth at China Mobile while its overall growth (2G and 3G to a lesser extent) waned.<sup>2</sup> By comparison, the LTE’s unilateral gain at China Mobile was largely made at the loss of its rivals: by June 2014, China Unicom reported revenue growth plummeted to 3% from nearly 19% a year ago, and profit wiped out by more than half. Its user growth also plunged in February and April, but managed to bounce up in May and June (see Figure 1). The worst performer is China Telecom which lost nearly 5.4 million cellphone customers during first six months of the year. The tow operators blame the policy for favoring TD-LTE that caused disappointing performance and called on MIIT to amend its policy by expediting LTE FDD license (Liu, 2014; Liu, 2014).



Sources: Company data.

**Figure 1**  
**Change of Cellphone Users at Three wireless Operators (from January to June 2014)**

Notes. 1) No LTE subscriber data for January. 2) When LTE growth supersedes total subscriber growth at China Mobile, it indicates lost customers in GSM. 3) China Unicom and China Telecom also made customers for TD-LTE, but the number is negligible and most dangle users (no smartphone).

<sup>2</sup> In its mid-year report (June 2014), China Mobile revenue grew 7.1% and profit fell 8.5%. a continuous decrease for four quarters in a row. It should be noted that decline in revenue growth and profit is also seen at other operators due to several reasons including a high cellphone penetration rate and rate cuts. Financial performance of telecom operators is beyond the scope of this paper.

## 2. THE REMEDY

The full impact of a shortsighted policy on LTE development may never be fully understood. China started exploring LTE (especially TD-LTE) about the same time as many other countries; however, progress was slow as the country drew itself into frivolous debates on things like if the technology was ready or if China was ready, conceived risks, and how TD-LTE could promote patriotism and how it could help China rise to a world leader. Truth is, while TD-LTE received so much adulation as a “bless-China” technology, China was not the inventor; it’s not even a major patent holder (Wang, 2011; ZOL, 2013), but somehow the country was genuinely reveled at the self-fulfilling prophecy while the rest of the world was passing by fast, especially its neighbors South Korea, Japan, and even Hong Kong.

Soon the flaws of TD-LTE license began to surface as it eliminated competition that could have propelled LTE at a faster pace; worse, if the policy should continue, the damage for the other operators may not be retrievable which would bring more harm to LTE development than benefit for the country.

So in late June of 2014, MIIT did an about-face by issuing two LTE FDD licenses to China Unicom and China Telecom (no China Mobile). The reason, according to the agency, was it felt LTE FDD was ready for commercial service (Kang, 2014). The real reason, however, was two-fold. First, MIIT believed TD-LTE was on strong footing from a rival standard and China Mobile had stepped out of shadow of TD-SCDMA and in a better position for growth. A few months of protection had created a comfortable distance from its competitors. Second, without LTE FDD, China may never become a powerful voice in face of most countries where TD-LTE remains less popular.

There is a restriction in LTE FDD license. China Unicom and China Telecom are only allowed to conduct trials (defined as pre-commercial phase) of “hybrid” LTE networks, i.e., LTE TDD/FDD. China Unicom and China Telecom did not volunteer to enter the hybrid territory; it is imposed on them without their consent. MIIT officials insisted that hybrid LTE was the future and China could benefit by taking an early position. In theory, a hybrid LTE network is intriguing because it allows roaming between LTE TDD and FDD networks without drop-offs or interruption of service; in practice, however, a hybrid is more of a fantasy than a viable solution. Most of all, it requires complicated configurations in RANs and operations, costs more (but not necessarily higher returns) and may not significantly improve user experience.

In addition to complexity in network design and operations, the notion of hybrid LTE network seems to be more like a whim than a real solution. First, a hybrid network may not generate significantly higher traffic than a standalone network because a) most LTE customers

will unlikely buy a handset that’s TDD/FDD compatible because it will cost more and could compromise performance such as responsiveness, processing speed, image rendering and power consumption; b) even for roaming, most users will prefer to go in and out of a network that employs the same technology such as TD-LTE or LTE FDD, but not both to avoid confusion and performance deterioration. In case coverage is not available in an area, the handset can automatically search for a lower-grade network such as 3G or GSM, but less likely for another LTE network. Although performance may suffer when the handset is switched to a lower grade such as lower data rate and time delay, it at least keeps communication uninterrupted.

It should be noted that China is not alone on hybrid LTE network as the notion is being explored in some countries, according to GSA (Global Mobile Suppliers Association), an international trade group, 39 operators that had launched TD-LTE service, 13 had built hybrid networks in various configurations (Middleton, 2014). However, most of these networks are small in size and located in countries where available radio spectrum is scarce.

The new license also limits LTE construction to only 16 cities (no geographic restriction for TD-LTE) (Tech2IPO, 2014), which means a license will be needed from MIIT if China Unicom and China Telecom want to build a national LTE network, which is subject to the “progress” of trials, according to MIIT. The policy, regardless of its makers’ intentions, proves it wants to go all lengths to impede or delay a technology that could benefit the operators, the public and competition.

One may wonder how the bureaucrats at MIIT came up with such an idea that is self-destructive. What is the purpose of doing this?

MIIT had no grudge against LTE FDD if TD-LTE was not ascribed to a politically charged issue and China Mobile assumed the role to carry it out. As a regulator, its task is not only to make LTE succeed but also to find additional significance. Since TD-LTE has been chosen for the ponderous purpose, LTE FDD must stay aside.

In fact, the logic behind the second LTE license is the same as the first license: TD-LTE needs more support from the government because it is a “minority” technology but bears great promise. If TD-LTE does succeed in China, there is a better chance it will for the world. What’s missing in MIIT’s line of thought is what the market has made where TD-LTE is in the world today, i.e., a minority technology. It is the choice by the market and a license can hardly change it, even in China.

We have to wait to see the impact of the restricted license on China Unicom and China Telecom, as well as on the overall LTE development, neither do we know when MIIT thinks time is ripe to allow full-fledged LTE FDD networks to be built. A licensing policy is absolutely necessary in China, but the government has picked

the wrong reason and bad execution which has caused irretrievable damage to LTE, both in dollar value and China's best chance in technology.

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### 3. THE ANALYSIS

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China ascribes strong emotions to TD-LTE because it is considered a "Chinese" technology. This is not true; China did not invent TD-LTE but one of the few countries that have adopted it. The decision by China Mobile to use TD-LTE is because it provides the best migration for its ill-fated TD-SCDMA. Plain and simple. However, a regular business decision was later blown up to China's mission for the world. The other puzzle is why MIIT was willing to go all the way to promote TD-LTE even at the cost of blocking other LTE alternatives and financial losses. This is way beyond the purpose of a license. It is stupidity.

Perhaps the answer can be found from outside of technology.

First, a little history. During most of the 20<sup>th</sup> century, China was a laggard in technology which remains to be a sore spot for a proud country that boasts an ancient history filled with innovations and craftsmanship. For several hundred years, China was embroiled in endless wars and economic hardship that dragged the country into poverty and drove it further away from the ranks of technology and innovation.

It is a long-held desire that China could someday reclaim its glorious past and become a world leader in technology. It's a painful recognition that without advancement in technology, China would always be a follower and a subject of exploitation. Right or wrong, a long history of agony and a strong will have formed the mindset of contemporary government and the orientation of policymaking. The early success of economic reforms in the 1980s reinforced the conviction which was repeated for the next two decades to create what's known as "China Miracle".

But the economic prosperity was mostly stemmed from manufacturing that mainly used low-cost materials and labor. The road to a world leader in technology is long and requires knowledge and innovation. And the gap with advanced countries is huge, so for many years China tries to circumvent the convention by using less time and effort, for example, a common approach is to copy the basic technology from somebody but add improved design and more features. In a way, the strategy has worked especially in consumer electronics and cellphone handsets, but that's far and away from the coveted title of a technology giant.

As the cycle of telecom technology has accelerated, China sees the opportunity in standard. A technical standard, if endorsed by an international body and adopted by other countries, can become the fastest way to leadership in a given field.

Since TD-LTE shares similar modulation scheme and

transmission as TD-SCDMA, China has made it a natural continuum and run a national campaign to claim its leadership in TD-LTE. China founded GTI (Global TD-LTE Initiative) in 2011, a multi-operator consortium to promote TD-LTE and rally support for TD-LTE ecosystem (China Mobile, 2011). In recent years, however, China seems to have lost its influence at GTI because of slow progress in TD-LTE.

Telecom is a regulated industry because it is prone to natural monopoly in the name of economic efficiency and public good. Therefore, the public needs government oversight to prevent operators from abusing their positions. For this to work, many countries have adopted a proactive policy framework to encourage technology while restricting operators from making excessive profit, one way is to create a competitive environment.

This fundamental principle is not always followed through in China. In addition to an overbearing government, lack of pro-competition conditions and enforcement, there is one other explanation that has been largely neglected. Although telecom operators and regulators do not always see things eye-to-eye, they both work for the government and are obligated to serve government agenda often in the name of national interest. This underlying principle leads to a passive telecom policy rather than proactive; for example, a policy is often created to prevent undesirable things from happening, to maintain balance between technology and competition, and, in many cases in China, to offer favorable treatments for an underdog or curb the other if disparity worsens.

With this analysis, a license clearly has more to do with a government agenda and maintain "market order" than encourage new technology and promote growth. China Mobile is not necessarily a trusted ally of MIIT, but on the issue of TD-LTE, the two have come to a common ground to save a doomed 3G service, to protect a large state asset and to create a world leader in LTE.

This heavy baggage has cost China dearly. A promising LTE technology (LTE FDD) was shut out of competition albeit a better option which could have made China leap forward and become the largest LTE market in the world. Instead, it was chained to the ground until the government made sure TD-LTE was far ahead so that LTE FDD would always be a runner-up. As we know now, the policy has unwittingly thwarted the country's ambition and lost the best window of opportunity to become a true leader in LTE.

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### 4. THE MORALS

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The clamor over LTE license may have subsided, but its impact on LTE development in China will be felt in many years to come. Here are some of the lessons we have learned.

(a) Why do we need license for the telecom industry? It is because natural monopoly could wreak tremendous harm to the public good. Therefore, the main objective

of licensing policy is to create a fair environment for technologies and services that contribute to the objective. It is an onerous responsibility so regulators must exercise great caution not to create a monster that may undo the good intention of the policy and cause damage in the market. Sometimes it is possible to design a policy to promote a less popular technology, but the government must make sure it follows the same principle and the technology will help innovation, benefit the public and business growth. For this to happen, policymakers need to think hard about the following questions: What objectives do we want to accomplish? And what consequences it could leave in next year or next decade?

(b) As we have learned from LTE in China, a license can become a double-edged sword: it can accelerate adoption of a new technology and spur growth, but it also can stymie innovation and free market spirit.

The Chinese regulators are still learning how to respect market and design a policy framework that will not create conflict to market balance and disrupt momentum. They also need to learn how to strike a balance between right regulation and infringement of normal business operations, so that both sides win. This is still a novel concept in China as regulation often swings from *laissez faire* to excessive interference. Change can take a long time when the old doctrine of complete control has its deep root in regulators.

(c) When a bad policy is carried out, it invariably creates a “chilling effect” as companies feel being targeted if they do not follow orders; as a result, they are forced to change plans to be politically correct or to make regulators look good. As we have witnessed in the LTE licensing process, there was a lack of channels for operators to raise their concerns; even if there were, their voice may have met a deaf ear because the atmosphere is not conducive to candid discussion and objection. The “chilling effect” is like a disease: it bogs down growth, eliminates competition and destroys public trust.

There is nothing mystic about a license. If it is given too much weight other than a permit for technology and operations, it would lose its very purpose and we must ask ourselves why we want to use it in the first place. A bad licensing policy can also lead to illicit behaviors such as abuse of market positions, unfair competition, price fixing, and corruption.

(d) Since the 1990s, China has made great strides in economic reforms including a Western style regulatory environment such as separation of government function and business as a way to avoid conflict of interest (Liu, 2001; Baike, 2014). But good intentions sometimes go awry by creating isolation between regulators and businesses as the former are less willing to listen to businesses of their needs and discontent, let alone to help business grow not to put shackles on their ankles. In theory, both regulators and corporations share a common

goal that should make the best synergy. Unfortunately, in reality, many policies serve as the “sword of Damocles” that makes companies fearful. In word, the regulators encourage operators to run faster, but when they do, they will face a set of policies designed to cut their hamstrings.

(e) When there is a conflict in technology, sign of a bad policy is it quickly take sides based on a preset of criteria and punish the other. The lack of rigorous due diligence and balance can cause irretrievable damage and miss the best choice for the public. It is possible a “minority” technology ends up being a winner, but it must be made by the market not determined by a preset of opinions or conditions. In an environment where market must yield to government will, a flawed policy could make a lose-lose situation: the government sanctioned technology may remain weak due to inherent technology or market weakness, while the other option is let to wither and may take a long time to recover. In this case, a policy set out to help one side may end up losing both. The better solution is to let both technologies compete and let the market be the judge. In a fair and open market, there is no such thing as a mainstream technology or minority technology; everything must pass market test by the law of “survival of the fittest”, not by government liking or a piece of paper (license).

(f) In order to prevent a policy from becoming self-destructive, the government should keep clear of imposing any form of wishful thinking on operators and resist rushing to conclusion too soon based on extraneous factors. Since China is not a bona fide market economy, the government must act carefully not to make decisions for the industry without due process and consent from business leaders. One way to prevent such mistake is to bring in people with a balanced background who have in-depth knowledge of the industry, technology and market issues. Admittedly, change takes time and can be painful, but this is the path China must go down in history and the reward will be much greater than the country can reckon with. This is the best telecom regulators can do for the country.

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